California Collaborative Fisheries Research Program: Using a Citizen Science Model to Monitor California’s Nearshore Fisheries

Melissa Monk, NOAA Fisheries
Rick Starr, Moss Landing Marine Lab
Dean Wendt, Cal Poly, SLO
Acknowledgements

The California Collaborative Fisheries Research Program is a collaborative effort among researchers from CA Sea Grant at Moss Landing Marine Laboratories and the CCMS at Cal Poly San Luis Obispo as well as the captains and crews of F/Vs Admiral, Caroline, Chubasco, Fiesta, Huli Cat, New Captain Pete, Pacific Horizon, Patriot, Princess, Queen of Hearts, Rita G, Salty Lady, and Tigerfish.
CCFRP Science
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Collaborative vs. Cooperative
Different terms for the same activities?

Collaborate by definition describes a joint intellectual effort, in addition to working toward a common goal.
Building A Community Science Model
Developing a Shared Understanding of Resources

- Managers, fishermen, scientists and environmentalists all have different understanding of the status of resources that result from different perspectives
- Over past 40 years fisheries and monitoring has been carried out to a large extent by academic and government scientists
- Give fishermen a voice in science and management and enable them to become part of the information solution
- Generate needed data for CDFW and NOAA Fisheries
- Build trust and facilitate communication among factions in fisheries management
- Models for stock assessments are complex and specialized
California Collaborative Fisheries Research Program

Goal: State-wide protocols for stock assessment and MPA monitoring utilizing fishermen knowledge and fishing expertise

- Synchronous monitoring program over a broad geographic scale
- Standardized protocols across the entire geographic scale
- Long term sampling for several years to develop data sets useful to fisheries management
Central California MPAs

- 29 MPAs
- 18% of the state waters
- Framework to accomplish the goal is the MLPA

www.dfg.ca.gov/mlpa/
Multiple workshops on the central coast included fishermen, fisheries scientists, NGO’s, city officials, resource managers

Steve Ralston (NOAA Fisheries), Deb Wilson-Vandenberg (CDFG), Debbie Aseltine-Neilson (CDFG), Jason Cope (NOAA Fisheries)

Met with approximately 60 fishermen, both recreational and commercial
CCFRP Approach

Stratified Random Surveys Through Time:

- Used Scientist’s Skills to Design Statistically Sound Study
- Used Joint Knowledge to Determine Where to Fish (Strata)
- Used CPFV Captains & Volunteer Fishermen’s Skills to Catch Fish
- Scientists to Record and Analyze Data
- All to Interpret and Build Common Understanding
Sampling Locations Distributed
Sampling Cells Located in MPA/REF Sites

- 1973 MPA boundaries
- 2007 MPA boundaries
- MPA grid cells
- Reference (REF) grid cells
## Data collection during fishing

### California Collaborative Fisheries Research Program

<table>
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<tr>
<th>Location</th>
<th>Montecito</th>
<th>Vessel</th>
<th>LADNOOS</th>
<th>Date</th>
<th>Year</th>
<th>Site (circle one)</th>
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<th>Drift #</th>
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| Start Time | 10:21 - 10:25 | End Time | 10:47 - 10:55 | Start/End Depth | 19 - 115 ft | Start Lat/Long | 34.5 - 120.884/121.757 |

### Data on Fishes

<table>
<thead>
<tr>
<th>Species</th>
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<th>Total Length (cm)</th>
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<th>Cond</th>
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<td>31</td>
<td>F</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Gopher 13</td>
<td>9</td>
<td>30</td>
<td>5</td>
<td></td>
<td></td>
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<td>30.147</td>
<td>57.207</td>
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### Catch Data
- Angler number
- Species
- Total length (cm)
- Fish condition
- Tag number
- Start/stop times
- GPS coordinates
Maximizing Survivorship of Released Fish

- sample ≤ 120 feet
- fish without barbed hooks
- use careful handling techniques
- keep surface time ≤ 5 min
- descend fishes, when necessary
- regularly replace seawater
- only tag fishes in good condition
CCFRP Summary (2007 to 2016)

