

Trends in Chlorophyll-a Concentration and Its Relationship to an Area-weighted Water Quality Index at the Bohai Sea, China

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The Bohai Sea is one of the key mid-latitude enclosed coastal seas located at the western Pacific Ocean. Its surrounding area has experienced strong disturbance from human activities with the rapid economic development of China in past decades, e.g., urbanization, industry, agriculture and aquaculture. Large amounts of nitrogen and phosphorus as well as other pollutants have been discharged into the sea, and the aquatic ecological system has been facing a serious problem of degradation. To study the ecological change in the Bohai Sea with the background of human disturbance, Chlorophyll-a concentration (Chl-a) derived from satellite remote sensing was used to investigate the variations of sea surface chlorophyll during 2001-2007. On the basis of water quality levels and its corresponding areas in the releases of Chinese government annual report on environment status, an Area-Weighted Water Quality Index (AWWQI) was proposed to evaluate the change of water quality status of the whole Bo Sea. As nitrogen and phosphorus are the main pollutants in China coastal waters and the main factors that control the growth of phytoplankton, an Area-Weighted Nutrient (nitrogen and phosphorus) Composite Pollution Index (AWNCPI) was also established for quantitative analysis. For comparison, two enclosed seas of Baltic Sea and Hudson Bay at the high-latitude zone, and another two mid-latitude China coastal seas, the Yellow Sea and the East China Sea, were also investigated. Results show that Chl-a at the Bohai Sea increased during 2001-2007, and it was opposite to the decreasing trend which was driven by climate event- El Nino/Southern Oscillation (ENSO) at the low-latitude zone of global open oceans. The Yellow Sea, the Baltic Sea and the Hudson Bay had a similar increasing trend in Chlorophyll concentration; on the contrary, Chl-a at the East China Sea decreased during the same period. However, the trends in Chl-a of all the three China coastal seas were in good agreement with the indices of AWWQI and AWNCPI, i.e., AWWQI and AWNCPI increased at the Bohai Sea and the Yellow Sea, and decreased at the East China Sea. The results suggest that land-source nutrient pollutants caused the increasing trend of Chl-a at the Bohai Sea, and thus management on land-source pollutants discharge is still the essential task in the controlling and improving the aquatic ecological status at the Bohai Sea.

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