

Long-term changes in the ecosystem of Jiaozhou Bay, the Yellow Sea

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This study analyzed the long term changes of Jiaozhou Bay marine ecosystem in the past several decades driven by the global changes. Major changes of Jiaozhou Bay ecosystem were summarized: 1) Air temperature in the region of Jiaozhou Bay showed an increasing trend, especially in winter. The mean annual air temperature after 1990 was 0.7°C higher than before 1990. The mean air temperature in February was 1.46°C higher after 1990 than before 1990. Similar trend was observed on seawater temperature. The mean annual and winter water temperature after 1990 was 0.45°C and 1.69°C higher than before 1990. We also found that the increment per 20 years is approximately one time for the number of heat waves. 2) The nutrient concentrations and molar ratio are changing. The concentration of NH₄-N showed a trend of increasing before 2001 and decline after that. The NH₄-N concentration in 2001 was 5 times higher than that in 1981. The concentrations of other nutrients such as NO₃-N, NO₂-N, PO₄-P, SiO₃-Si were all increase. The N/P ratio increased before 2001 but decrease after that. A reverse trend was observed on the change of Si/N and Si/P ratio. 3) The abundance and composition of planktonic community changed. Both the abundance and biomass of phytoplankton and zooplankton were increased, especially after 2000. The mean density of phytoplankton and biomass of zooplankton after 2000 were 4.9 and 3.1 times higher than those of before 2000. Dominant species have considerably alternated. Some species such as *Chaetoceros affinis*, *Thalassionema nitzschioides*, *Rhizosolenia setigera*, *Coscinodiscus radiatus* have been replaced by *Asterionella kariana*, *Thalassiosira nordenskioldi*, *Nitzschia paradoxa*. Some eutrophic species such as *Skeletonema costatum* and warm water species such as *Lithodesmium undulatum* increased abundantly. For the zooplankton community, the species number and abundance of medusa increased evidently in recent years. The biodiversity of phytoplankton and zooplankton increased slightly. 4) The total biomass of benthic organisms increased, which was mainly due to the increase of mollusk biomass. The densities of polychaeta, mollusk and crustacea were all increased but the density of Echinodermata decreased during 1981-2007. The diversity of benthic community showed a trend of increase before 2001 but declined slightly after 2001. The concurrent impact of climate change and anthropogenic activities had led to changes on the structure and function of the Jiaozhou Bay ecosystem.