Developing Research: Community perspectives on temperature perturbation in coastal systems

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INTRODUCTION

- Extreme temperature perturbations, including marine heatwaves, disrupt oceanic and coastal ecosystems with increasing frequency, intensity and duration.
- We propose a cross-cutting team science approach to holistically investigate how ecosystems respond to oceanic thermal anomalies, and how this disturbance propagates across social-ecological systems.
- Focusing on the California Current Marine Ecosystem, we will explore case studies of cascading effects of temperature perturbations on interconnected human and biophysical systems.
- Our planned research leverages long-term data, including CalCOFI datasets, and we are here to solicit feedback that will guide our research agenda toward an impactful study of temperature perturbation in coastal ecosystems and communities.

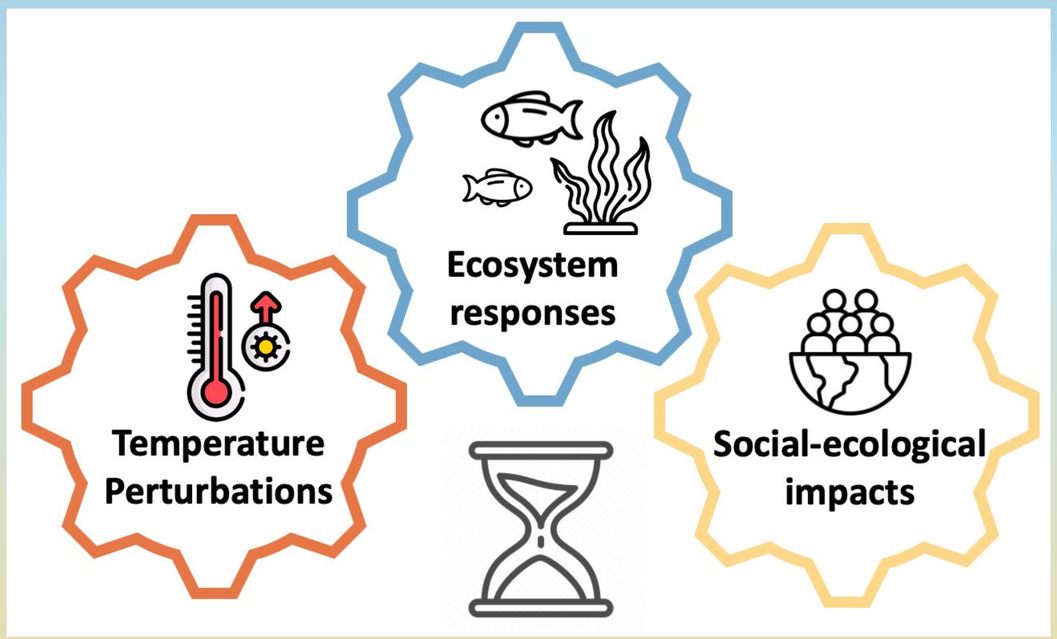
OBJECTIVE

As part of our research development process, we are here to engage with the CalCOFI community to identify perspectives and approaches that can improve our interdisciplinary understanding of coastal temperature perturbations.

KEY RESEARCH QUESTIONS

- How do ecosystem responses lag temperature perturbations in time?
- How do social-ecological impacts lag temperature perturbations in time?
- What are the key data needed to understand these ecosystem responses and social-ecological impacts?

CONCEPTUAL FRAMEWORK



APPROACHES

Community Driven

- As we develop this work, we invite dialogue to center priorities on concerns of coastal communities (i.e. fishers, tribal nations, researchers, and other community members)
- So far we have reached out to:
  - Campaign for the Chumash National Marine Sanctuary (CHNMS)
  - Northern Chumash Tribal Council
  - CalCOFI research community (here)

Student-Centered

- Undergraduate students at PUIs and MSIs lack opportunities to work with Big Data, but data analysis skills are as important as lab bench skills for many career paths
- We will design CUREs that teach how to handle and analyze large datasets while students explore environmental issues in their local communities
- Goals include preparing students for future research experiences (e.g. REUs), and retaining students in STEM majors and careers

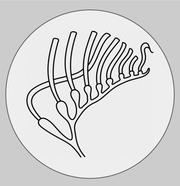
Data Synthesis

- We will integrate existing remotely-sensed and *in situ* data sets with available offshore and coastal model outputs
- Students will contribute data from onshore coastal sampling
- Biophysical data will be integrated with social-ecological data to assess impacts on local communities

Responsive Monitoring

- A major goal is to identify time lags between offshore thermal anomalies, nearshore responses, and impacts on society
- Using results from our time-lag analysis, we will collaborate with community groups to develop early warning and rapid response monitoring protocols
- Upon the onset of a temperature-related event, we can activate local partners to begin monitoring onshore ecosystems

EXAMPLE CASE STUDIES

Focal species	Key Ecological Roles	Economic Importance	Sensitivity to warming	Community responses to prior marine heat waves
	Habitat-forming Primary producer	Commercial & recreational	Reduced survival	Ecosystem state change
	Food web link Scavenger/ Predator	Commercial & recreational	Faster metabolism	Fisheries closed due to toxicity

Sources: Sunday et al. 2021, Global Change Biology, Cavole et al. 2016, Oceanography, CA Ocean Acidification Action Plan, Cavanaugh et al. 2019, Frontiers in Marine Science

CalCOFI COMMUNITY ENGAGEMENT

- What focal species and ecosystem responses are priorities to understand impacts from temperature perturbations?
- What existing data connect offshore, nearshore, and coastal processes with human communities?
- What's missing from our conceptual framework and research design?

NEXT STEPS

- Recruit a social scientist to our team to develop effective responsive monitoring strategies that integrate with local communities.
- Submit a full proposal for funding in early 2023 (target: NSF Biological Oceanography).

WHO WE ARE

We are researchers at minority-serving and research-intensive institutions, brought together through NSF's Diverse Ocean Science Community through Collaboration (DOCC) program in August 2022 for mutual learning, relationship building, and co-developing research. We are excited to do societally relevant science, engage undergraduate students in research, and find mutually beneficial ways of working with each other and community collaborators.