Phytoplankton community structures in Fushan Bay

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Abstract. This paper analyzed the community structures of phytoplankton in Fushan Bay in June to August 2002. Results showed that phytoplankton in Fushan Bay was dominated by *Bacillariophyta* and *Pyrrophyt*a, whose species accounted for 74% and 24% of total phytoplankton species, respectively. *Chaetoceros* and *Peridinium* were the major genera of *Bacillariophyta* and *Pyrrophyt*a, accounted for 19% and 44% for *Bacillariophyta* and *Pyrrophyt*a, respectively. There were something in common between phytoplankton community structures of Fushan Seas, Guangzhou Seas and Hongkong Seas. Firstly, *Bacillariophyta* and *Pyrrophyt*a were the dominant and subdominant phyla in Seas in different latitude. Secondly, the proportions of the species of *Bacillariophyta* and *Pyrrophyt*a were consistent in Seas in different latitude. These features were determined by nutrient Silicon.

Introduction

Phytoplankton is the basis of marine food chain, and is playing an important role in atmospheric CO_2 removing [1]. Previous studies showed that Silicon was the limited factor of the primary productivity in Jiaozhou Bay, China [2]. Based on the researches of the influences of Silicon in the growth, physiological feature and community structure of phytoplankton, we found that Silicon was the limited factor of phytoplankton in ocean [3], and the growth of phytoplankton determined the balance of atmospheric CO_2[4-5].

Studying the community structure of phytoplankton is meaningful in marine ecosystem and climate change. Based on investigation data on phytoplankton in Fushan Bay in June to August 2002, this paper analyzed the phytoplankton community structure Fushan Bay. Moreover, a comparison study on phytoplankton community structures between Fushan Seas, Guangzhou Seas and Hongkong Seas was provided to reveal the spatial variations of phytoplankton community structures.

Material and method

Loushan Bay (36°00′-36°06′ N, 120°29′-120°42′ E) is located in the south of Qingdao, Shandong Province, China (Fig. 1). The water depth and coastline are 9-30 m and 7 km, respectively. The data was provided by North China Sea Environmental Monitoring Center. Eleven monitoring sites were set up, and the survey was conducted in June, July, August and September 2002. The sampling method of phytoplankton was followed by National Specification for Marine Monitoring [6], and the species identification of phytoplankton was follow by Hu et al. [7].

