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.

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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

California Collaborative Fisheries Research Program

Protocol Scoping Workshops

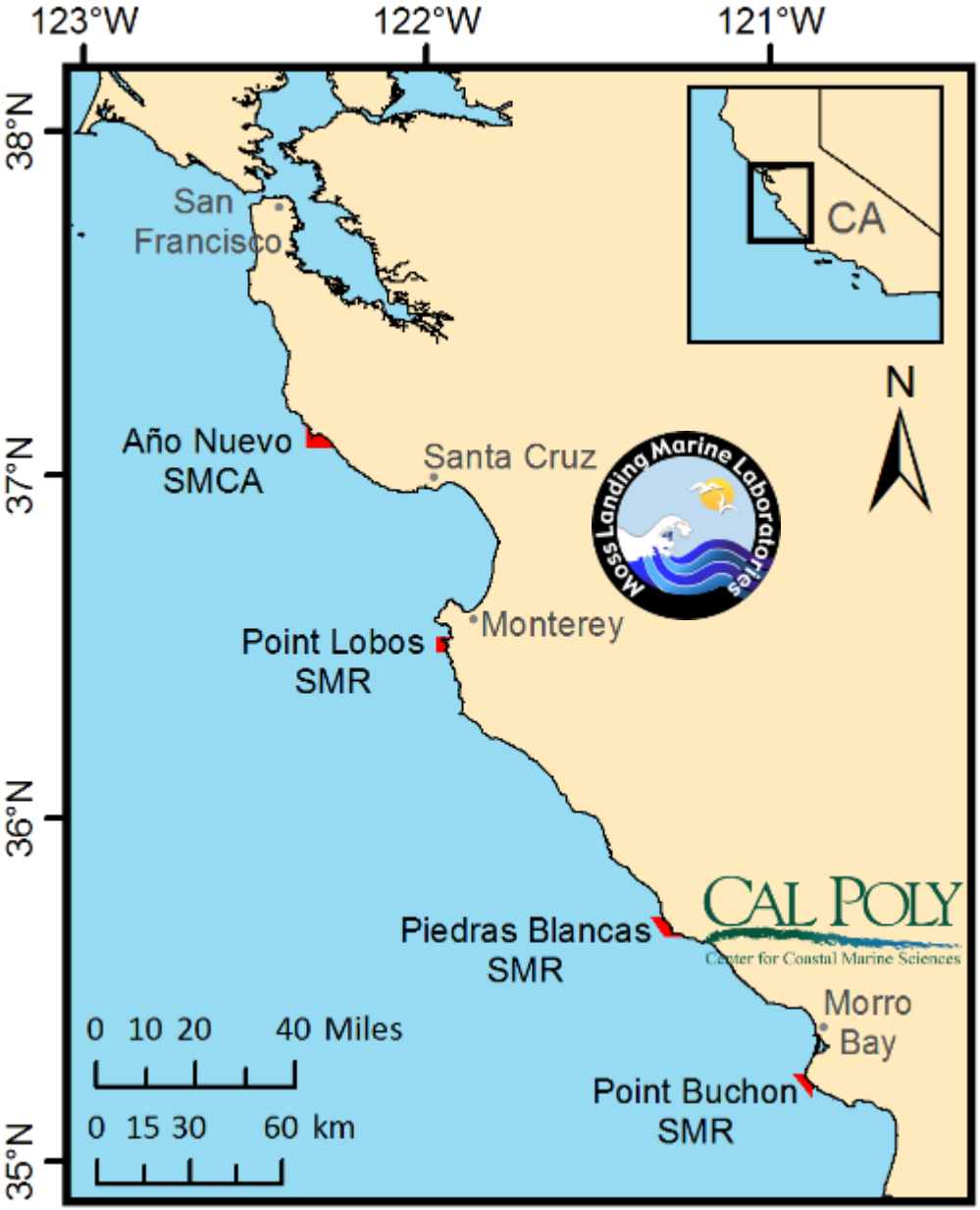
- Multiple workshops on the central coast included fishermen, fisheries scientists, NGO's, city officials, resource managers
- Steve Ralston (NOAA Fisheries), Deb Wilson-Vandenberg (CDFG), Debbie Aseltine-Neilson (CDFG), Jason Cope (NOAA Fisheries)
- Met with approximately 60 fishermen, both recreational and commercial

CCFRP Approach

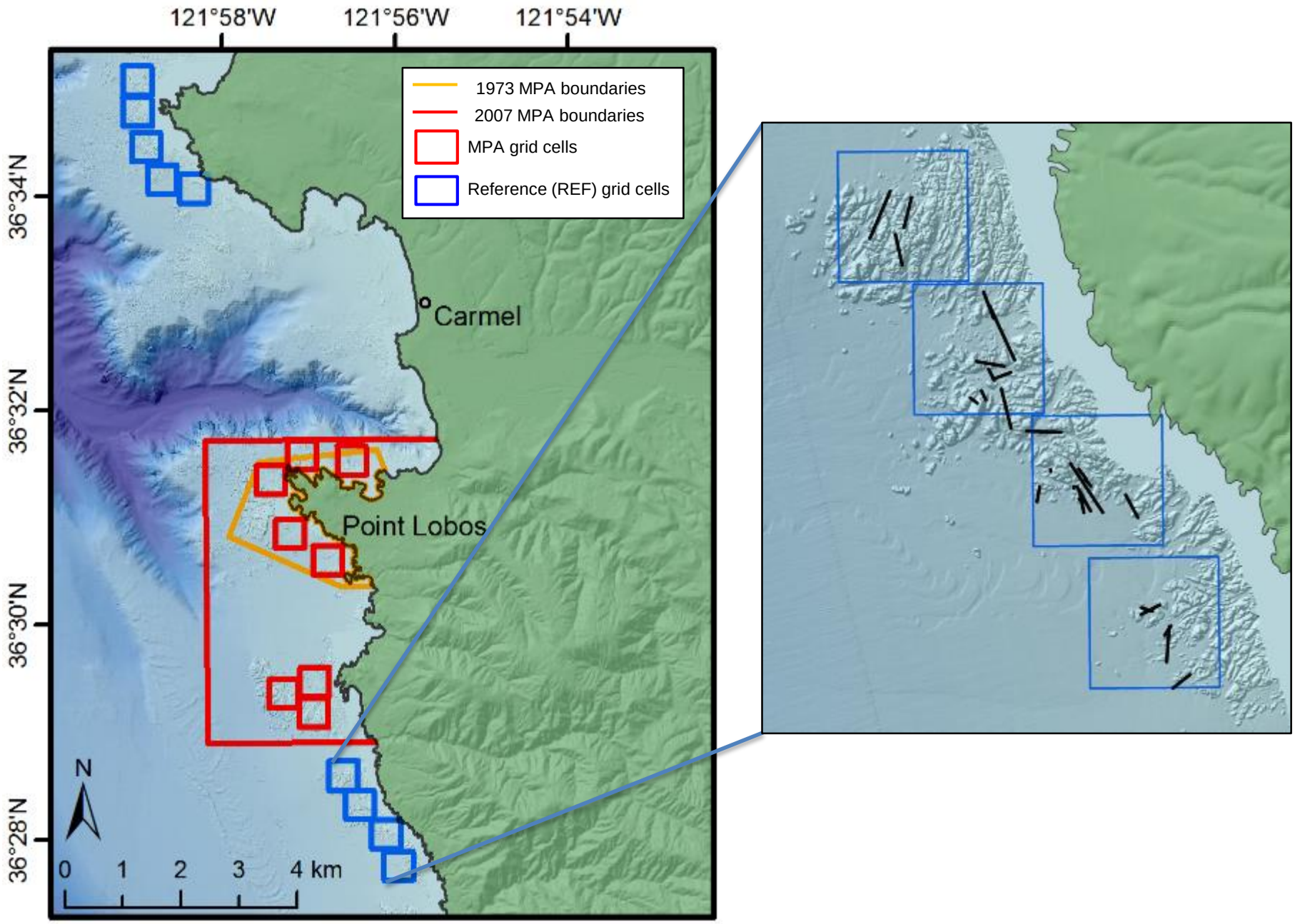
Stratified Random Surveys Through Time:

