

Yin-Zheng Lai (黎穎禎)

Research Center for Environmental Changes (RCEC), Academia Sinica

No. 128, Sec. 2, Academia Rd., Nankang, Taipei, Taiwan 115

Email: yzheng@gate.sinica.edu.tw

Lab website link: <https://rcec.sinica.edu.tw/>

EDUCATION

2019/09 – 2026/02 Ph.D. Institute of Fisheries Science, National Taiwan Uni., Taiwan

2017/09 – 2019/08 M.S. Institute of Fisheries Science, National Taiwan Uni., Taiwan

2013/09 – 2017/08 B.A. Depart. of Life Science, National Taiwan Uni., Taiwan

EMPLOYMENT

2026/03 - present Postdoctoral Researcher RCEC, Academia Sinica, Taiwan

RESEARCH INTEREST

My research lies in marine ecology and marine biogeography, with a central focus on how climate change reshapes the distribution, movement, and ecological roles of marine species. As ocean conditions shift rapidly, many marine fishes are undergoing range changes that challenge conventional management and influence fisheries sustainability and ecosystem services. A key emphasis of my work is improving how we model and interpret these changes by examining the role of data choice in species distribution modeling. In particular, I investigate how predictions differ when using occurrence versus abundance data, and how these differences affect our understanding of species' responses to environmental change. During my doctoral training, I applied species distribution models to long-term marine survey data to explore distributional dynamics while explicitly incorporating both data types into predictive frameworks. By integrating ecological theory with spatial analysis and large-scale datasets, I aim to enhance the reliability of projections under future climate scenarios. Ultimately, my research seeks to refine predictive tools that better capture ecological realities and support ecosystem-based management and spatial conservation planning in a changing ocean.

RESEARCH HIGHLIGHTS Why Data Choice Matters: Comparing Occurrence and Abundance for Climate-driven Fish Range Shifts

Climate change is reshaping global marine ecosystems, with fish range shifts among the most direct ecological responses. While most studies rely on occurrence data, such approaches may underestimate or misrepresent distributional changes, highlighting the importance of abundance data. Using long-term bottom-trawl surveys across the Northeast US Continental Shelf, North Sea, and East Bering Sea, we compared predictions based on occurrence versus abundance data.

Between 38.5% and 45.9% of species exhibited inconsistent movement directions depending on data type, including many commercially important species. These results demonstrate that predictions of fish distributions are highly sensitive to data choice, and misinterpretation could misguide management and underestimate climate risks. We advocate systematically integrating abundance data into biogeographic analyses to strengthen biodiversity conservation, fisheries management, and climate adaptation strategies.

Reference: Lai et al. 2024, *Diversity and Distributions*

1. Species Interactions and Community Instability via Geographical Overlaps

This study uses geographical overlaps to infer species interaction networks in marine fish communities and develops indices of species interdependence. Mean Spatial Robustness (MSR) quantifies the geographical influence of a species on others, while Mean Spatial Sensitivity (MSS) measures how a species is affected by others. Integrating MSR and MSS allows assessment of community coexistence stability and structure. We found consistent long-term increases in MSR and MSS across large marine communities, with interactions showing varying correlations with species' range sizes and overlap patterns. However, the strength of these correlations has decreased over recent decades, suggesting that marine communities are gradually becoming spatially symmetrical and less stable under environmental and climate change.

Reference: Lai et al. 2022, *Frontiers in Marine Science*

REPRESENTATIVE PUBLICATIONS (*: corresponding author; #: co-first author)

1. **Lai, Y.-Z.**, Lin, Y.-C., & Ko, C.-Y.* (2024). How would estimation of geographic range shifts of marine fishes be different when using occurrence and abundance data? *Diversity and Distributions*, 30, e13919. doi:10.1111/ddi.13919 (IF: 4.6; Ranking: Ecology, 27/197, Q1)
2. Tu, C.-W.#, **Lai, Y.-Z.** #, Chen, H. C., Kuo, C.-Y., Lee, P.-F., & Ko, C.-Y.* (2022). Trends in Geographic Sensitivity of Marine Fishes Over Decades in the North Sea. *Frontiers in Marine Science*, 8, 748278. doi:10.3389/fmars.2021.748278 (IF: 2.8; Ranking: Marine & Freshwater Biology, 14/119, Q1)
3. **Lai, Y.-Z.**, Tu, C.-W., Hsieh, C.-h., & Ko, C.-Y.* (2022). Using Geographical Overlaps to Track Temporal Changes in Species Interactions and Community Coexistence Instability. *Frontiers in Marine Science*, 9, 751094. doi:10.3389/fmars.2022.751094 (IF: 2.8; Ranking: Marine & Freshwater Biology, 14/119, Q1)
4. Kuo, C.-Y.*, Ko, C.-Y., & **Lai, Y.-Z.** (2022). Assessing warming impacts on marine fishes by integrating physiology-guided distribution projections, life-history changes and food web dynamics. *Methods in Ecology and Evolution*, 13, 1343-1357. doi:10.1111/2041-210X.13846 (IF: 6.3; Ranking: Ecology, 12/197, Q1)