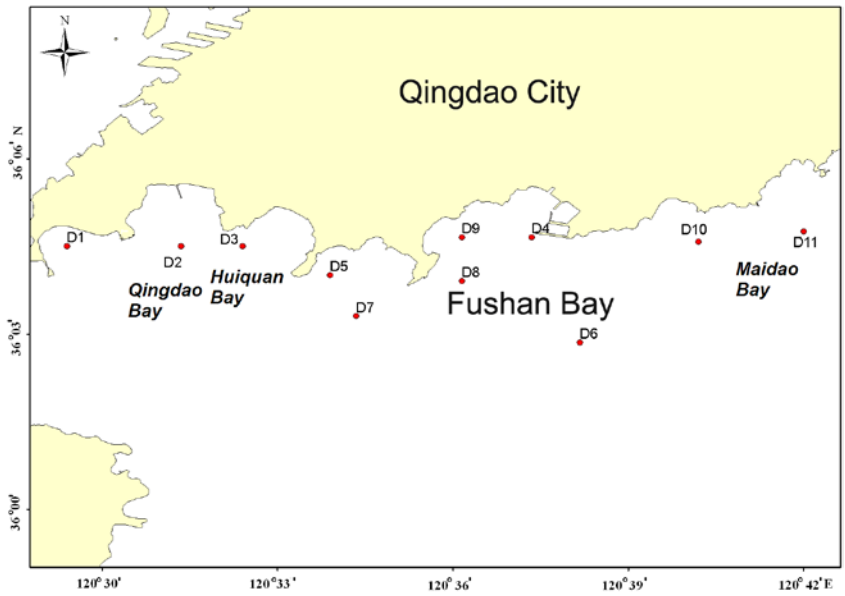

Fig.1 Investigation sites in Fushan Bay

Results and discussion

Proportions of species for different phyla. There were 4 phyla, 39 genera and 102 species in study Fushan Bay in June to September 2002, including *Bacillariophyta*, *Pyrrophyta*, *Chlorophyta* and *Chrysophyta*, accounted for 74%, 24%, 1% and 1% for all of the 102 species (Fig. 2). It could be seen that the number of the phytoplankton species was relative high in Fushan Bay in 2002, and the phytoplankton community structure was also relative stable. Obviously, phytoplankton in Fushan Bay was dominated by *Bacillariophyta* and *Pyrrophyta*.

Chaetoceros, *Coscinodiscus*, *Rhizosolenia*, *Nitzschia* and *Pleurosigma* were the major genera for *Bacillariophyta* phyla, accounted for 19%, 14%, 10%, 7% and 5% for the species of *Bacillariophyta* (Fig. 3). While for *Pyrrophyta* phyla, *Peridinium*, *Ceratium* and *Noctiluca* were the major genera, accounted for 44%, 28% and 8% for the species of *Pyrrophyta* (Fig. 4).

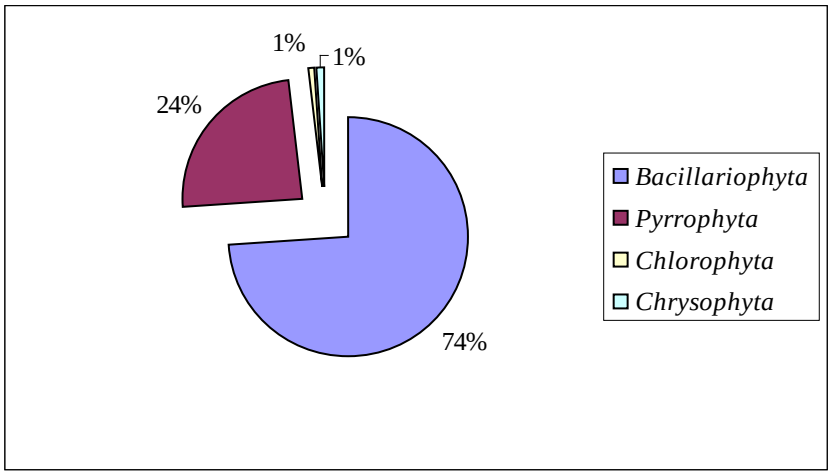

Fig.2 The proportion of different phyla for species

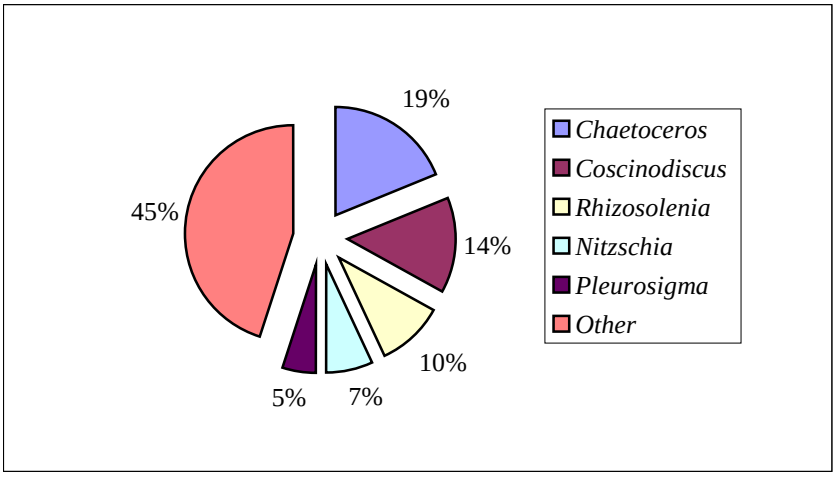

Fig. 3 The proportions of different genera for species in *Bacillariophyta* phyla

