West Coast Groundfish distribution and ontogenetic overlap analyses in the California Current Ecosystem

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Introduction

- Climate change is reshaping the California Current Ecosystem (CCE) through warming, declining oxygen, and altered stratification, with cascading effects on demersal fish populations.
- Groundfish shift habitats across life stages as conditions change, yet how climate-driven variability alters spatial overlap among juveniles, sub-adults, and adults remains poorly understood.
- Changes of spatial overlap among different life stages can alter **ontogenetic connectivity**

Research Question

How does the distribution and ontogenetic overlap of groudfish species changes in relation to temperature in the California Current Ecosystem Region?

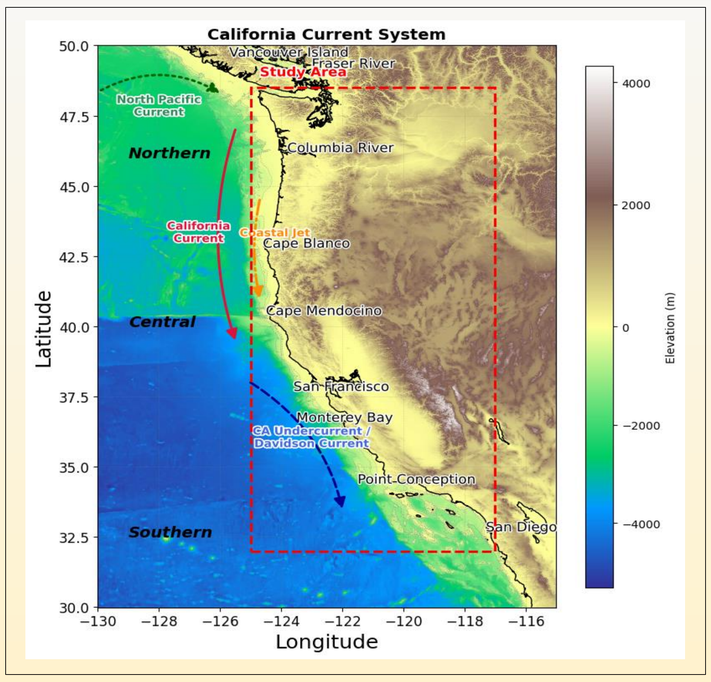

Figure 1. Map showing study area of California Current Ecosystem Region

Methodology

- We analyzed the effects of temperature at gear depth, latitude, longitude, and depth, on ontogenetic distribution.
- Data:- NOAA West Coast Groundfish Bottom Trawl Survey data (2003–2024) for six representative species—English sole (*Parophrys vetulus*), petrale sole (*Eopsetta jordani*), Dover sole (*Microstomus pacificus*), sablefish (*Anoplopoma fimbria*), longspine thornyhead (*Sebastolobus altivelis*), and shortspine thornyhead (*Sebastolobus alascanus*) were used for the analysis.
- Small, Medium and Large groups represented different ontogenetic stages of each fish species.
- Boosted Regression Trees were fitted to abundance data for each species and ontogenetic stage.
- Area and Biomass Overlaps between consecutive ontogenetic stages were estimated.
- Correlation between Area and Biomass overlaps between and temperature were estimated to analyze drivers of overlap shifts.