- 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

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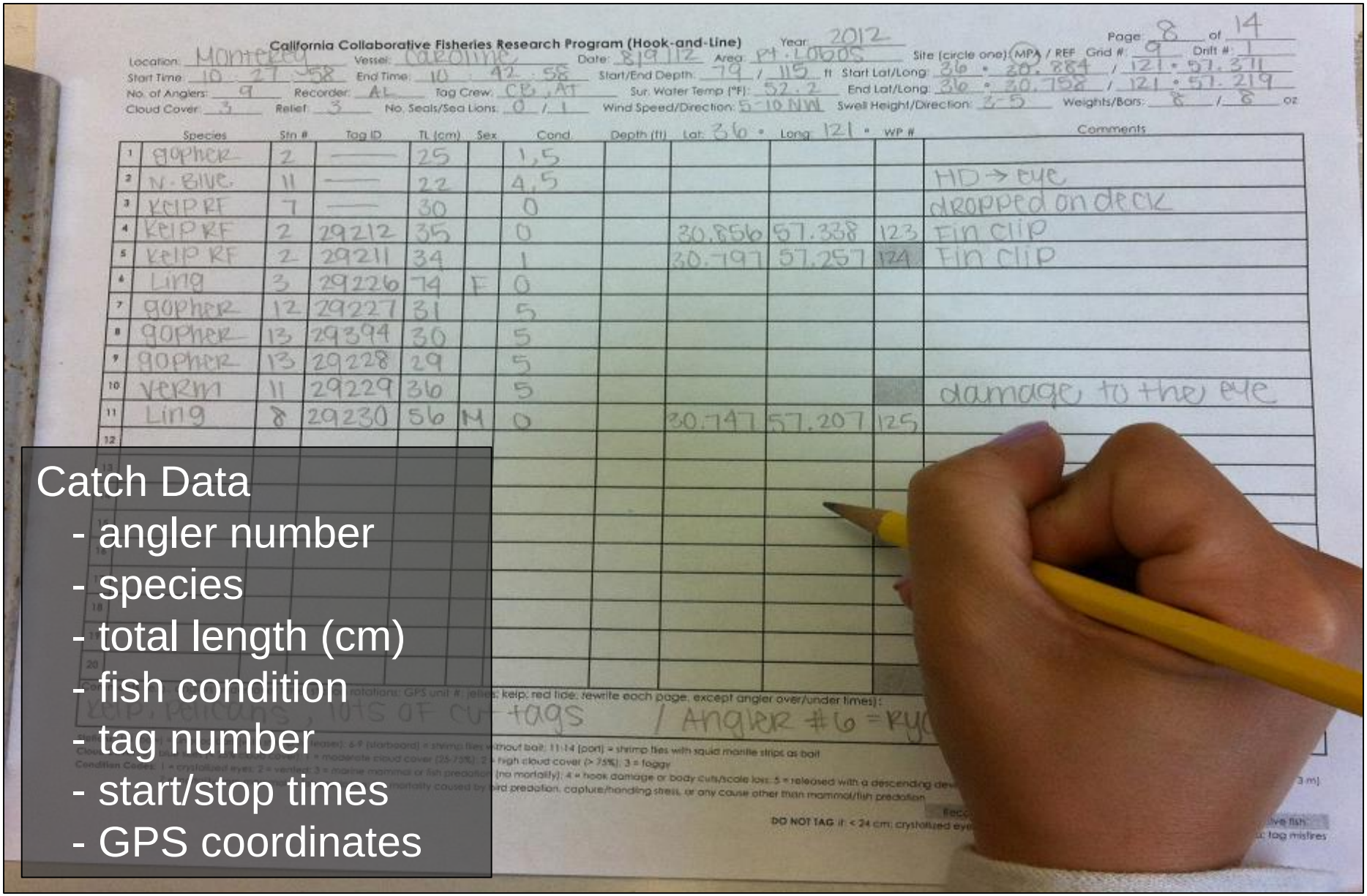
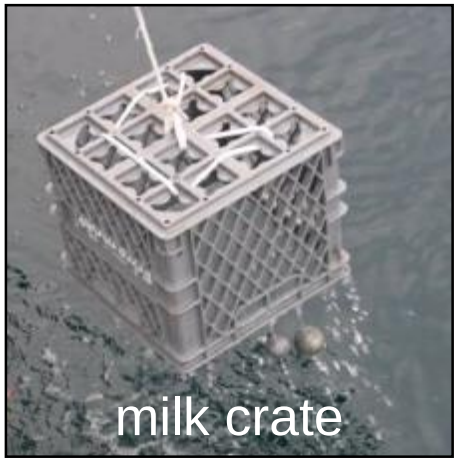
Data collection during fishing



Catch Data
- angler number
- species
- total length (cm)
- fish condition
- tag number
- start/stop times
- GPS coordinates

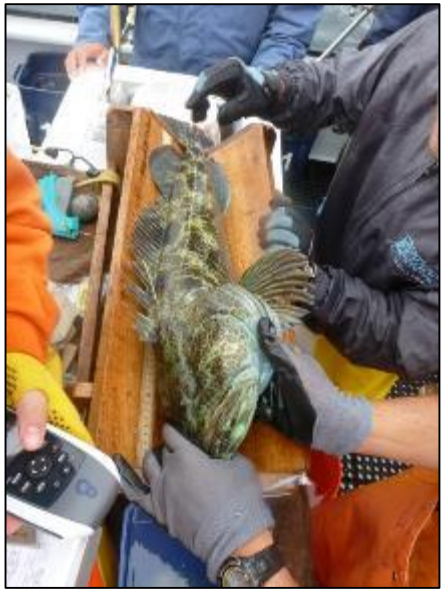
Maximizing Survivorship of Released Fish



