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Editorial

Marine Organisms in a Rapidly Changing Ocean

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1. Introduction

Oceans are changing due to intensive human activities and worsening climate change. Intensive human activities around coastal areas have precipitated severe pollution, and a reduction in marine populations due to overfishing in local areas of the oceans [1,2]. Additional CO_2 emissions that have amassed since the Industrial Revolution are leading to ocean warming and acidification at a global scale [3–5]. Marine organisms are affected by human activity and climate change at levels ranging from molecular processes to biological, community, and ecological systems [6]. For example, stock restoration of a targeted species affects population dynamics and genetic diversity to a certain extent [2]. In addition, the long-term adaptation of phytoplankton to high temperatures has been proven to improve these creatures' heat resistance [4]. At the same time, one study showed that the interaction between acidification and warming will aggravate the negative impacts on rocky coastal communities, resulting in a reduction in species richness and complexity, the continued migration of benthic organisms into intertidal zones, and large-scale death due to climate warming [7].

Therefore, the responses of marine life to human activity and climate change have been concerning, but the relevant information is currently limited. The purpose of this Special Issue of *Water* is to study the responses of individuals, communities, and even marine ecosystems to anthropogenic activity and environmental stressors, for which five original papers have been collected (Table 1). In general, these papers, based on the background of human activities and environmental pressure, have studied the molecular responses of marine polychaetes (*Sternaspis scutata*) to polycyclic aromatic hydrocarbons (PAHs) [8], the spatial genetic structure and diversity of the large yellow croaker (*Larichthys crocea*) [9], the relationship between the eDNA concentration and the biomass of the fish *Acanthopagrus latus* [10], the potential influencing factors of the northward expansion of warm water Doliolida (*Dolioleta gegenbauri*) [11], and the assessment of the quality of the benthic habitat in the intertidal zone of an estuary [12].

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Table 1. Summary of the five papers published in this Special Issue, "Responses of Marine Life to Human Activity and Environmental Stress", published in the journal *Water* (https://www.mdpi.com/journal/water/special_issues/MarineLife_Human_Environmentalstress, accessed on 15 February 2023).

Title	Authors	Keywords	Organism
A Novel CYP4 Gene Identified in the Polychaete Sternaspis scutata and Its Transcriptional Levels along the Coasts of the Liaodong Peninsula	Z Yu, A Qi, L Wang, E Shan, D Li, X Yang and A Zhang	Cytochrome P450; polychaetes; *Sternaspis sculata*; transcriptional response; PAHs; field study	*Sternaspis scutata*
Spatial Genetic Structure and Diversity of Large Yellow Croaker (Larimichthys crocea) from the Southern Yellow Sea and North-Central East China Sea: Implications for Conservation and Stock Enhancement	F Zhang, Y Jiang, C Ma, W Chen, J Cheng and L Ma	*Larimichthys crocea*; mitochondrial COI; genetic diversity; population; conservation	*Larimichthys crocea*
Optimal Conditions to Quantify the Relationship between eDNA Concentration and Biomass in Acanthopagrus latus	Y Xin, Y Guo, M Sun, G Yu, Z Ma, K Pei and C Qin	Environmental DNA; temperature; salinity; pH; resource assessment	*Acanthopagrus latus*
Northward Expansion of a Warm-Water Doliolid Dolioletta gegenbauri (Uljanin, 1884) into a Temperate Bay, China	S Wang, A Wa, G Zhang and S Sun	*Dolioletta gegenbauri*; Jiaozhou Bay; warming; boundary current; borthward shift	*Dolioletta gegenbauri*
Benthic Habitat Quality Assessment in Estuarine Intertidal Flats Based on Long-Term Data with Focus on Responses to Eco-Restoration Activity	A Zhang, Y Gu, X Yuan, M C Brustolin, X Yang, R Zhang, Z Wang and H Shi	Benthic habitat quality; macrobenthos; biotic indices; intertidal flats; human activity; Liaohe Estuary	Macrobenthic community

2. Overview of the Contributions in this Special Issue

2.1. A Novel CYP4 Gene Identified in the Polychaete Sternaspis scutata and Its Transcriptional Levels along the Coasts of the Liaodong Peninsula

To study the response characteristics of marine polychaetes to environmental pollutants, Yu et al. [8] identified a new Cytochrome P450 (CYP) gene from *Sternaspis sculata* (marine polychaetes widely distributed across the coasts of the world). The results showed that the deduced amino acid sequence of the new CYP gene contained the conserved motif of the P450 family (FxxGxxxCxG) and the characteristic sequence of the CYP4 family (EVDTFMFEGHDTT), which showed a high degree of similarity with marine polychaete CYP4V (tentatively named SsCCYP4V). The expression level of SsCP44V was detected by field sampling at multiple locations. The results showed that the relative expression level of SsCP44V at different sites was significantly different. However, there was no positive correlation between the expression level of SsCP44V and the concentration of PAHs in sediment. This study has proven that the transcription and expression of the SsCP44V gene in response to PAHs is complex in the field environment and that the expression level of this gene may not be a suitable biomarker for the on-site monitoring of PAH pollution in sediments.

