



MPA Baseline Program

Annual Progress Report



Principal Investigators - please use this form to submit your MPA Baseline Program project annual report, including an update on activities completed over the past year and those planned for the upcoming year. This information will be used by the MPA Baseline Program Management Team to track the progress of individual projects, and will be provided to all MPA Baseline Program PIs and co-PIs prior to the Annual PIs workshop to facilitate discussion of project integration. Please submit this form to California Sea Grant when complete (sgreport@ucsd.edu, Subject [Award Number, project number, PI, "Annual Report"].)

Project Information

Project Year: Year 2; 1 Feb. 2015 – 31 Jan. 2016 MLPA Region: North Coast

Project Title & Number: Baseline Characterization of Nearshore Fish Communities Associated with Rocky Reef Habitats in the Northern California MPA Study Region

PI name: Tim Mulligan Co-PI name: Joe Tyburczy

PI Contact Info Co- PI Contact Info (please list additional PIs and contact info in the "Project Personnel" section if necessary)

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Project Goals & Objectives

We will conduct collaborative fisheries research by partnering with charter boat fishing captains and volunteer anglers to characterize the baseline status of nearshore rocky reef fish assemblages in Marine Protected Areas (MPAs) and reference sites, in the North Coast study region. This quantitative baseline data will describe the diversity, abundance, size structure, and movement patterns of rocky reef fishes found inside and outside of MPAs along the >250 mile North Coast. Its completion will provide a benchmark for the evaluation of MPA performance. This project will geographically expand on our existing 2-year (2010-2011) dataset (Barrett et. al. 2012), funded by the Resource Legacy Fund Foundation (RLFF), on nearshore reef fishes to create a 4-year dataset surrounding the time of MPA implementation in the North Coast Region. Our sampling methods will produce data comparable to that of reef fish monitoring done on California's Central Coast MPAs and marine reserves in Oregon, and will allow for direct comparisons to be made. Unlike our previous project, fish caught during this study will be tagged, providing data on site fidelity and movement patterns of fishes across MPA boundaries.

We will analyze results from this work using many of the same statistical methods employed in our RLFF work as well as those used by the California Collaborative Fisheries Research Project (CCFRP). We will estimate abundance of species at each site via catch-per-unit-effort (CPUE). Relative abundance and size of fish, as well as species richness, evenness, and diversity (Shannon Diversity Index) will be compared among paired MPA/reference sites and sites stratified by distance from port. Non-metric multidimensional scaling (NMDS) analysis will be used to examine patterns of species abundance and size among sites and how this varies temporally and spatially (including among MPA/reference site pairs and with distance from port). Recaptured tagged fish will also allow an analysis of current fish movement patterns (into, out of, and within MPAs and reference sites).

In addition we will use high resolution multi-beam sonar imagery available from the California Seafloor Mapping Program to extract habitat variables such as size of reef, rugosity, proximity to other reefs, and substrate type (hard or soft bottom) for each station. Using generalized linear models we will examine the relationship between relative fish abundance, diversity, and size structure and these habitat variables as well as spatial variables (distance from port and latitudinal position) at the site level. We will also examine species habitat preferences at a smaller scale using individual fish points attained from video footage synced with a GPS track log.

By engaging local fishing communities in collaborative fisheries research to monitor North Coast MPAs, we will establish a foundation for long term-term collaborative monitoring using repeatable research techniques that foster community support for MPA-related management. We will continue to develop and strengthen collaborative working relationships among fishermen, fisheries scientists, and local/state management agencies to improve marine fisheries research and management. Data from this project will compliment other North Coast baseline surveys (rocky intertidal, shallow water SCUBA, and deep water ROV surveys) to help evaluate the placement, monitoring and overall effectiveness of North Coast MPAs.

Summary of Project Activities Completed to Date

Overview of Project Year 2 Activities, including progress towards meeting goals & objectives

January-April 2015: Preparation for fieldwork

- Took inventory and purchased necessary gear
- Prepared and organized gear
- Contacted CPFV captains and began scheduling sampling trips

May-August 2015: Hook and line sampling of 4 MPA sites and 4 associated reference sites; each site was sampled 2 times during Year 2.