- 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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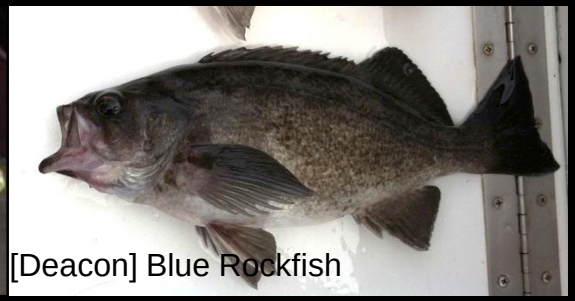
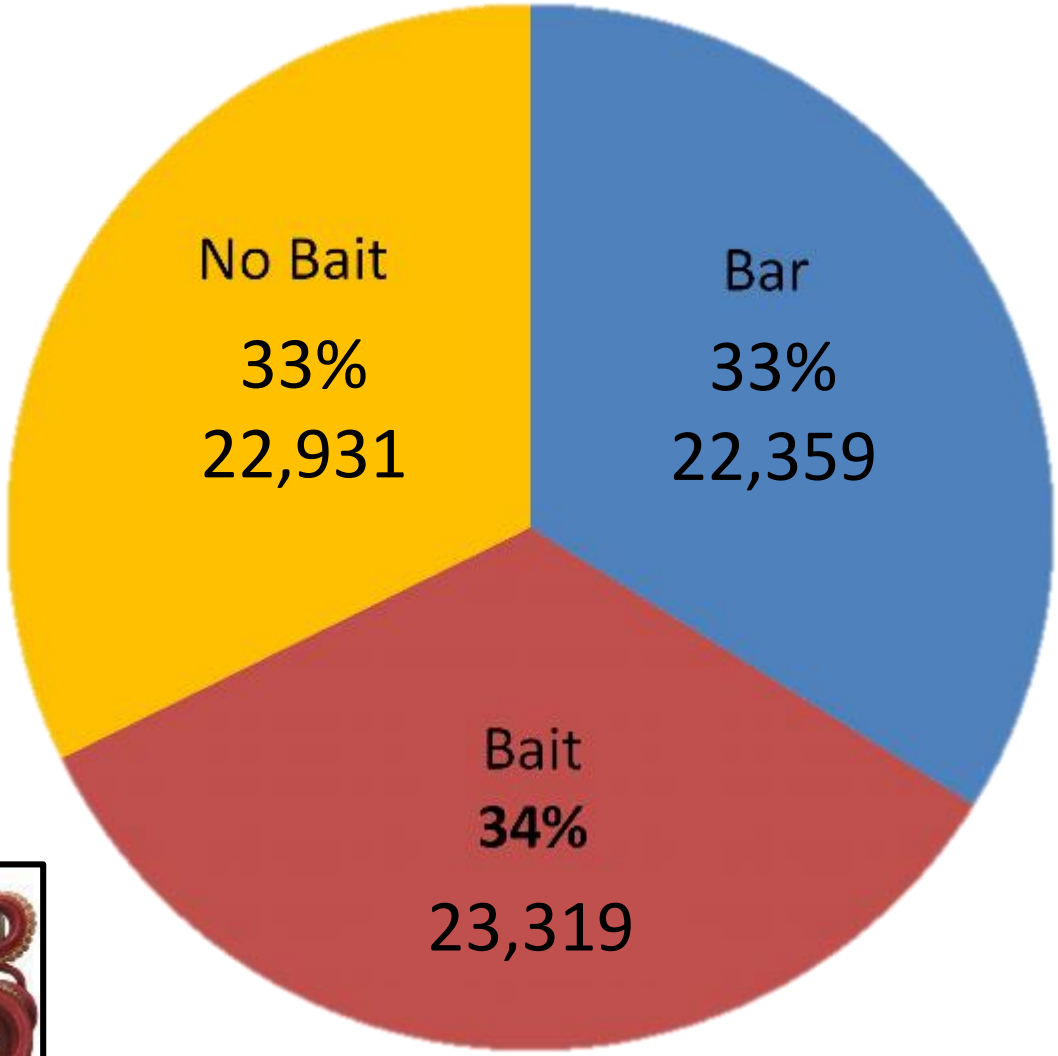
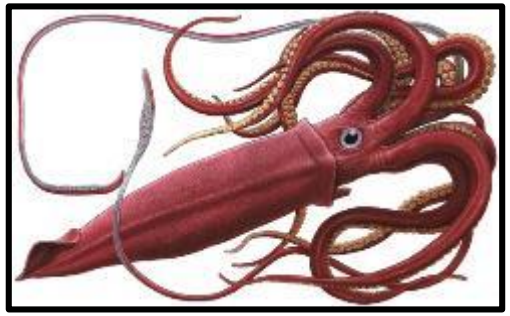
10 Species Accounted for >80% of Catch



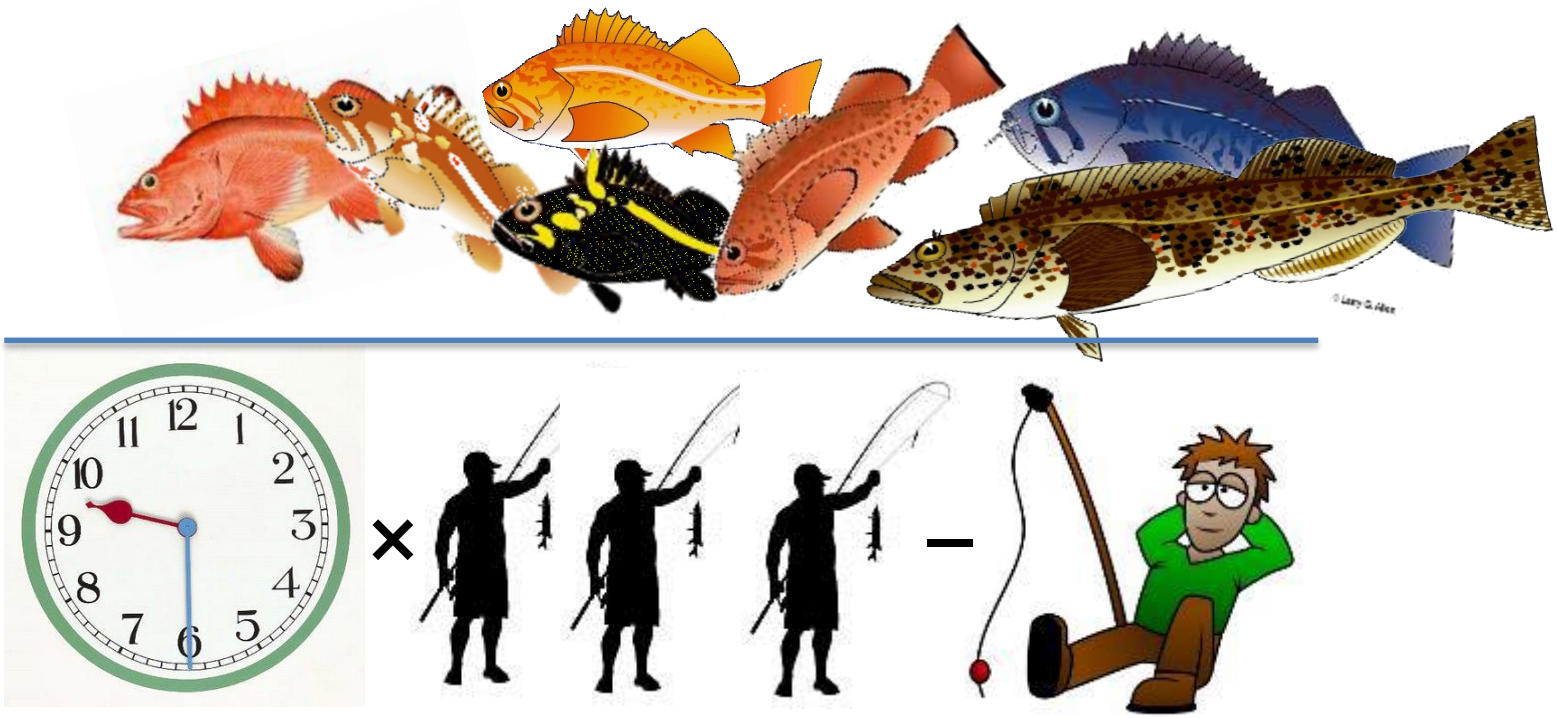
Top 10 species caught combined





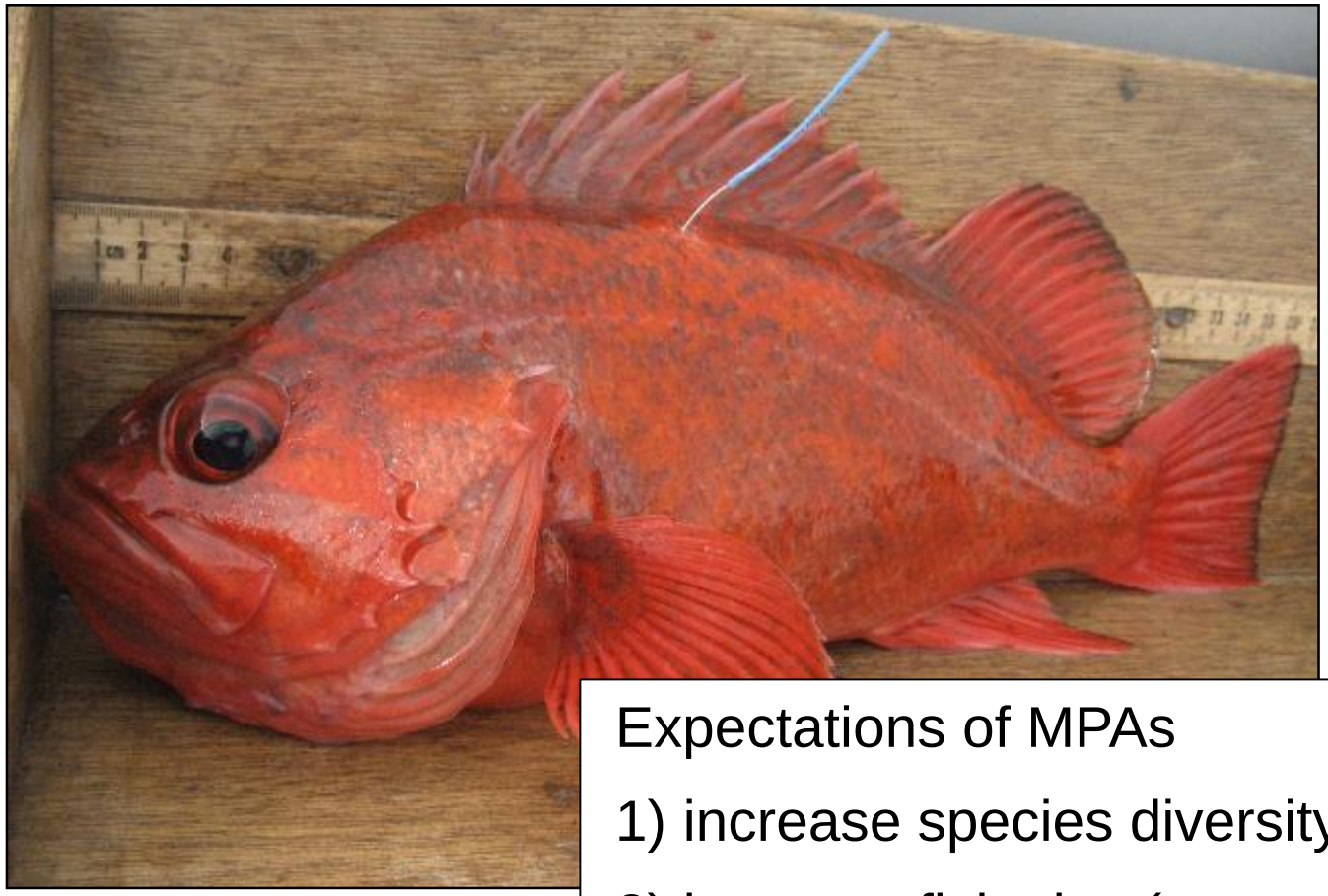
How we measure relative abundance: Catch-Per-Unit-Effort (CPUE)