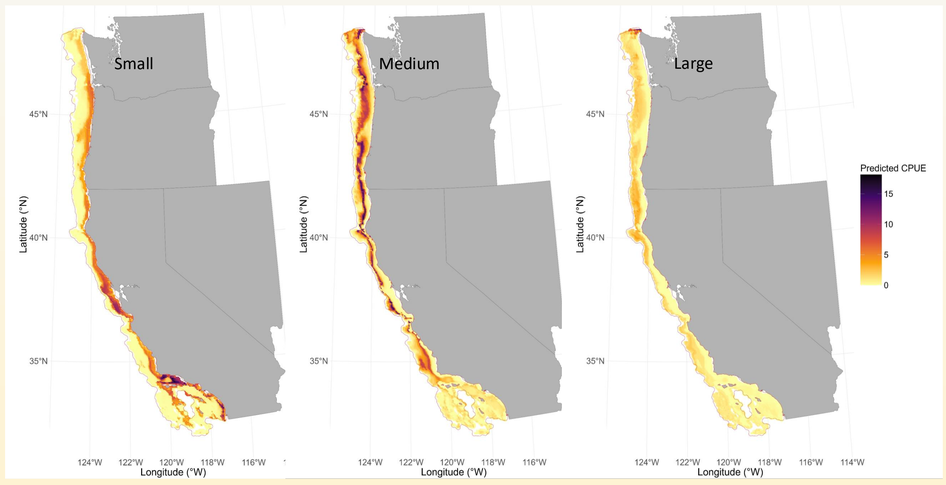

Figure 2. Top panel: Distribution of **Dover sole** Small, Medium and Large groups; Lower panel: Area and Biomass Overlaps of Dover sole Small- Medium and Medium-Large groups and relationship between Area Overlap and temperature for small to medium life stages

Results and Discussion

- Across the groundfish species examined, ontogenetic changes in temperature and depth were more pronounced than longitudinal shifts, while latitude showed species-specific but generally consistent redistribution between juvenile and adult life stages.
- Specifically, Sablefish, shortspine thornyhead, and Dover sole showed pronounced shifts in overlap that tracked temperature variability whereas petrale sole, English sole, and longspine thorny head showed stable patterns or responses structured primarily by latitude and depth.
- Small–medium fishes (juveniles) generally occupied warmer waters and shallower or more northern habitats, whereas medium–large fishes (adults) shifted toward cooler, deeper, and more coastal or offshore distributions.
- These ontogenetic shifts may be likely due to limited mobility of small individuals and reliance on latitudinally constrained nursery zones whereas the adults or larger fishes have greater mobility, changing energetic, feeding, and reproductive requirements as fishes mature.