September-January 2016: Data Analysis

- Entered all data into Microsoft Excel
- Summarized catch data in tables and figures
- Calculated CPUE, species richness, evenness, and Shannon Diversity
- Downloaded bathymetry data from the California Seafloor Mapping Project for our study sites and extracted habitat data for each of our 32 stations (substrate type and rugosity)

Progress towards Education and Outreach goals:

- Strengthened working relationships with Commercial Passenger Fishing Vessel (CPFV) captains.
- Attended and presented project methods and initial results at The Western Society of Naturalist Annual Meeting and the North Coast Collaborative Forum.
- Involved ~30 different volunteer anglers consisting of community members, recreational and commercial fishermen, and Humboldt State students and 12 CPFV captains

Over 16 sampling days in year 2, 1,574 fish were caught; 1,293 were tagged. The catch was dominated by Black Rockfish (462 individuals), followed by Blue Rockfish (390), Lingcod (263), Canary Rockfish (163), and Yellowtail Rockfish (86). The greatest number of fish were sampled at Sea Lion Gulch SMR (439). The fewest number were sampled at Pyramid Point SMCA (83). See Table 1 attached for details on all fish counts by site in year 2 of sampling.

Year 1 and 2 combined:

- 4,235 total fish
- 23 different species (14 *Sebastes* species)
- 3,491 tags deployed
- Catch dominated by Black rockfish (1,652 individuals), Blue rockfish (791), Lingcod (618), Canary rockfish (347), and Yellowtail rockfish (284)

See Table 2 attached for details on all fish counts by site in years 1 and 2 combined.

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Highlights from project progress so far, such as successes achieved, new collaborations or partnerships, or interesting stories from the past year that may be suitable for a blog post or other media venue

Highlights:

Our field work for the project was completed on schedule in August 2015.

Graduate students Jay Staton and Ian Kelmartin presented preliminary results from the project at the Western Society Naturalists Conference in Sacramento and at the North Coast Collaborative Forum.

The largest Lingcod of the project (93cm) was captured and tagged in the Damnation Creek reference area.

Wildlife sightings: Breaching juvenile Humpback Whale, large Mako Shark.

Strengthening working relationships with the charter boat captains and regular volunteers.

Description of any unforeseen events and substantial challenges, and resulting effects on project activities and progress. Please indicate any issues that may affect other PI's or require coordination with other Baseline partners (e.g., ME, DFG, Sea Grant).

With our experience from sampling year 1, field work proceeded smoothly through year 2 and we completed all of our sampling on schedule in August. There were no unforeseen events or substantial challenges that hindered progress.

Data status (i.e., paper/raw format or digitized; if digitized, what format?)

All project data from years 1 and 2 has been entered into Microsoft Excel software and will be exported in comma separated value (csv) format to analytical software. The original data sheets have also been retained.

Data includes:

Date, Site, Cell, Species, Gear Type, Fork length (mm), Tag number, Condition, and Comments

Additionally, year 2 data includes capture coordinates for each fish.

Activities Planned for following Project Year __ (if applicable) – *Please describe remaining work and approximate timelines for completing that work, including any anticipated budget variances necessary to complete the project.*

February-August 2016: Analysis of data

January 2016-January 2017:

-Preparation of Final Report, Graduate Theses, and Manuscripts.

Presentation of results at collaborative forums and scientific meetings.

Project Personnel – Please indicate additional project personnel involved in your MPA baseline project, including students and volunteers, or additional PI contact information if necessary, as well as the nature of their assistance in the project project.

	<i>Students Supported</i>	<i>Student Volunteers</i>	<i>Nature of Assistance</i>
<i>K-12</i>			
<i>Undergraduate</i>	2	10	<i>Supported: Anglers, samplers, data recorders. Volunteers: Anglers</i>
<i>Masters</i>	2	3	<i>Supported: Scheduling & logistics, preparation of reports, input & analysis of data. Volunteers: Anglers</i>
<i>PhD</i>			

Number of other Volunteers not counted above and the nature of their assistance in the project:

~20 volunteers from the community participated in the project as volunteer anglers

Additional PI contact info not listed on first page:

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 Eureka, CA 95503
 drew_bar@msn.com
 (707) 834-9100

Cooperating Organizations and Individuals - Please list organizations or individuals (e.g., federal or state agencies, fishermen, etc.) that provided financial, technical or other assistance to your project since its inception, including a description of the nature of their assistance.