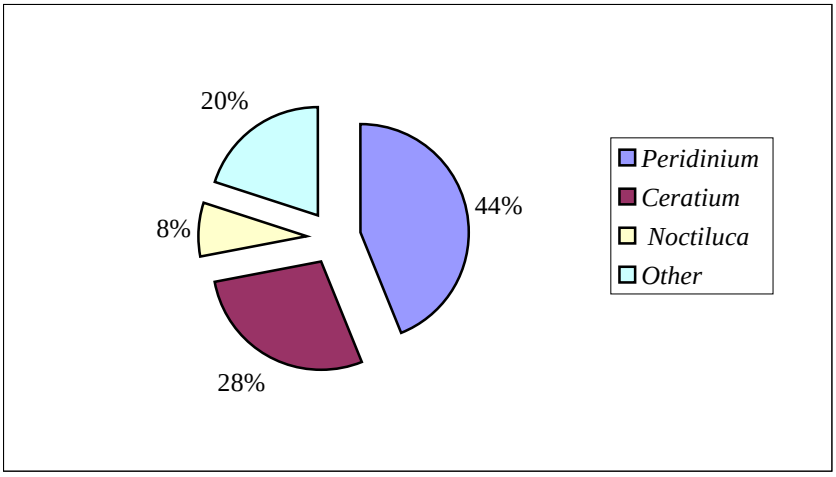

Fig. 4 The proportions of different genera for species in *Pyrrophyta* phyla

Spatial variations of phytoplankton community structures in different Seas. In order to reveal the spatial variations of phytoplankton community structures, comparison study on phytoplankton community structures between Fushan Seas, Guangzhou Seas and Hongkong Seas was provided. There were 89 genera and 209 species in Guangzhou Seas in May 2003 to May 2004, in which *Bacillariophyta* accounted for 55% of the species [8]. For Hongkong Seas in 2004, there were 48 genera and 139 species, in which *Bacillariophyta* and *Pyrrophyta* accounted for 71% and 25% of the species [9]. These results confirmed the viewpoint of Yang et al. [10-12] that *Bacillariophyta* was the dominant phyla in global ocean. *Pyrrophyta* was the subdominant accounted for 24% and 25% of the phyla in Fushan Seas and Hongkong Seas.

Silicon determined the proportions of species for *Bacillariophyta* and *Pyrrophyta*. Soluble inorganic silicon is one of the essential nutrients for marine phytoplankton, having close relations to the structure and metabolism of *Bacillariophyta*, and is controlling the growing process of phytoplankton [13-14]. $Si(OH)_4$ plays a core role in the algal bloom [15]. Silicon is the limited factor of the primary productivity of phytoplankton, especially for the growth of *Bacillariophyta* [16-19]. In generally, Silicon is the engine for the growth of phytoplankton, having strong and rapid influence on the growth of phytoplankton [17], and therefore is the limited factor of the global ocean phytoplankton [18]. The surface water temperature of Fushan Seas and Hongkong Seas were 2-24℃ (13 ℃in average) and 18-29℃(26℃ in average), respectively. However, both the proportions of species of *Bacillariophyta* and *Pyrrophyta* were closed. Based on previous researches by Yang et al., such as the factor and way of limiting nutrient for the growth of phytoplankton [20], the uniqueness of nutrient limitation [11], and magnitude order of the effect of light, water temperature and nutrients on phytoplankton growth [12], it could be concluded that these features were determined by Silicon.

Conclusion

Phytoplankton in Fushan Bay was dominated by *Bacillariophyta* and *Pyrrophyt*a, accounted for 74% and 24% for the species. *Chaetoceros*, *Coscinodiscus*, *Rhizosolenia*, *Nitzschia* and *Pleurosigma* were the major genera for *Bacillariophyta* phyla. For *Pyrrophyta* phyla, *Peridinium*, *Ceratium* and *Noctiluca* were the major genera. Both the proportions of species of *Bacillariophyta* and *Pyrrophyt*a in Fushan Seas and Hongkong Seas were closed, these features were determined by Silicon.

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