2.2. Spatial Genetic Structure and Diversity of Large Yellow Croaker (Larimichthys crocea) from the Southern Yellow Sea and North-Central East China Sea: Implications for Conservation and Stock Enhancement

Due to overfishing and environmental degradation, the resources of the large yellow croaker (*Larimichthys crocea*) are currently threatened. The presence of numerous released yellow croakers may have harmful effects on the genetic composition of the natural population. The spatial genetic structure and diversity of *L. crocea* from the southern Yellow Sea and the north-central East China Sea are still unclear. To evaluate the genetic diversity of wild populations, Zhang et al. [9] analyzed the genetic variation and population structure of *L. crocea* at 22 sites using mitochondrial COI sequences. The results showed that there was no genetic differentiation between the 22 sites and that a relatively stable degree of genetic diversity was maintained. In addition, this study proved that the large yellow croaker in the southern Yellow Sea and the north-central East China Sea belong to the same group and, therefore, can be released as a management unit. This study will be of great significance for the management, protection, and wild population recovery of this important commercial fish.

2.3. Optimal Conditions to Quantify the Relationship between eDNA Concentration and Biomass in Acanthopagrus latus

Due to the impacts of overfishing and extreme weather on the marine ecosystem, the survey of fishery resources has become particularly important. At present, little is known about the biomass of the ecologically, socially, and economically important fish *Acanthopagrus latus*. Environmental DNA (eDNA) analysis is an effective and accurate survey method that can more effectively monitor the space–time distribution and dynamic changes of *A. latus* populations. Xin et al. [10] studied and evaluated the relationship between the biomass of *A. latus* and the concentration of eDNA in an aquarium to more effectively apply eDNA technology to the quantitative analysis of *A. latus* in the field. The results showed that there was a significant linear positive correlation between the concentration of eDNA and the biomass of *A. latus* (R^2 = 0.72–0.93). In addition, it was observed that high temperature and salinity have a significant impact on the eDNA concentration of *A. latus*. This study provides a reference for the resource evaluation of *A. latus* and the monitoring of the distribution pattern of its resources.

2.4. Northward Expansion of a Warm-Water Doliolid Dolioletta gegenbauri (Uljanin, 1884) into a Temperate Bay, China

Doliolids (*Dolioletta gegenbauri*) are widely distributed in the subtropical shallow waters of the world. In China, they are usually distributed in the South China Sea and the southern part of the East China Sea, and they are considered to be an indicator of warm and saline water. In 2019 and 2020, a high density of *D. gegenbauri* appeared in Jiaozhou Bay (JZB) in the Yellow Sea, constituting the first record of this species since the 1980s. JZB has been under great pressure from human activities such as shipping, industry, urban sewage, and aquaculture. In addition, the bay is also affected by climate change impacts such as ocean warming and marine heat waves. To explore the potential role of boundary flow transport and a warming background in the northward expansion of such warm water organisms, Zhang et al. [11] studied the distribution, abundance, stage composition, and size frequency distribution of *D. gegenbauri* and its relationship with environmental factors. The results showed that the population mainly consisted of gonozooids, indicating that the population was actively reproducing. In addition, the authors determined that the abundance of *D. gegenbauri* is significantly affected by temperature and that the continuous warming trend of JZB may expand the scope of biogeography. Simultaneously, the Yellow Seas' warm currents may play a central role in the northward extension of *D. gegenbauri*. Finally, the study found that when the winter temperature dropped below 15 °C in JZB, the *D. gegenbauri* population disappeared.

