

## Species and composition of phytoplankton in Fushan Bay

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**Abstract.** This paper analyzed the species and composition of phytoplankton in Fushan Bay based on investigation data on June to August 2002. Results showed that there were 4 phyla, 39 genera and 102 species, including *Bacillariophyta*, *Pyrrophyta*, *Chlorophyta* and *Chrysophyta*. There were 29 genera and 75 species for *Bacillariophyta*, 8 genera and 55 species for *Pyrrophyta*, 1 genera and 1 species for *Chlorophyta*, and 1 genera and 1 species for *Chrysophyta*, respectively. Phytoplankton in this bay was dominated by *Bacillariophyta* and *Pyrrophyta*, whose genera and species were increasing from north to south, along with the increasing of water temperature.

### Introduction

Phytoplankton is playing double-acting role in marine ecosystem [1]. On one hand, phytoplankton is the basis of marine food chain, which is the core of marine ecosystem. On the other hand, atmosphere CO<sub>2</sub> is mainly absorbed and removed by phytoplankton by means of photosynthesis. Therefore, understanding the specific composition of phytoplankton in marine environment is of great significance. The major purpose of this paper was to analyze the species and composition of phytoplankton in Fushan Bay based on investigation data on June to August 2002, and to provide basis for ecological environmental protection.

### Material and method

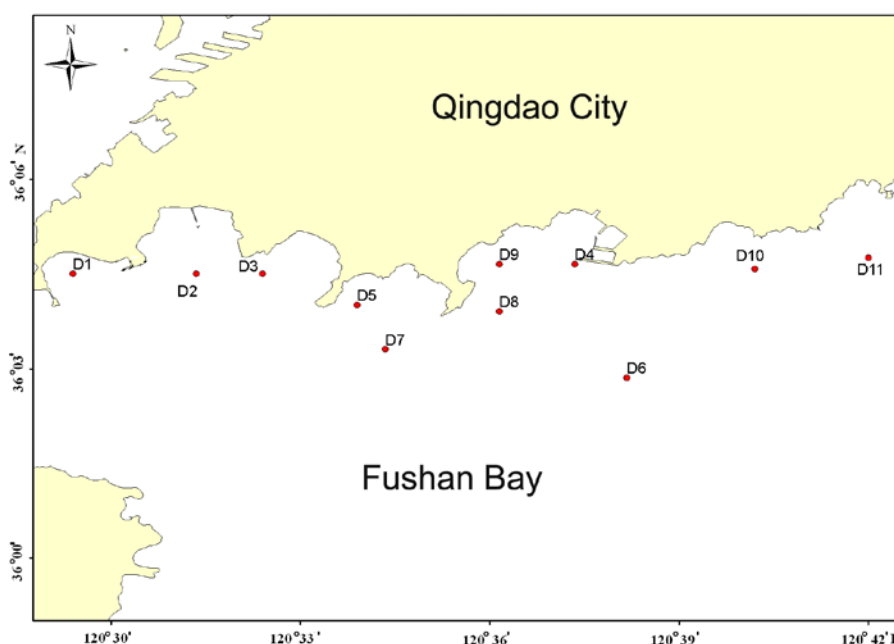


Fig.1 Sampling sites in Fushan Bay

Loushan Bay (36°00'-36°06' N, 120°29'-120°42' E) is located in the south of Qingdao, Shandong Province, eastern China (Fig. 1). The water depth of Fushan Bay ranges from 9-30 m, and the coastline is about 7 km. This bay was the major division of sailing in 2008 Beijing 2008 Olympics Games.

The data was provided by North China Sea Environmental Monitoring Center. Eleven monitoring sites were set up, and the survey was conducted in June to August 2002. The sampling method was followed by National Specification for Marine Monitoring [2], and the species identification was followed by Hu et al. [3].

## Results and discussion

**Species and composition of Phytoplankton.** During June to August 2002, there were 4 phyla, 39 genera and 102 species, including *Bacillariophyta*, *Pyrrophyta*, *Chlorophyta* and *Chrysophyta* in Fushan Bay (Table 1). There were 29 genera and 75 species for *Bacillariophyta*, 8 genera and 55 species for *Pyrrophyta*, 1 genera and 1 species for *Chlorophyta*, and 1 genera and 1 species for *Chrysophyta*, respectively. Obviously, phytoplankton in this bay was dominated by *Bacillariophyta* and *Pyrrophyta*.

**Species and composition of *Bacillariophyta* and *Pyrrophyta*.** There were 29 genera and 75 species for *Bacillariophyta*, in which there were 14, 11, 8, 5, and 4 species for *Chaetoceros*, *Coscinodiscus*, *Rhizosolenia*, *Nitzschia* and *Pleurosigma*, respectively; 2 species for *Thalassiosira*, *Thalassionema*, *Pleurosigma*, *Hemiaulus*, *Eucampia*, *Scenedesmus*, *Pleurosigma* and *Bacteriastrum*; and 1 species for the other genera. There were 8 genera and 25 species for *Pyrrophyta*, in which there were 11, 7 and 2 species for *Peridinium*, *Ceratium* and *Noctiluca*, respectively; and 1 species for the other genera.

**Spatial distribution of phytoplankton.** The species and composition of surrounding waters were compared with Fushan Bay in order to reveal the spatial distribution of phytoplankton. The results of the investigation on phytoplankton in waters near by Guangzhou in May 2003 to May 2004 showed that there were 89 genera and 209 species, in which there were 41 genera and 122 species for *Bacillariophyta* [4]. The results of the investigation on phytoplankton in waters near by Hongkong in 2004 showed that there were 196 species, in which there were 48 genera and 139 species for *Bacillariophyta*, and 18 genera and 48 species for *Pyrrophyta* [5]. The dimensionality of Fushan, Guangzhou and Hongkong sea areas were from decreasing from north to south, hence the water temperature in where were increasing from north to south. It was clearly that both genera and species of *Bacillariophyta* and *Pyrrophyta* were increasing from north to south, along with the increasing of water temperature.

