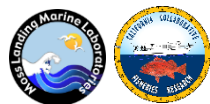


# Examining the effects of the 2014-2015 marine heatwave on fish community composition along the central California coast



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## Abstract

Marine heatwaves (MHWs) are increasing in intensity and frequency across the world and these events have been shown to impact the diversity and composition of fish communities. California experienced a heatwave from 2014-2015, where ocean temperature anomalies were persistently elevated along the entire U.S. West Coast by up to 6°C. Our study seeks to understand the impact of the 2014-2015 MHW on rocky reef fish diversity and community composition along the central California coast. We utilized hook-and-line survey data collected by the California Collaborative Fisheries Research Program (CCFRP) to examine fish species diversity and community composition inside and outside four Marine Protected Areas (MPAs) along central California before, during, and after the 2014-2015 MHW. Across the entire region there was a drastic decline in evenness and Shannon-Weiner diversity following the MHW both inside MPAs and in associated reference sites (REFs). We also found that there was a shift in community composition following the MHW due to changes in relative abundance of Blue Rockfish, Olive Rockfish, Black Rockfish and Gopher Rockfish in both MPAs and REFs. In more recent years, there is evidence that diversity and evenness are recovering more rapidly inside the MPAs than REFs. Our results suggest MPAs may not mitigate short-term effects of climatic disturbance events, but may contribute to the long-term resiliency of marine fish communities.

## Questions

1. How do fish communities respond to MHWs inside and outside of MPA?
2. What is the effect of MHWs on species richness, diversity, and evenness?
3. How do MHWs influence fish community composition?

## Methods

- Data collected by volunteer anglers through CCFRP
- Sampled inside and outside of 4 MPAs
- Calculated Shannon Diversity Index, species richness, and species evenness over time
- Conducted ANOVAs and linear regressions to determine changes in diversity metrics from MHW
- Examined changes in community composition before, during and after the 2014-2015 MHW with PERMANOVA & NMDS

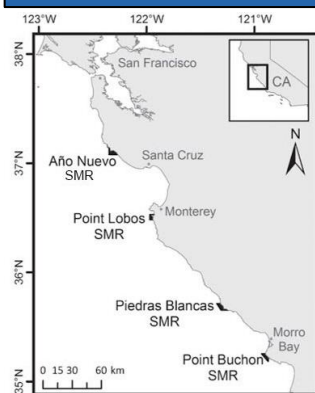


Fig 1. Map of CCFRP study sites

## Results

### Species evenness and diversity at MPA and REF sites declined following the 2014-2015 MHW

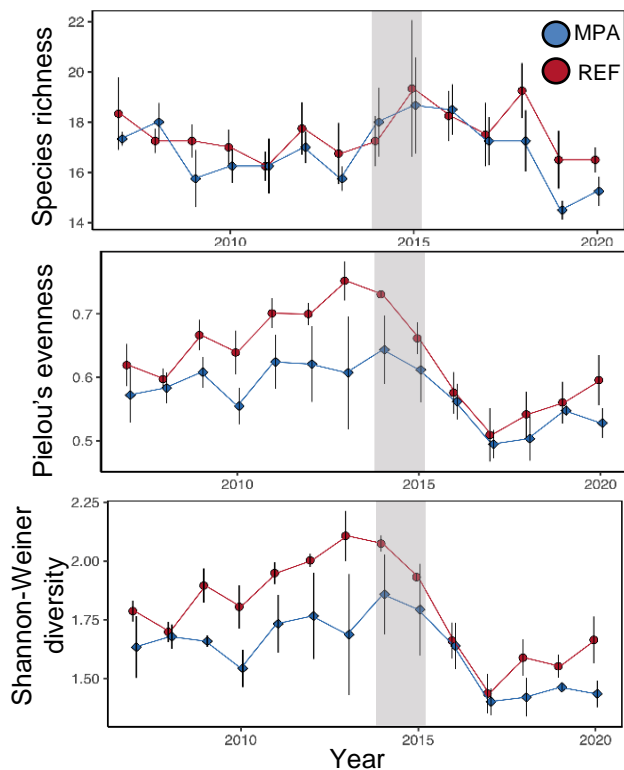


Fig 2. Change in species richness, Pielou's evenness, and Shannon-Weiner diversity at MPA and REF sites over time. Gray bar highlights timing of the MHW. All values are mean +/- 95% CI