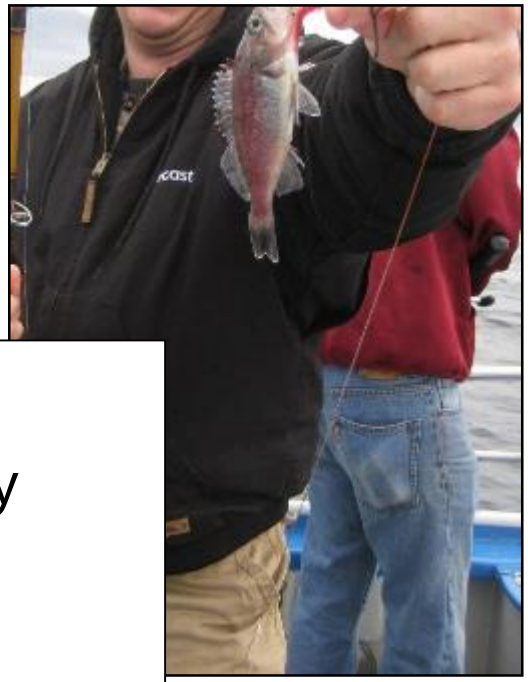
Here, CPUE is <u>catch per *angler-hour*</u>



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

MPA Performance





Expectations of MPAs

1) increase species diversity

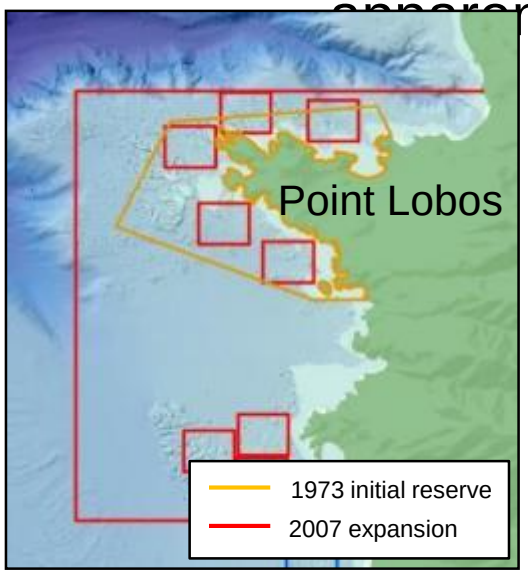
2) increase fish size (e.g., length)

