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Editorial: The ecology, diversity and migration pattern of aquatic organisms in a changing climate

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Editorial on the Research Topic
The ecology, diversity and migration pattern of aquatic organisms in a changing climate

Climate change is one of the most significant threats to global biodiversity. According to the fifth report from the Intergovernmental Panel on Climate Change (IPCC-AR5), aquatic species are expected to shift their habitats in response to anticipated climate changes by the mid-21st century and beyond. This redistribution is foreseen to reduce marine biodiversity and other ecosystem services in climate-sensitive regions (Islam et al., 2020). Resource managers may face complications due to the unpredictable interactions between climate change and existing stressors like habitat degradation. Climate change's direct and indirect effects on marine and freshwater environments are expected to affect economic ecosystems. Vulnerability to climate change is particularly pronounced in coastal communities in developing countries within tropical regions. This Research Topic presents the current understanding of aquatic organisms' ecology, ecosystems, and migration patterns in a changing climate.

Ecology and main impacts on aquatic organisms

The sixth report of the Intergovernmental Panel on Climate Change (IPCC-AR6) stated that temperature increases can negatively impact marine species' performance and survival. In addition, the rise in temperature in marine ecosystems during the last few decades has proven climate warming. Temperature is a fundamental physical, regulatory factor in aquatic organisms, and this effect is expressed particularly strongly in the control of all reproductive processes from gamete development and maturation, ovulation and spermiation, spawning, embryogenesis and hatching, to larval and juvenile development

and survival. The impacts of climate change, encompassing events like heat waves, droughts, and alterations in rainfall patterns, have led to significant consequences for the availability and variability of freshwater resources. These unpredictable impacts of climate change may provide complications for resource managers and policymakers.

Marine ecology and ecosystems, particularly coral reef ecosystems are the most productive and biodiverse environments globally. These ecosystems are vital in delivering essential environmental services such as biodiversity support and nutritional resources for food security and livelihoods. Offshore resources, environment, and space have become important material bases to support human society's and marine ecosystems' sustainable development (Ren et al., 2024). Park et al. presented a study on Siphonophores, which are highly polymorphic and complex marine organisms and abundant in marine ecosystems. However, various factors may affect the occurrence of siphonophores, including water temperature, salinity, zooplankton biomass, and trophic niche. The species with high contributions to distinguishing the water mass groups show species-specific correlations with water temperature and salinity. This suggests that diphyids can be used as indicator species for currents and hydrological factors influencing water mass. Changing climate conditions are well documented to affect species distribution patterns and migratory phenology, especially for thermally constrained species refugia. A marine mammal, *Trichechus manatus*, was used (Hieb et al.) as a model to understand how other thermally constrained species may expand their ranges into higher latitudes due to the impact of climate change. Cyanobacterial blooms, observed globally in freshwater systems and cyanobacterial cultures, commonly show the simultaneous presence of multiple toxins and represent another potential negative impact in aquatic environments.

Identifying an odour-producing microorganism is also important to understand its odour compounds using a molecular approach. Qiu et al. resolved the identification of the main odour-producing microorganisms in water bodies by predicting functional genes from microbial metagenomics. This approach represents a significant advance in the monitoring of drinking water. This might help to improve taste and odour problem management.

The diversity of the coral-reef ecosystem and anthropogenic pressure

Coral reefs and their biota face substantial anthropogenic pressure, decreasing coral reefs globally due to anthropogenic stress, including overfishing, nautical tourism, global climate change impact and sedimentation (Hoeksema et al., 2022; Massei et al., 2023). The East Asian finless porpoise, *Neophocaena asiaeorientalis sunameri*, ranks among the most endangered species with a rapidly decreasing population in the Northwest Pacific. Nonetheless, the East Asian finless porpoise is highly vulnerable to anthropogenic threats due to fishing by artisanal fishers, bycatch and habitat disruption. Kim et al. reported new distribution records for *Nasitrema* spp., an important group of pathogenic parasites in *Neophocaena* and other marine mammals.

Concluding remarks

This Research Topic unveiled novel findings regarding the distribution of pathogenic parasites and investigated Siphonophores, essential components of marine ecosystems and food chains. Furthermore, a key odour-producing microorganism in water bodies was identified. Additionally, the study suggests that species constrained by thermal conditions might extend their habitats towards higher latitudes in response to the influence of climate change.

Author contributions

AH: Conceptualization, Writing – original draft. UA: Writing – review & editing. MH: Writing – review & editing. HS: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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