2.5. Benthic Habitat Quality Assessment in Estuarine Intertidal Flats Based on Long-Term Data with Focus on Responses to Eco-Restoration Activity

Intensive human activities, such as overfishing and restocking, affect the macrobenthic community and benthic habitat in the intertidal zone. Therefore, the long-term and continuous monitoring of the quality of benthic habitats in the intertidal zones of estuaries is necessary for fisheries' protection and production. Zhang et al. [12] conducted a long-term (2013–2020) assessment of the quality of the benthic habitats in the intertidal zone of the Liaohe estuary by using three comprehensive ecological indicators, namely, AZTI's Marine Biotic Index (AMBI), Multivariate-AMBI (M-AMBI), and the Shannon–Wiener diversity index (H'). The results showed that in the AMBI group, the macrobenthic community was characterized by indifferent and sensitive species. In addition, there were significant differences in the results of the evaluation of the three biological indexes. The H', AMBI, and M-AMBI values assessed that about 100%, 24%, and 78% of the sampling points, respectively, corresponded to the "moderate", "poor", and "bad" statuses. It was suggested that M-AMBI may be more suitable for evaluating the habitat quality of benthos in the intertidal zone of the Liaohe estuary. The results showed that the quality of the benthic habitats in the middle of the intertidal zone has not been fundamentally improved after the large-scale restoration of intertidal mariculture ponds.

3. Conclusions

The five articles in this Special Issue focus on different marine organisms, such as polychaetes, doliolids, and fish, under the background of human activities and environmental stressors. The results show that marine organisms are affected in terms of genetic diversity, biological diversity, and distribution. In fact, the responses of marine organisms are species-dependent and complex at different levels. This Special Issue can provide information for building a data-driven research paradigm of marine organisms' responses to human activities and climate change.

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References

1. Yuan, X.; Yang, X.; Zhang, A.; Ma, X.; Gao, H.; Na, G.; Zong, H.; Liu, G.; Sun, Y. Distribution, potential sources and ecological risks of two persistent organic pollutants in the intertidal sediment at the Shuangtaizi Estuary, Bohai Sea of China. *Mar. Pollut. Bull.* **2017**, *114*, 419–427. [CrossRef] [PubMed]
2. Zhang, A.; Li, H.; Yang, X.; Wang, L.; Gao, Y.; Song, M.; Yuan, X. Stock Assessment of Hatchery-Released Clam Meretrix meretrix in an Estuary of China from the Perspectives of Population Ecology and Genetic Diversity. *Front. Mar. Sci.* **2021**, *8*, 725238. [CrossRef]
3. Brierley, A.S.; Kingsford, M.J. Impacts of Climate Change on Marine Organisms and Ecosystems. *Curr. Biol.* **2009**, *19*, R602–R614. [CrossRef] [PubMed]
4. Ani, C.J.; Robson, B. Responses of marine ecosystems to climate change impacts and their treatment in biogeochemical ecosystem models. *Mar. Pollut. Bull.* **2021**, *166*, 112223. [CrossRef] [PubMed]
5. IPCC. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2022.
6. Poertner, H.O. Integrating climate-related stressor effects on marine organisms: Unifying principles linking molecule to ecosystem-level changes. *Mar. Ecol. Prog.* **2012**, *470*, 273–290. [CrossRef]
7. Bindoff, N.L.; Cheung, W.W.L.; Kairo, J.G.; Arístegui, J.; Guinder, V.A.; Hallberg, R.; Hilmi, N.; Jiao, N.; Karim, M.S.; Levin, L.; et al. Changing ocean, marine ecosystems, and dependent communities. In *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2019; pp. 447–587.
8. Yu, Z.; Qi, A.; Wang, L.; Shan, E.; Li, D.; Yang, X.; Zhang, A. A Novel CYP4 Gene Identified in the Polychaete *Sternaspis scutata* and Its Transcriptional Levels along the Coasts of the Liaodong Peninsula. *Water* **2022**, *14*, 3489. [CrossRef]
9. Zhang, F.; Jiang, Y.; Ma, C.; Chen, W.; Cheng, J.; Ma, L. Spatial Genetic Structure and Diversity of Large Yellow Croaker (*Larimichthys crocea*) from the Southern Yellow Sea and North-Central East China Sea: Implications for Conservation and Stock Enhancement. *Water* **2023**, *15*, 338. [CrossRef]
10. Xin, Y.; Guo, Y.; Sun, M.; Yu, G.; Ma, Z.; Pei, K.; Qin, C. Optimal Conditions to Quantify the Relationship between eDNA Concentration and Biomass in *Acanthopagrus latus*. *Water* **2022**, *14*, 3521. [CrossRef]
11. Wang, S.; Wan, A.; Zhang, G.; Sun, S. Northward Expansion of a Warm-Water Doliolid *Dolioletta gegenbauri* (Uljanin, 1884) into a Temperate Bay, China. *Water* **2022**, *14*, 1685. [CrossRef]
12. Zhang, A.; Gu, Y.; Yuan, X.; Brustolin, M.C.; Yang, X.; Zhang, R.; Wang, Z.; Shi, H. Benthic Habitat Quality Assessment in Estuarine Intertidal Flats Based on Long-Term Data with Focus on Responses to Eco-Restoration Activity. *Water* **2022**, *14*, 3846. [CrossRef]