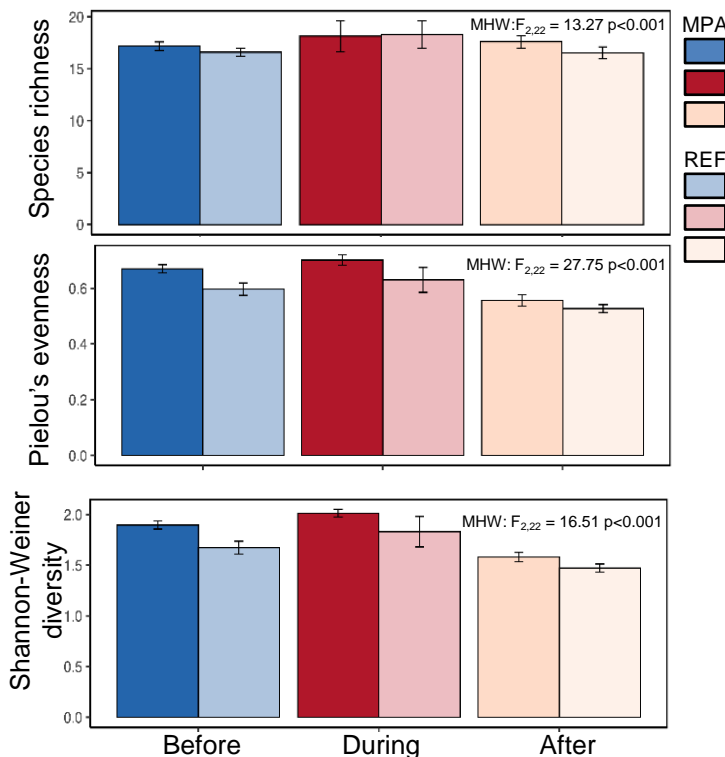


Fig 3. Change in species richness, Pielou's evenness, and Shannon-Weiner diversity in relation to the MHW. All values are means +/- 95% CI

### Fish community composition shifted after MHW

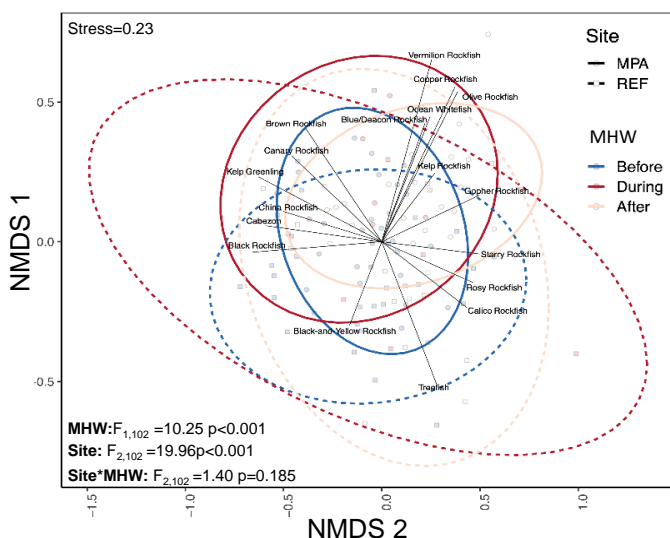


Fig 4. Change in community composition before, during and after MHW

## Discussion

- Species evenness and diversity in both MPA and REF sites declined following MHW
- Species diversity in MPAs appear to be recovering faster than in REF sites
- Changes in community composition after the marine heatwave were driven by the dominance of the Blue/Deacon Rockfish complex
- With continued climate change, MPAs may provide increased resiliency of marine fish communities

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