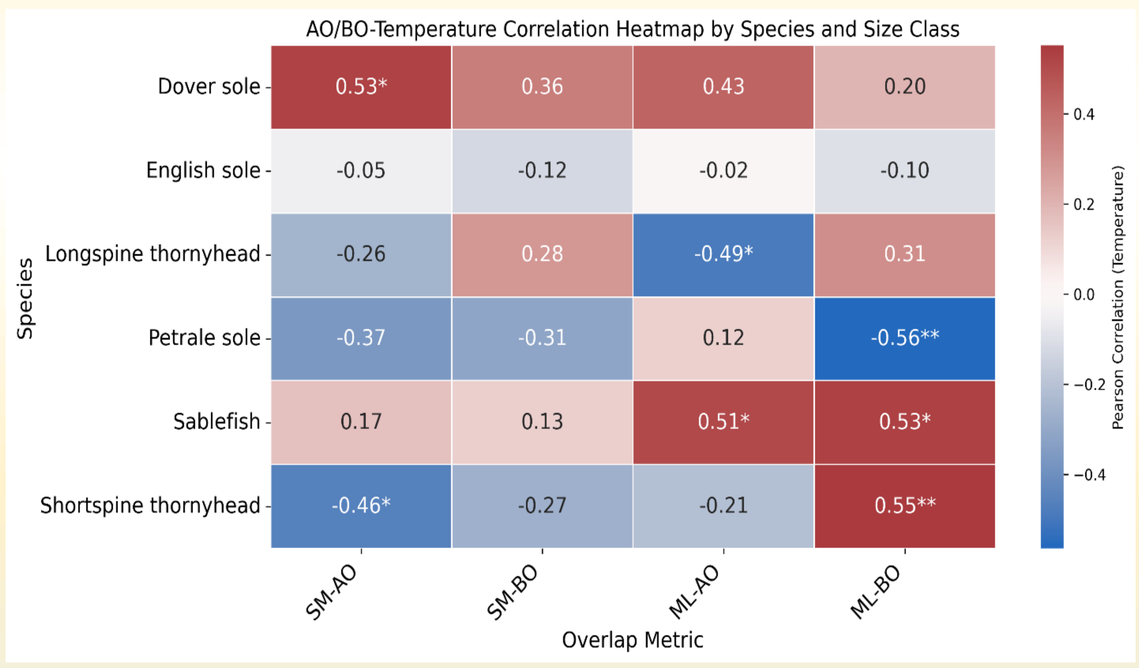

Figure 3. Correlations of Area and Biomass overlaps of Small- Medium (SM-AO, SM-BO), Medium-Large (ML-AO, ML-BO) with Temperature significance (p values <0.0001 -***, <0.01 -**, <0.05 -*)

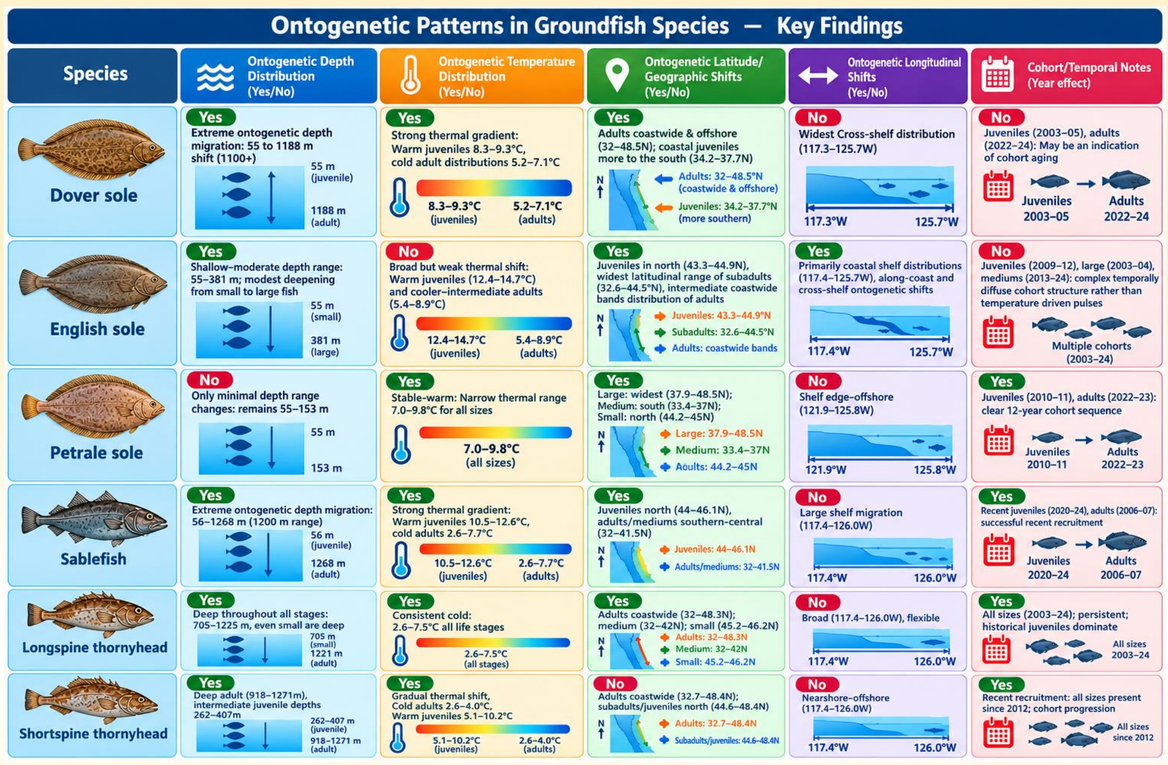

Figure 4. Table showing consolidated results and observations form the analysis

Conclusion

In conclusion, our study highlights that temperature sensitivity and spatial overlap are not only species specific but also life stage specific.

The Area and Biomass overlaps are shaped by a range of factors including mobility, habitat fidelity, adaptive capacity and environmental tolerance.

Acknowledgements