☑ 12 CPFVs, 20 skippers, 4 harbors
☑ 325 sampling days at sea
☑ 901 volunteer anglers
☑ 11,700 hours of fishing
☑ 82,457 fishes (52 spp.)
☑ 40,368 fishes tagged and released
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10 Species Accounted for >80% of Catch

- Black Rockfish
- [True] Blue Rockfish
- [Deacon] Blue Rockfish
- Canary Rockfish
- Copper Rockfish
- Gopher Rockfish
- Kelp Rockfish
- Lingcod
- Olive Rockfish
- Vermilion Rockfish
- Yellowtail Rockfish
Top 10 species caught combined

- **No Bait**: 33% (22,931)
- **Bar**: 33% (22,359)
- **Bait**: 34% (23,319)
How we measure relative abundance:
Catch-Per-Unit-Effort (CPUE)

Here, CPUE is catch per *angler-hour*

$$\text{CPUE} = \frac{\text{Number of fishes caught}}{[\text{total drift time}] \times [\# \text{ anglers fishing}] - [\text{angler off time}]}$$
MPA Performance

Expectations of MPAs
1) increase species diversity
2) increase fish size (e.g., length)
3) increase reproductive output
4) increase abundance of fishes
MPA Performance

35 years = reserve effects

Fish Species
- Kelp Rockfish
- Copper Rockfish
- Blue Rockfish
- Vermilion Rockfish
- Gopher Rockfish
- Olive Rockfish
- Black Rockfish

Point Lobos

Percent Similarity

Piedras Blancas
Año Nuevo

Point Lobos
Point Buchon

1973 initial reserve
2007 expansion

Fish Species
- Kelp Rockfish
- Copper Rockfish
- Blue Rockfish
- Vermilion Rockfish
- Gopher Rockfish
- Olive Rockfish
- Black Rockfish

Point Lobos

Percent Similarity

Piedras Blancas
Año Nuevo

Point Lobos
Point Buchon

1973 initial reserve
2007 expansion
MPA Performance

35 years = greater mean lengths inside MPAs

Point Lobos
(2007 and 2008)

Reference Site

Point Lobos Ecological Reserve (est. 1973)

Mean Length (cm)

- ★ p < 0.05 (MPA greater)
- ★★ p < 0.001 (MPA greater)
- ✺ p < 0.05 (REF greater)
- ✺✺ p < 0.05 (REF greater)
all areas and years (2007 to 2013) combined

Proportion of Individuals ≥ Length at 50% Maturity

- Black Rockfish
- Blue Rockfish
- Canary Rockfish
- China Rockfish
- Copper Rockfish
- Gopher Rockfish
- Kelp Rockfish
- Lingcod
- Olive Rockfish
- Vermilion Rockfish
- Yellowtail Rockfish

Reference Site
Point Lobos Ecological Reserve (est 1973)
CCFRP Data Analyses

Signs of potential MPA effects

Mixed model regression analysis
Variation in Responses of Fishes across Multiple Reserves within a Network of Marine Protected Areas in Temperate Waters

Richard M. Starr¹,²*, Dean E. Wendt³, Cheryl L. Barnes², Corina I. Marks², Dan Malone⁴, Grant Waltz³, Katherine T. Schmidt², Jennifer Chiu², Andrea L. Launer², Nathan C. Half³, Noëlle Yochum⁵

¹ California Sea Grant Extension Program, Moss Landing Marine Laboratories, Moss Landing, California, United States of America, ² Moss Landing Marine Laboratories, Moss Landing, California, United States of America, ³ California Polytechnic University, San Luis Obispo, California, United States of America, ⁴ University of California Santa Cruz, Santa Cruz, California, United States of America, ⁵ Oregon State University, Corvallis, Oregon, United States of America

* starr@mml.calstate.edu
General Trends in MPA Performance

Total

Año Nuevo

Point Lobos

Piedras Blancas

Point Buchon

Mean CPUE (# Fish / Angler*Hour)