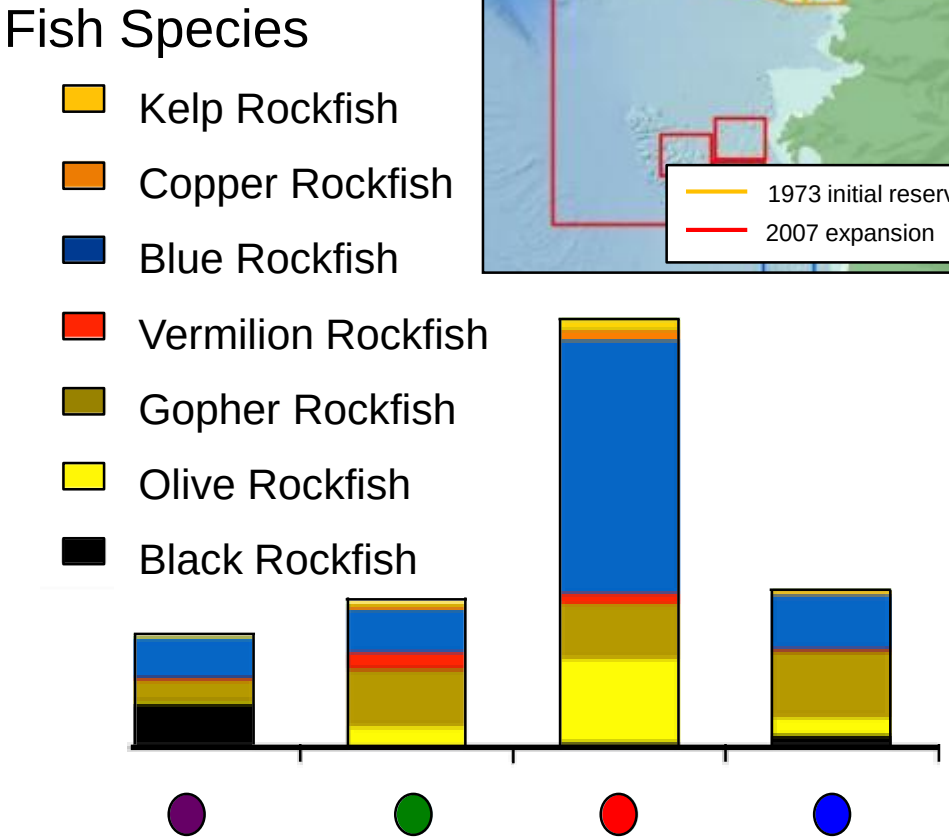
3) increase reproductive output

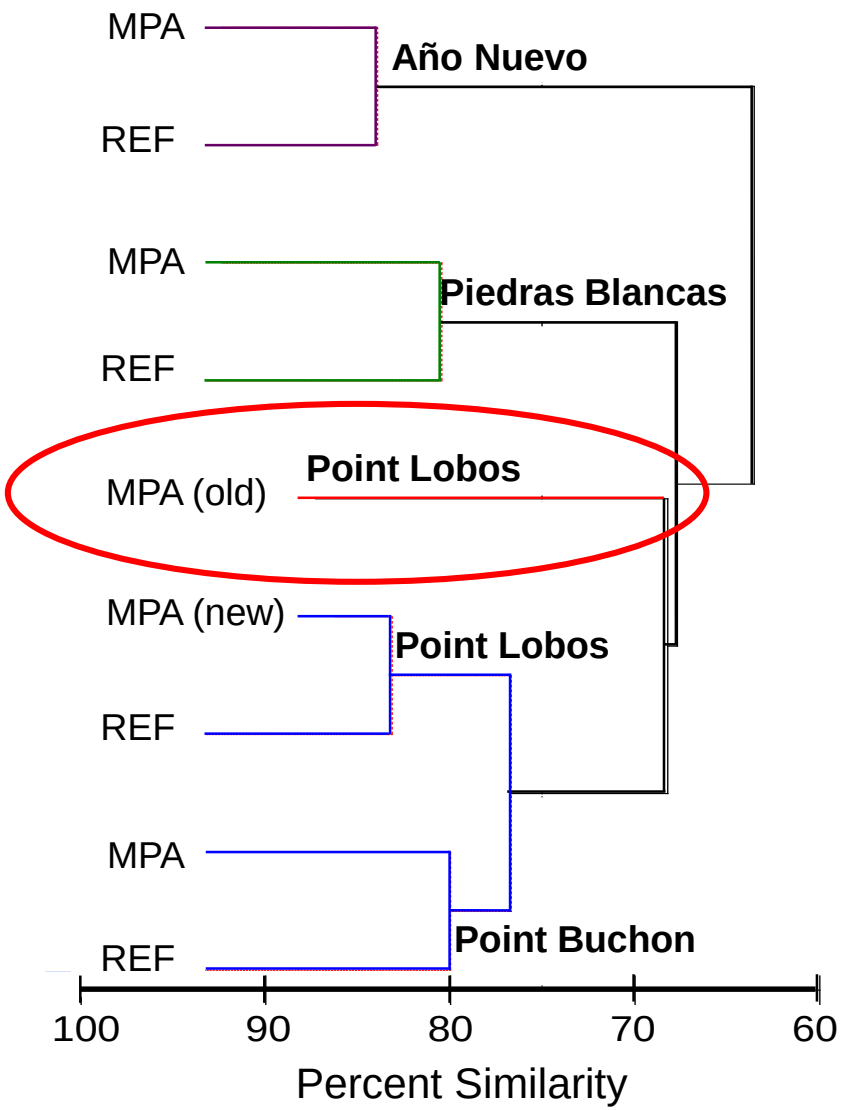
4) increase abundance of fishes

MPA Performance

35 years = reserve effects apparent

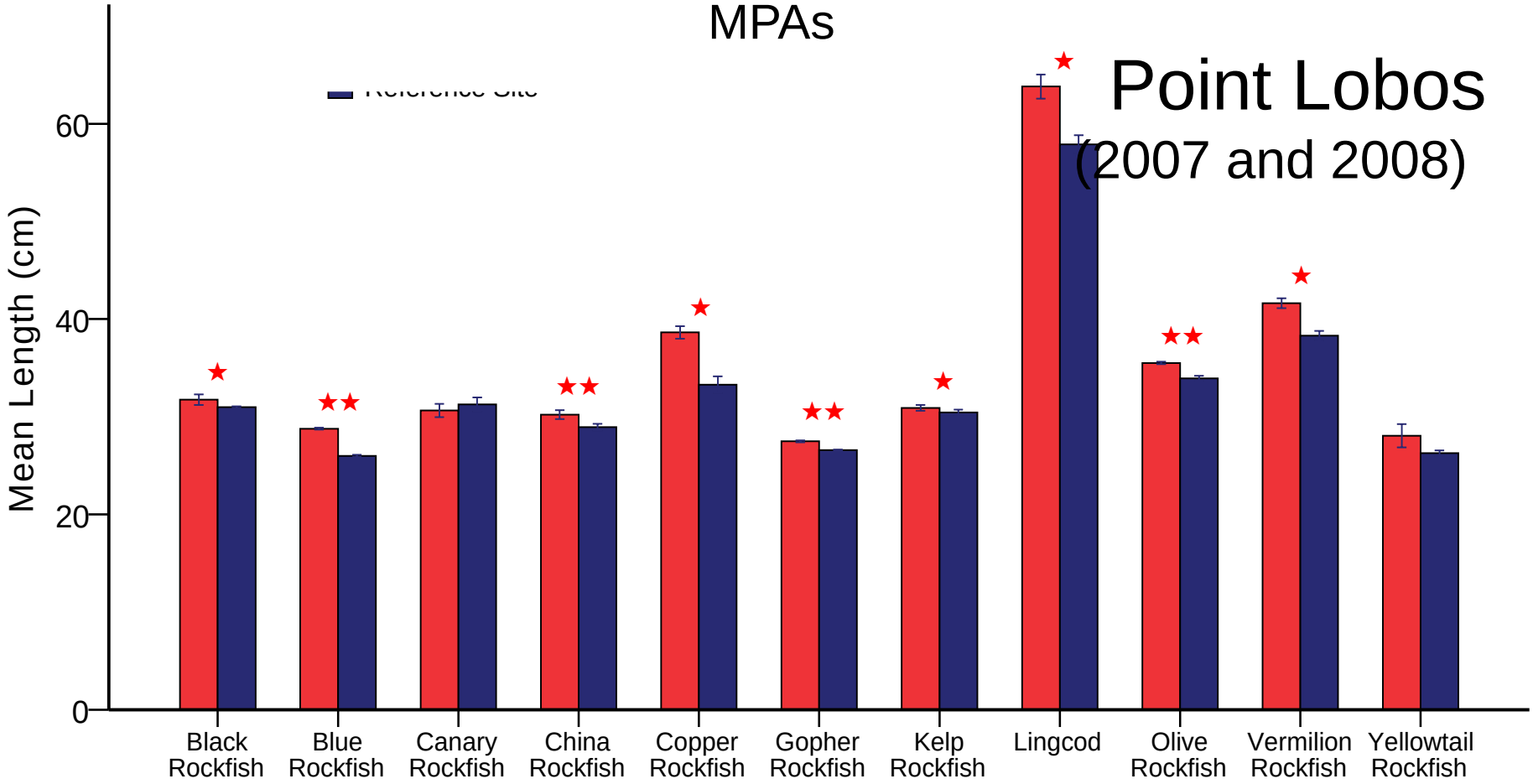






MPA Performance

35 years = greater mean lengths inside MPAs



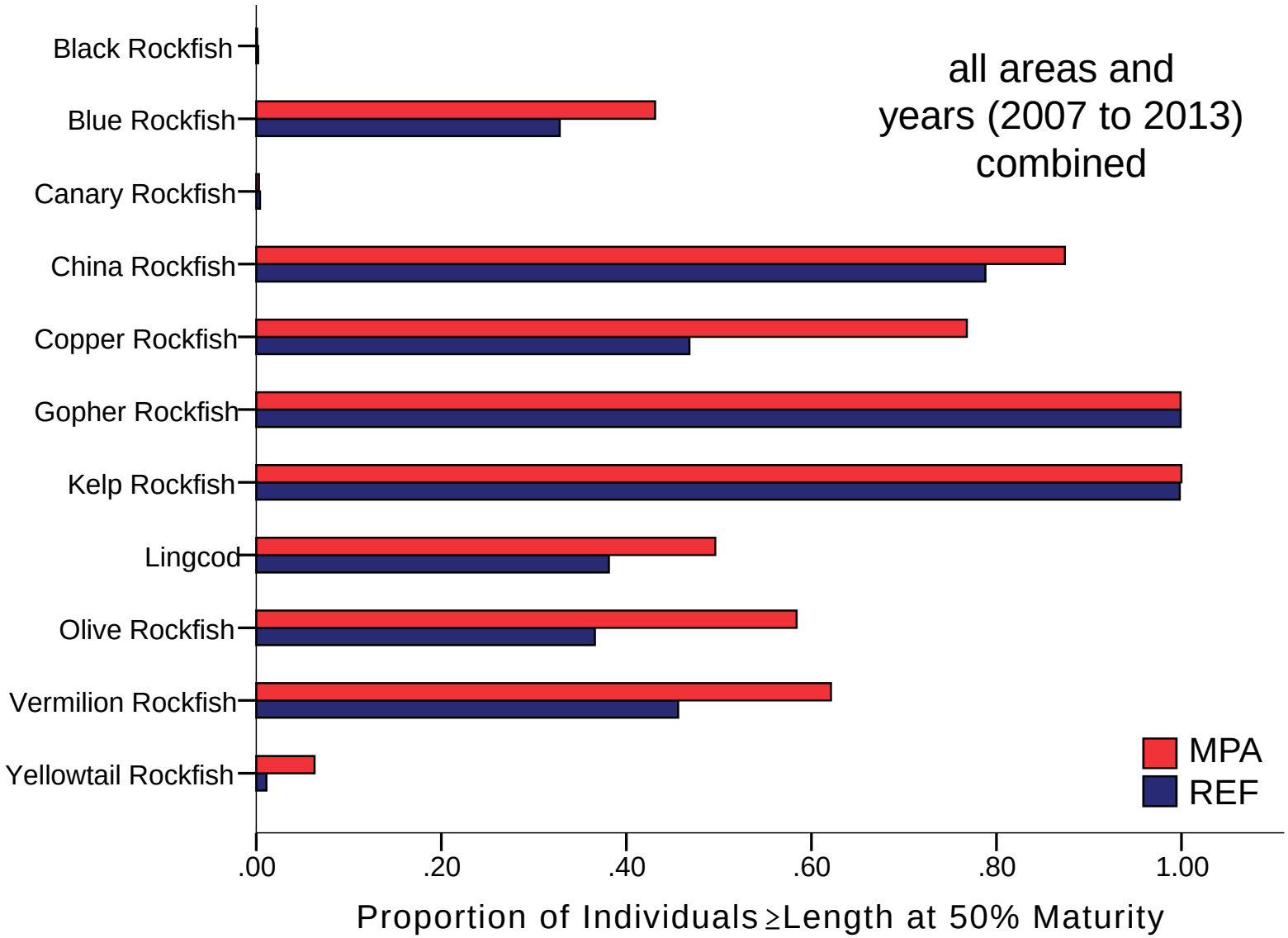
★ $p < 0.05$ (MPA greater)