Name of Organization or Individual	Sector (City, County, Fed, private, etc.)	Nature of cooperation (If financial, provide dollar amount.)
Craig Strickhouser	Private	Charter captain
Tim Klassen	Private	Charter captain
Jared Morris	Private	Charter captain
Kevin Riley	Private	Charter captain
Kurt Akin	Private	Charter captain
Matt Dallam	Private	Charter captain

Project Outputs and Materials: Please provide any other project-relevant information, such as descriptions of attached materials, media coverage your project has received, presentations, publications, images etc.

Talk presented by Graduate student, Ian Kelmartin at the Western Society of Naturalists meeting in Sacramento, CA. November 2015: *Collaborative Research Methods for Surveying Fish Communities associated with Nearshore Rock Reefs in the Northern California Marine Protected Area Study Region.*

Poster presented by Graduate student Jay Staton at the Western Society of Naturalists meeting in Sacramento, CA. November 2015: *Distance from Port as a Proxy for Historical Fishing Pressure on Nearshore Rocky Reefs in Northern California.* (attached)

Graduate students Ian Kelmartin and Jay Staton have been invited to present to the Chancellor, Board of Trustees, and Campus presidents at the CSU Council on Ocean Affairs, Science and Technology annual student poster reception in March 2016.

Table 1 (attached). Count of species caught at each site during entire second sampling season (May – August, 2015). Sites consisted of 4 MPA (Pyramid Point SMCA, South Cape Mendocino SMR, Ten Mile SMR, and Sea Lion Gulch SMR) and 4 associated reference sites (Damnation Creek, North Cape Mendocino, Westport, and Point Delgada). Each site was sampled 2 times throughout sampling season. Fish collected via standardized hook and line sampling. Five most common species caught include Black rockfish, Blue rockfish, Lingcod, Canary rockfish, and Yellowtail rockfish. Catch per unit effort (CPUE) values equal to number of fish per angler per hour.

Table 2 (attached). Count of species caught at each site during both the 2014 and 2015 sampling season. Sites consisted of 4 MPA (Pyramid Point SMCA, South Cape Mendocino SMR, Ten Mile SMR, and Sea Lion Gulch SMR) and 4 associated reference sites (Damnation Creek, North Cape Mendocino, Westport, and Point Delgada). Each site was sampled three times in 2014 and twice in 2015. Fish collected via standardized hook and line sampling. Five most common species caught include Black rockfish, Blue rockfish, Lingcod, Canary rockfish, and Yellowtail rockfish. Catch per unit effort (CPUE) values equal to number of fish per angler per hour.

Table 1. Count of species caught at each site during entire second sampling season (May – August, 2015). Sites consisted of 4 MPA (Pyramid Point SMCA, South Cape Mendocino SMR, Ten Mile SMR, and Sea Lion Gulch SMR) and 4 associated reference sites (Damnation Creek, North Cape Mendocino, Westport, and Point Delgada). Each site was sampled 2 times throughout 2015 sampling season. Fish collected via standardized hook and line sampling. Five most common species caught include Black rockfish, Blue rockfish, Lingcod, Canary rockfish, and Yellowtail rockfish. Catch per unit effort (CPUE) values equal to number of fish per angler per hour.