Summary of Results

- Greater size and abundance of fishes in old Point Lobos MPA (1973)

- Species differences in sizes and abundances vary by area for new MPAs (2007)

- Overall, greater catch rates, biomass, size, and reproductive potential inside central California MPAs
Lessons about MPA Performance
Greater lengths for some species, in some areas

<table>
<thead>
<tr>
<th>Species</th>
<th>Año Nuevo</th>
<th>Point Lobos</th>
<th>Piedras Blancas</th>
<th>Point Buchon</th>
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<tbody>
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<td>Black Rockfish</td>
<td>★★</td>
<td>★★</td>
<td>★★★</td>
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<tr>
<td>Blue Rockfish</td>
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<td>★★</td>
<td>★★★</td>
<td>★</td>
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<tr>
<td>Canary Rockfish</td>
<td>★</td>
<td></td>
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<tr>
<td>China Rockfish</td>
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<td>★★</td>
<td>★★★</td>
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<tr>
<td>Copper Rockfish</td>
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<td>★★</td>
<td>★★</td>
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<tr>
<td>Gopher Rockfish</td>
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<td></td>
<td>★★★</td>
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<tr>
<td>Kelp Rockfish</td>
<td>★</td>
<td>★</td>
<td></td>
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<tr>
<td>Lingcod</td>
<td>★★</td>
<td>★★</td>
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<tr>
<td>Olive Rockfish</td>
<td>★★</td>
<td>★★</td>
<td>★★</td>
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<td>Vermilion Rockfish</td>
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<td>★★</td>
<td>★★</td>
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<tr>
<td>Yellowtail Rockfish</td>
<td>★</td>
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<td>★★</td>
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★ p < 0.05 (MPA greater)  ★★ p < 0.001 (MPA greater)
⋯ p < 0.05 (REF greater)  ⋯ p < 0.001 (REF greater)
**Lessons about MPA Performance**

Greater abundance for some species, in some areas

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<th>Point Buchon</th>
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<tr>
<td>Blue Rockfish</td>
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<td>★★</td>
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<td>Canary Rockfish</td>
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<td>Copper Rockfish</td>
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<td>Lingcod</td>
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<td>Vermilion Rockfish</td>
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★ p < 0.05 (MPA greater)  
★★ p < 0.001 (MPA greater)  
✪ p < 0.05 (REF greater)  
✪✪ p < 0.001 (REF greater)
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CCFRP and Fisheries Management

• Many nearshore West Coast groundfish species have not been assessed or assessed for the first time recently

• No West Coast nearshore fishery-independent survey

• Assessments have relied on fishery-dependent data for indices of relative abundance

• CCFRP can help fill data gaps
CCFRP Data for Stock Assessment

- Catch and effort data for indices of abundance
  - Index trends provide stock assessment models information about stock trend
- Length composition
- Otoliths collected as of 2017 for age-growth curves
- Fin clips for future genetic work (ex. Blue and deacon rockfishes)
- CCFRP is the only long-term sampling program within MPAs
  - No longer receive the traditional fishery-dependent data once areas are closed to fishing
Indices of Abundance

- Inform stock assessment of the stock’s trend
- Ideally, have both fishery-independent and fishery-dependent indices
- Often a high percent of zero observations
  - Especially for less common or elusive species
Indices of Abundance

- Combine high resolution (2 m) bathymetric data to further refine site and data selection for analyses
- Proxy for rockfish habitat
Example: Blue rockfish

- Comparison of indices from the CCFRP and a fishery-dependent survey of the recreational boat fleet
- Blue rockfish fairly common
  - Average 50% positives in CPFV data (7%-83%)
  - Average 55% positives in CCFRP data (26%-81%)
Example: Gopher rockfish

- Comparison of indices from the CCFRP and a fishery-dependent survey of the recreational boat fleet
- Small sample sizes from the CPFV fleet in 2010
- Need to investigate
The 2015 stock assessment indicated a strong 2010 year class.
CCFRP data not used in the 2015 assessment.

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