★★ $p < 0.001$ (MPA greater)

✪ $p < 0.05$ (REF greater)

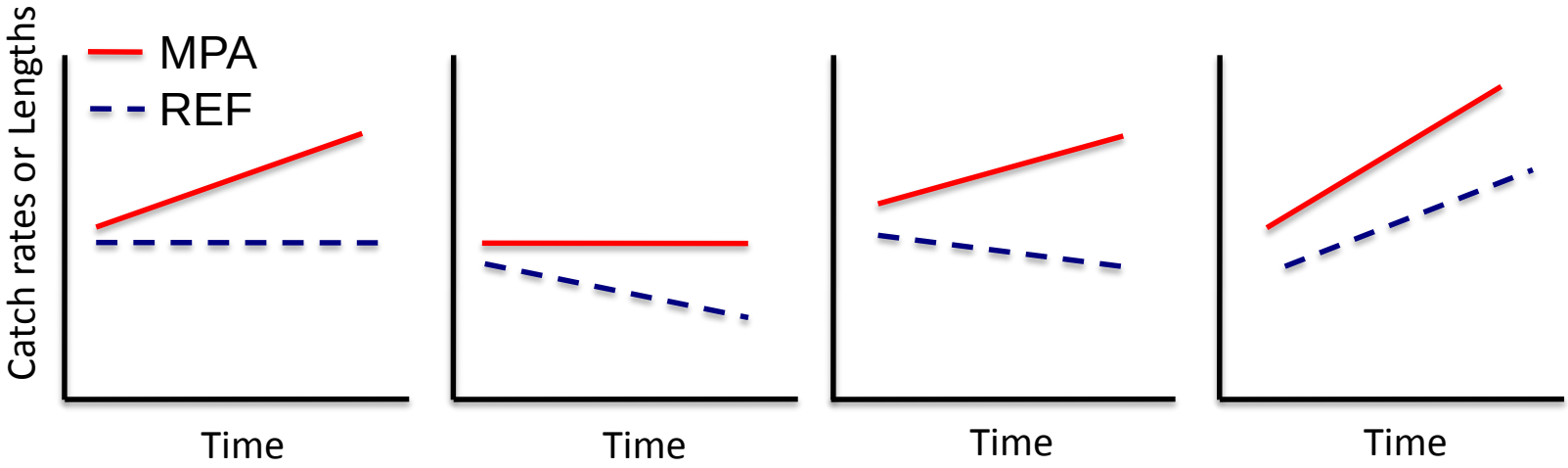
✪✪ $p < 0.05$ (REF greater)

MPA Performance



CCFRP Data Analyses

Signs of potential MPA effects



Mixed model regression analysis

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0118502

PLOS | ONE

RESEARCH ARTICLE

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

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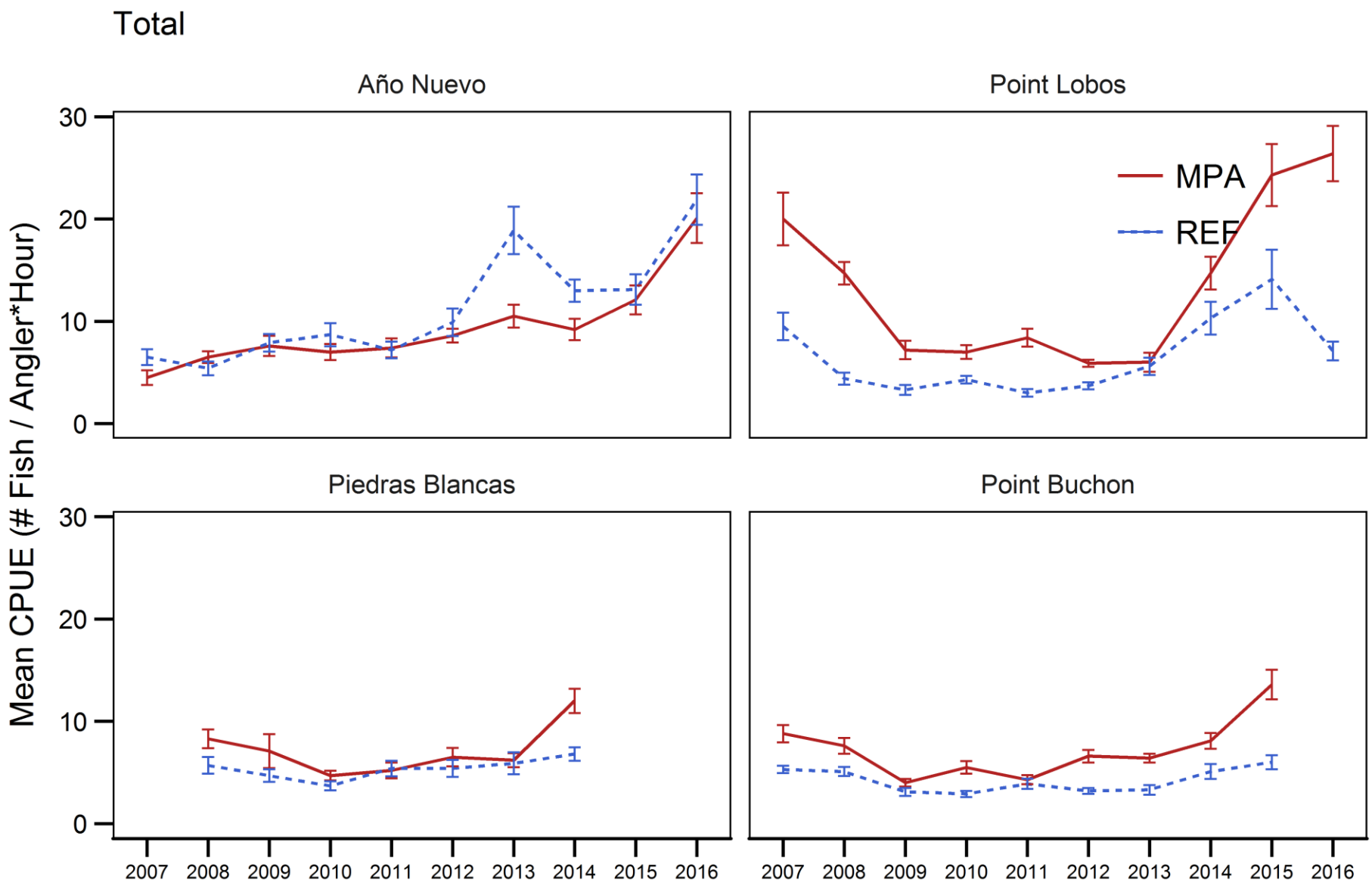
General Trends in MPA Performance