Species	Crescent City			Eureka			Shelter Cove			Fort Bragg			Total Species Count
	Damnation Creek	Pyramid Point SMCA	Total	North Cape Mendocino	South Cape Mendocino SMR	Total	Point Delgada	Sea Lion Gulch SMR	Total	Westport	Ten Mile SMR	Total	
Black rockfish	95	68	163	74	51	125	30	102	132	14	28	42	462
Blue rockfish	36	1	37	29	4	33	2	196	198	69	53	122	390
Lingcod	15	10	25	27	36	63	25	52	77	47	51	98	263
Canary rockfish	30	0	30	21	54	75	14	10	24	16	18	34	163
Yellowtail rockfish	12	0	12	8	4	12	19	24	43	10	9	19	86
Copper rockfish	2	0	2	3	5	8	3	13	16	0	15	15	41
Vermilion rockfish	0	0	0	4	12	16	4	3	7	3	5	8	31
China rockfish	0	0	0	0	0	0	7	8	15	13	1	14	29
Quillback rockfish	0	0	0	4	10	14	1	10	11	0	4	4	29
Cabezon	1	3	4	0	0	0	1	1	2	7	2	9	15
Yelloweye rockfish	0	0	0	0	6	6	2	7	9	0	0	0	15
Kelp greenling	1	0	1	1	0	1	0	2	2	3	6	9	13
Olive rockfish	0	0	0	0	0	0	5	1	6	7	0	7	13
Rosy rockfish	0	0	0	0	0	0	3	7	10	0	1	1	11
Gopher rockfish	0	0	0	0	0	0	0	0	0	1	4	5	5
Brown Rockfish	0	0	0	0	0	0	0	0	0	0	2	2	2
Buffalo sculpin	0	1	1	0	0	0	0	0	0	1	0	1	2
Chinook salmon	0	0	0	0	0	0	0	1	1	0	0	0	1
Pacific halibut	0	0	0	1	0	1	0	0	0	0	0	0	1
Pacific sanddab	0	0	0	0	0	0	0	1	1	0	0	0	1
Widow rockfish	0	0	0	0	0	0	0	1	1	0	0	0	1
Total Catch/Site	192	83	275	172	182	354	116	439	555	191	199	390	1574
CPUE (fish/angler/hour)	8.00	3.46	5.73	7.17	7.58	7.38	4.83	18.29	11.56	7.96	8.29	8.13	

Table 2. Count of species caught at each site during both the 2014 and 2015 sampling seasons. Sites consisted of 4 MPA (Pyramid Point SMCA, South Cape Mendocino SMR, Ten Mile SMR, and Sea Lion Gulch SMR) and 4 associated reference sites (Damnation Creek, North Cape Mendocino, Westport, and Point Delgada). Each site was sampled three times in 2014 and twice in 2015. Fish collected via standardized hook and line sampling. Five most common species caught include Black rockfish, Blue rockfish, Lingcod, Canary rockfish, and Yellowtail rockfish. Catch per unit effort (CPUE) values equal to number of fish per angler per hour.

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	Damnation Creek	Pyramid Point SMCA	Total	North Cape Mendocino	South Cape Mendocino SMR	Total	Point Delgada	Sea Lion Gulch SMR	Total	Westport	Ten Mile SMR	Total	
Black rockfish	225	188	413	192	241	433	89	483	572	116	118	234	1652
Blue rockfish	46	5	51	66	35	101	26	362	388	147	104	251	791
Lingcod	49	20	69	71	77	148	82	105	187	118	96	214	618
Canary rockfish	51	0	51	66	98	164	27	21	48	57	27	84	347
Yellowtail rockfish	24	0	24	23	40	63	40	86	126	22	49	71	284
China rockfish	0	0	0	0	1	1	32	24	56	38	5	43	100
Copper rockfish	4	0	4	19	16	35	8	29	37	3	21	24	100
Quillback rockfish	0	0	0	18	27	45	4	24	28	1	4	5	78
Vermilion rockfish	2	0	2	20	24	44	5	11	16	5	7	12	74
Olive rockfish	0	0	0	0	1	1	6	20	26	16	0	16	43
Yelloweye rockfish	0	0	0	3	10	13	5	17	22	1	1	2	37
Kelp greenling	9	1	10	3	0	3	1	4	5	8	8	16	34
Rosy rockfish	0	0	0	0	0	0	7	16	23	0	1	1	24
Cabezon	3	5	8	0	0	0	2	1	3	8	3	11	22
Gopher rockfish	0	0	0	0	0	0	2	0	2	5	6	11	13
Chinook salmon	0	0	0	0	1	1	0	1	1	0	2	2	4
Brown Rockfish	0	0	0	0	0	0	0	0	0	0	3	3	3
Buffalo sculpin	0	1	1	0	0	0	0	0	0	1	1	2	3
Pacific halibut	0	0	0	1	0	1	1	0	1	0	0	0	2
Pacific sanddab	0	0	0	0	0	0	0	1	1	0	1	1	2
Widow rockfish	0	0	0	0	0	0	0	2	2	0	0	0	2
Petrale sole	0	0	0	0	1	1	0	0	0	0	0	0	1
Red Irish lord	1	0	1	0	0	0	0	0	0	0	0	0	1
Grand Total	414	220	634	482	572	1054	337	1207	1544	546	457	1003	4235
CPUE(fish/angler/hr)	6.90	3.67	5.28	8.03	9.53	8.78	5.62	20.12	12.87	9.10	7.62	8.36	

