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# Regional variations in fish abundance and their impacts on the northern region's microbiome and ecosystem

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**ABSTRACT**

In recent decades, northern fish coastal waters have been observed to be major hotspots for fishbloom. A bottom trawling survey in summer 2021 will investigate the spatial distribution of large fish abundance and biomass in this area. Nemopilema nomuroi, Cyanea spp. and Urmaryidae (undefined species) were identified during the survey. Realized niches for the three most common species (N. nomuroi, Cyanea spp., and A. nomuroi coerulea) were measured using a maximum entropy model (MaxEnt) to describe its spatial distribution pattern. Nemopilema nomurai was used as a representative species to estimate the feeding rate and feeding pressure of large fish on zooplankton. During flowering of N. nomuroi, the potential zooplankton consumption by N. nourai was enormous and exceeded the zooplankton productivity of the area where N. nourai was flowering. Nomurai gathered in this study. For dwarf copepods, reduced absolute and relative abundances were observed in mid-flowering and flowering stations compared to non-flowering stations. The niches of large fish identified in this study and their relationship with zooplankton help us to understand their biogeographic distribution and ecological role in northern China coastal waters under future climate change scenarios.

Keywords: Fish bloom; Geographical distribution; Realized niches; Ecological roles

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## INTRODUCTION

In recent decades, large-scale fish outbreaks have been reported in various sea areas, and fluctuations in large-fish populations are receiving increasing attention around the world as they adversely affect marine fisheries and aquaculture industries [1]. Flowering of large fish is thought to be influenced by changes in the coastal environment caused by both climate change and anthropogenic disturbances. The Earth's ecosystems are undergoing rapid and pervasive changes, and climate change will continue to escalate. Predicting changes in large fish populations in future scenarios is critical to fish stock management and the health of marine ecosystems [2].

Northern Fish s coastal waters, including the Northeast China Sea (nECS), Yellow Sea (YS), and Bohai Sea (BS), are among the largest hotspots for fishbloom. In this area, large fish such as Nemopyrema nomurai and Cyanea spp. generally increase in summer and autumn and Aurelia Correa. However, this trend has reversed or paused over the past decade, during which time fish abundances have declined. Scientists have conducted numerous field surveys and laboratory experiments in northern Fish s coastal waters to demonstrate the population dynamics and spatio-temporal distribution, flowering mechanisms, and ecological roles of large fish [3]. Among them, N. nomuroi is one of the most dominant species, widely distributed in the region, and its population size has shown significant inter-annual variability since the 2002 consecutive outbreak. Compared to N. nomuroi, Cyanea spp. is a species found in warm waters, mainly distributed in the East China Sea and BS. Cyanea has a complex nutritional relationship with other zooplankton [4]. Stable isotope results indicated the existence of intraguild predation of C. nozakii against N. nomuroi and small jellyfish within the nECS. Aurelia coerulea is a cosmopolitan he Scyphomedusa that mainly blooms in coastal areas such as harbors and Jiaozhou Bay, BS in the China Sea. Due to the lack of complete and systematic studies on large fish in northern Fish s coastal waters, a global analysis of large fish in this region is limited [5]. Previous studies have linked interannual variations in large fish populations to climate variability. Therefore, this study is also an important data supplement for elucidating the mechanism of large annual fluctuations in fish [6].

## RESULT

### Spatial variation in environmental variables

Regional distribution of depth, temperature, salinity

and chlorophyll concentration in the study area. All environmental variables were significantly different in the three regions (Kruskal-Wallis test, $p<0.05$). Temperatures ranged from 7.71°C to 27.50°C, with the lowest recorded in the Yellow Sea (YS). The salinity range for summer 2021 was 25.09 to 34.31 across the study area. Chlorophyll a concentrations ranged from 0.16 to 2.85 mg m-3 [7].

## DISCUSSION

### Distribution of large fish abundance and biomass

Nemopyrema nomurai was widespread in the study area in summer 2021, with a wide range of temperature niches and one high average salinity niche. Nemopyrema nomurai was the dominant large fish species in this study in terms of abundance and biomass. Based on long-term historical data from the southern Yellow Sea (YS), N. nomuroi populations were at mid-flowering levels. (Our non-public data). The southern YS ranged from 34 to 4951 ind.km-2. N. omuroi in the 2021 summer YS were 888.38 ± 1005.45 ind. km-2 and 11,008.805 ± 12,284.80 kg km-2, respectively, similar to 2013. Nemopyrema nomurai clustered in the Central Bohai Sea (BS), with abundance and biomass values up to 4878. No N. nomuroi individuals were collected from Laizhou Bay in this study [8]. The maximum entropy (MaxEnt) results show that the probability of occurrence of N. nomuroi increases with salinity in the range of approximately 28 to 31, suggesting that water with high salinity may be beneficial for N. nomuroi dispersal suggests that there is a This may be one of the reasons for the rare occurrence of N. nomuroi in the low-salinity coastal waters of Laizhou Bay.

Compared with N. nomuroi, Cyanea spp. was considered in this study to be a warm-water species with a higher average temperature, mainly distributed in the northern East China Sea (nECS) and BS. Abundance and biomass of Cyanea spp. nECS was 23.19 ± 34.61 ind. km-2 and 86.13 ± 144.27 kg km-2. Comparison with the distribution of Cyanea spp. It was registered with nECS at the end of August 2006. In the summer of 2021, it became more widespread and closer to the pelagic region [9]. Cyanea genus In this study, distributed mainly in BS and collected in Liaodong Bay, abundance and biomass values reached 9058.92 Indian km-2 and 18,765.13 kg km-2, respectively, while N. nomurai individuals were slightly collected it was done. There were fewer stations in Liaodong Bay in summer 2021 compared to September 2014 and June 2016. In this study, this may be one of the reasons for the low population of N. nomuroi in Liaodong Bay. Stable isotope analysis showed that N. nomuroi accounted for 9.54% of the diet of her large Cyanea nozakii individuals, suggesting an intraguild predatory relationship between the two species. A similar phenomenon occurred in Liaodong Bay in July 2004. Number of N The nomurai population declined significantly, while the C. nozakii population increased significantly [10].

## CONCLUSION

A large school of fish collected in coastal waters of northern China in the summer of 2021 included Nomepilema nomuroi, Cyanea spp., Aurelia coerulea and Aequorea spp. and Urmaridae (undefined species). Among them, N. nomuroi was the dominant species in terms of population and biomass, followed by Cyanea spp. and A. coerulea. The genus Aequorea and Urmaridae (undefined species) were only sporadically distributed in the Yellow Sea (YS). Based on long-term historical data from southern YS, N. nomuroi populations were at intermediate flowering levels in the summer of 2021. We used the maximum entropy method (MaxEnt) to achieve niches for the three most common large fish species (N. Nomurai, Cyanea spp. and A. coerulea) were adjusted to describe their distribution patterns in the study area and their responses to multiple environmental variables. The realized niches for large fish varied widely in terms of temperature and salinity. The feeding pressure of N. nomuroi on zooplankton exceeded zooplankton productivity at stations inhabited by N. nomuroi. Nomurai gathered. For small copepods, absolute and relative population declines were observed in mid- and flowering stations compared to non-flowering stations, suggesting that top-down control of flowering of large fish may affect zooplankton production. It was suggested that it has an important influence on population size and community composition.

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