General Trends in MPA Performance

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

Species	Año Nuevo	Point Lobos	Piedras Blancas	Point Buchon
Black Rockfish	★★		✪✪	★
Blue Rockfish	★★	★★	✪✪	✪
Canary Rockfish	★			
China Rockfish		★★		
Copper Rockfish		★★	★★	
Gopher Rockfish		★	✪✪	✪✪
Kelp Rockfish	✪	★		
Lingcod		★★	★★	★★
Olive Rockfish		★★	★★	✪
Vermilion Rockfish		★	★★	★★
Yellowtail Rockfish		★		

★ $p < 0.05$ (MPA greater)
★★ $p < 0.001$ (MPA greater)
✪ $p < 0.05$ (REF greater)
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Lessons about MPA Performance

Greater abundance for some species, in some areas

Species	Año Nuevo	Point Lobos	Piedras Blancas	Point Buchon
Black Rockfish	✪✪			
Blue Rockfish		★★	★	★★
Canary Rockfish	★		★	★★
China Rockfish	✪✪	★★	★	★★
Copper Rockfish	★★	★★		
Gopher Rockfish	★★	★★		★★
Kelp Rockfish			✪✪	★★
Lingcod	★★	★		★
Olive Rockfish		★★	★★	★★
Vermilion Rockfish	★★	★★		★
Yellowtail Rockfish	★			★
All Species	✪	★★	★	★★

★ $p < 0.05$ (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

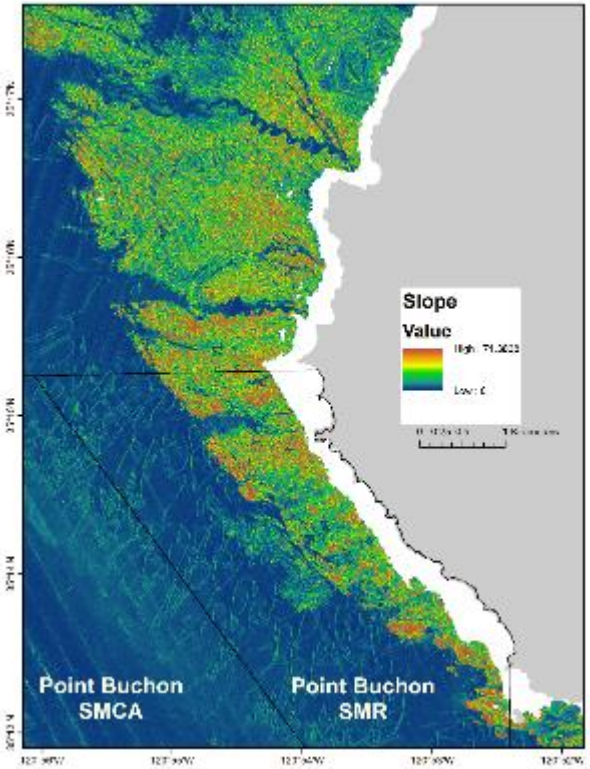
- Catch and effort data for indices of abundance
  - Index trends provide stock assessment models information about stock trend
- Length composition
- Otoliths collected as of 2017 for age-growth curves
- Fin clips for future genetic work (ex. Blue and deacon rockfishes)
- CCFRP is the only long-term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

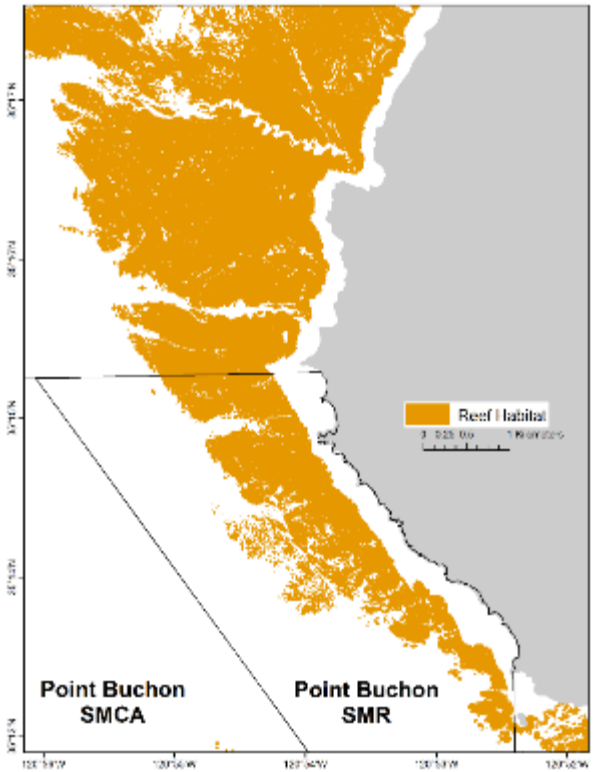
Indices of Abundance

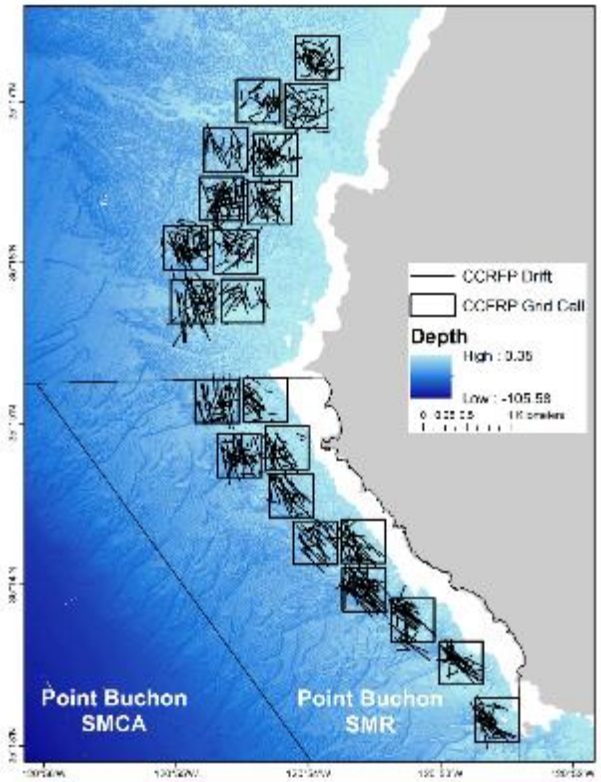
- Inform stock assessment of the stock's trend
- Ideally, have both fishery-independent and fishery-dependent indices
- Often a high percent of zero observations
  - Especially for less common or elusive species

Indices of Abundance

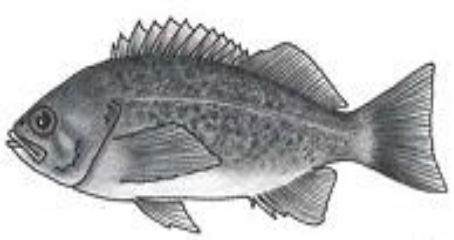
- Combine high resolution (2 m) bathymetric data to further refine site and data selection for analyses
- Proxy for rockfish habitat