Introduction

California North Coast Marine Protected Areas (MPA)

- 19 new MPAs enacted December, 2012
- California/Oregon border to Pt. Arena
- 137 square miles, 13% of North Coast

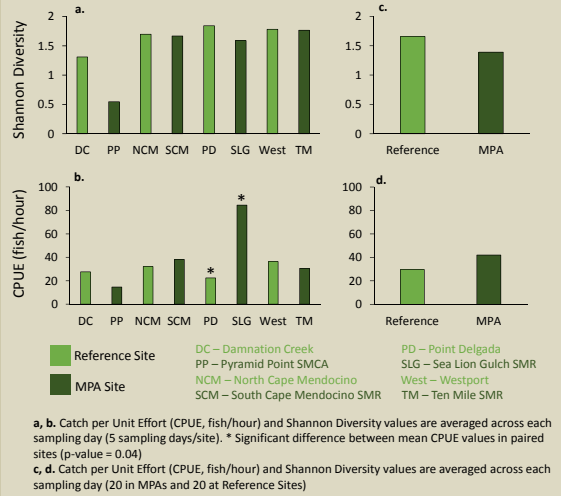


Nearshore Rocky Reefs

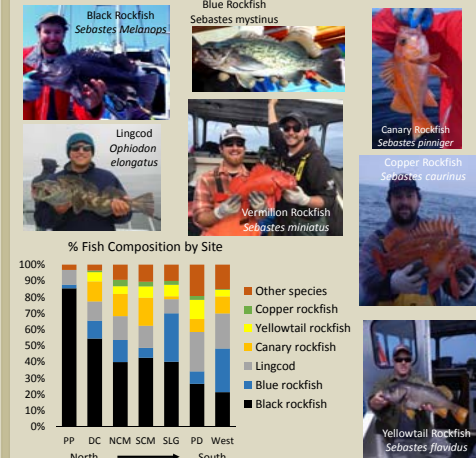
- Not well studied in Northern California
- Support important commercial and recreational fisheries
- High fish diversity, especially Rockfishes (*Sebastes spp.*), many of which are long lived, slow growing, and mature late in life making them susceptible to population declines from overfishing

Study Questions

- Is relative fish abundance, diversity, and size structure different between MPA and associated reference sites?
- Does distance to closest fishing port explain differences in relative fish abundance, diversity, and size structure?



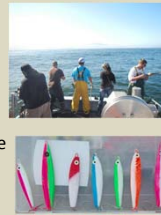
Commonly Caught Fishes



Methods

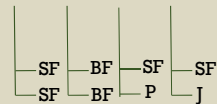
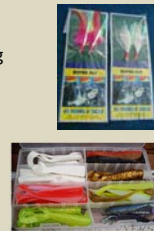
Study Design

- 4 Ports: Crescent City, Eureka, Shelter Cove, and Fort Bragg
- 4 paired MPA and Reference Sites
- 4 random sampling stations at each site
- Summer 2014 (3 trips/site) and 2015 (2 trips/site)



Data Collection

- Chartered Commercial Passenger Fishing Vessel (CPFV)
- Standardized hook-and-line sampling
- 4 anglers, 1 fish processor, 1 data recorder
- Each fish was identified, measured, and tagged (if fork length > 240mm)
- Minimum of 3 drifts through each of the 4 stations. Each station fished for 45 minutes