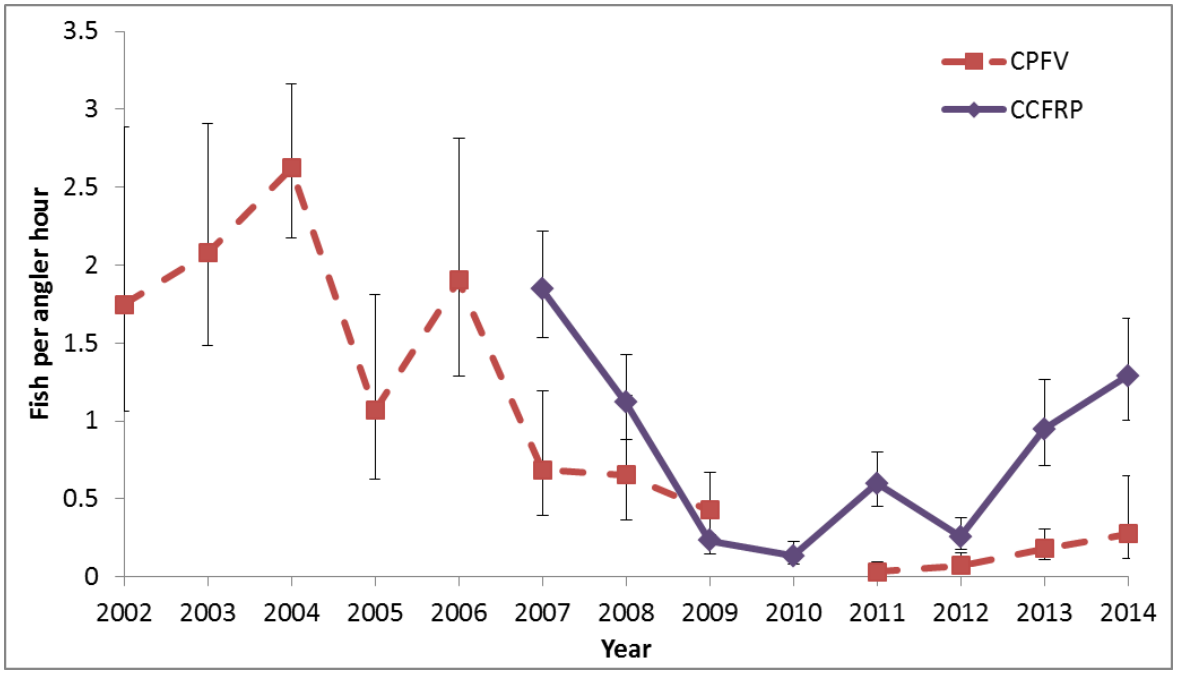




Example: Blue rockfish

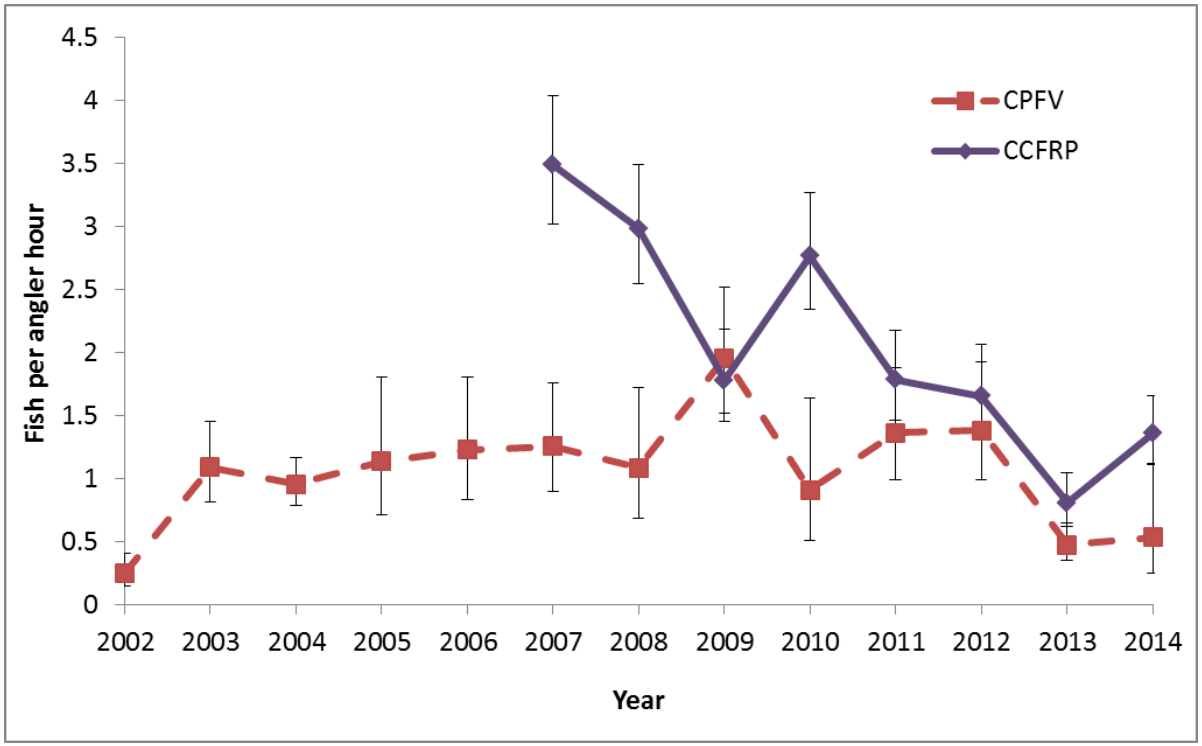


- Comparison of indices from the CCFRP and a fishery-dependent survey of the recreational boat fleet
- Blue rockfish fairly common
  - Average 50% positives in CPFV data (7%-83%)
  - Average 55% positives in CCFRP data (26%-81%)



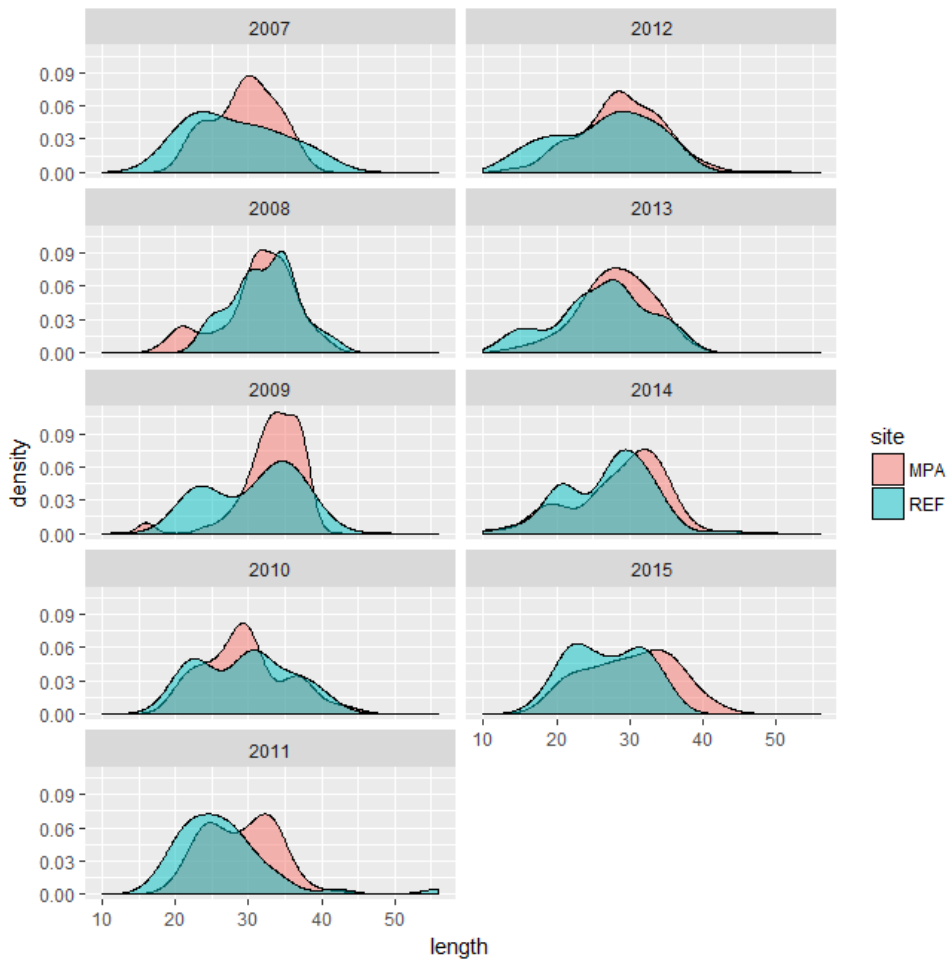
Example: Gopher rockfish

- 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



Length composition: Canary rockfish

- The 2015 stock assessment indicated a strong 2010 year class
- CCFRP data not used in the 2015 assessment



Sample sizes

Year	MPA	Reference
2007	42	13
2008	69	45
2009	74	23
2010	89	46
2011	80	40
2012	129	44
2013	139	38
2014	176	79
2015	43	38

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