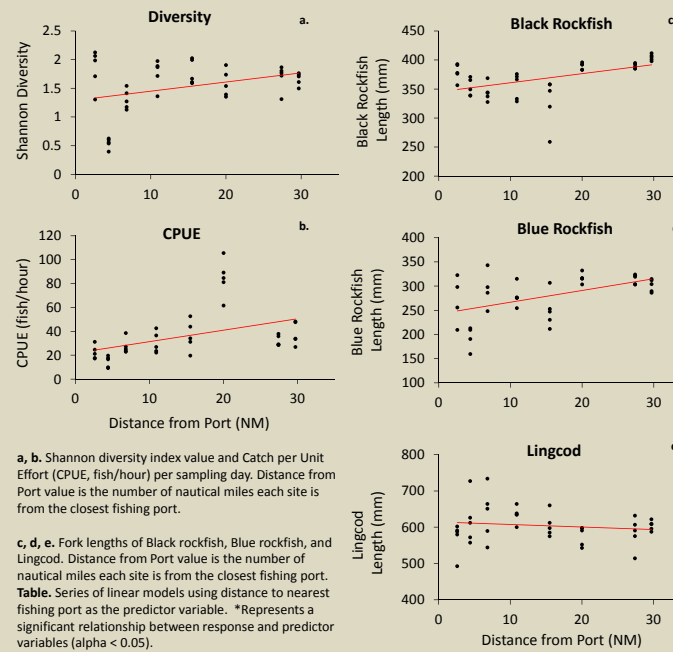
SF= Shrimp Fly BF= Baited Shrimp Fly
P= Plastic Swimbait J= Metal Jig

Data Analysis

- Shannon diversity index is calculated using the "vegan" package in program R
- Generalized linear models built to evaluate distance from port as a predictor of relative fish abundance, diversity and size structure
- Site maps built in ArcGIS 10.2 (Esri, Inc)



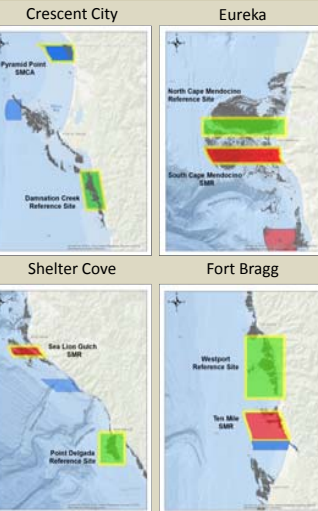
Distance from Port as Explanatory Variable



a, b. Shannon diversity index value and Catch per Unit Effort (CPUE, fish/hour) per sampling day. Distance from Port value is the number of nautical miles each site is from the closest fishing port.
c, d, e. Fork lengths of Black rockfish, Blue rockfish, and Lingcod. Distance from Port value is the number of nautical miles each site is from the closest fishing port.
Table. Series of linear models using distance to nearest fishing port as the predictor variable. *Represents a significant relationship between response and predictor variables (alpha < 0.05).

Linear Regression Models

Response	Predictor	Estimate	Std Error	p-value
Mean CPUE (a)	Distance from Port	0.956	0.325	0.006*
Mean Shannon Diversity (b)	Distance from Port	0.016	0.007	0.028*
Black Rockfish Length (c)	Distance from Port	1.566	0.441	0.001*
Blue Rockfish Length (d)	Distance from Port	2.429	0.669	0.001*
Lingcod Length (e)	Distance from Port	-0.695	0.777	0.376



Broader Implications

- Direct effects of MPAs may not be seen for several years
- These data should be used as a baseline for future MPA studies
- Distance from port can be used as a proxy for historical fishing pressure in Northern California nearshore rocky reefs

Acknowledgments

- Tim Mulligan, Tim Bean, Joe Tyburczy
- Drew Barrett, Chad Martel, Leon Davis, Kaitlyn Manishin, and all volunteer anglers
- CPFV Captains
- Mulligan Lab