Table 1 Phytoplankton species in Fushan Bay in June to September 2002.

Phyla	Genus	Specie
Bacillariophyta	Chaetoceros	<i>Chaetoceros castracanei</i> karsten
		<i>Chaetoceros densus</i> (Cleve) Cleve
		<i>Chaetoceros didymus</i> Ehrenberg
		<i>Chaetoceros curvisetus</i> Cleve
		<i>Chaetoceros subsecundus</i> (Grunow)Hustedt
		<i>Chaetoceros affinis</i> Lauder
		<i>Chaetoceros nipponica</i> Ikari
		<i>Chaetoceros</i> spp.
		<i>Chaetoceros pseudocurvisetus</i> Margin
		<i>Chaetoceros compressus</i> Lauder
		<i>Chaetoceros lorenzianus</i> Grunow
		<i>Chaetoceros eibenii</i> Grunow

	<i>Chaetoceros teres</i> Cleve
	<i>Chaetoceros debilis</i> Cleve
	<i>Coscinodiscus wailesii</i> Gran & Angst
	<i>Coscinodiscus radiatus</i> Ehrenberg
	<i>Coscinodiscus</i> sp.
	<i>Coscinodiscus spinosus</i> Chin, sp. nov.
	<i>Coscinodiscus divisus</i> Grunow
	<i>Coscinodiscus granii</i> Gough
	<i>Coscinodiscus marginatus</i> Ehrenberg
	<i>Coscinodiscus centralis</i> Ehrenberg
	<i>Coscinodiscus asteromphalus</i> Ehrenberg
	<i>Coscinodiscus oculus-iridis</i> Ehrenberg
Coscinodiscus	<i>Coscinodiscus curvatulus</i> Grunow
	<i>Rhizosolenia delicatula</i> Cleve
	<i>Rhizosolenia setigera</i> Brightwell
	<i>Rhizosolenia crassispina</i> Schroder
	<i>Rhizosolenia stolterfothii</i> Peragallo
	<i>Rhizosolenia setigera</i> Brightwell
	<i>Rhizosolenia robusta</i> Norman
	<i>Rhizosolenia alata</i> f. <i>gracillima</i> (Cleve) Grunow
Rhizosolenia	<i>Rhizosolenia alata</i> f. <i>indica</i> (Perag.) Hustedt
	<i>Nitzschia longissima</i> (Breb.) Ralfs
	<i>Nitzschia paradoxa</i> (Gmelin) Grunow
	<i>Nitzschia lorenziana</i> Grunow
	<i>Nitzschia pungens</i> Grunow
Nitzschia	<i>Nitzschia</i> sp.
	<i>Pleurosigma affine</i> Grunow
	<i>Pleurosigma pleagicum</i> peragallo
	<i>Pleurosigma formosum</i> W. Smith
Pleurosigma	<i>Pleurosigma</i> sp.
	<i>Thalassiosira rotula</i> Meunier
Thalassiosira	<i>Thalassiosira subtilis</i> (Ostenf.) Gran
	<i>Thalassionema nitzschioides</i> Grunow
Thalassionema	<i>Thalassiothrix franuenfeldii</i> Grunow
	<i>Pleurosigma</i> sp.
Pleurosigma	<i>Pleurosigma affine</i> Grunow
	<i>Hemiaulus sinensis</i> Greville
Hemiaulus	<i>Hemiaulus membranaceus</i> Cleve
	<i>Eucampia zodiacus</i> Ehrenberg
Eucampia	<i>Eucampia zodiacus</i> Ehrenberg
	<i>Tropidoneis longa</i> Cleve
Scenedesmus	<i>Tropidoneis maxima</i> (Greg) Cleve
	<i>Biddulphia regia</i> (Schultze) Ostensfeld
Biddulphia	<i>Biddulphia sinensis</i> Greville
	<i>Stephanopyxis turris</i> (Greville et Arnott) Ralfs
Stephanopyxis	<i>Stephanopyxis turris</i> (Greville et Arnott) Ralfs

	Bacteriastrum	<i>Bacteriastrum hyalinum</i> Lauder
	Grammatophora Ehrenberg	<i>Bacteriastrum</i> sp.
	Asterionella Hassall	<i>Grammatophora undulata</i> Ehrenberg
	Melosira	<i>Asterionella japonica</i> Cleve
	<u>Skeletonema</u>	<i>Melosira sulcata</i> (Ehrenberg) Cleve
	Triceratium	<i>Skeletonema costatum</i> (Greville) Cleve
	Streptotheca thamesis	<i>Triceratium favus</i> Ehrenbrg
	Ditylum	<i>Streptotheca thamesis</i> Schrubsole
	Dactyliosolen	<i>Ditylum brightwellii</i> (West) Grunow
	Navicula	<i>Dactyliosolen mediterraneus</i> Peragallo
	Corethronaceae	<i>Navicula</i> sp.
	cylindrotheca	<i>Corethron hystrix</i> Hensen
	Pleurosigma	<i>Leptocylindrus danicus</i> Cleve
	Gyrosigma	<i>Pleurosigma pelagicum</i>
	Licmophora	<i>Gyrosigma</i> sp.
	Amphiprora	<i>Licmophora abbreviata</i> Agardh
		<i>Amphiprora alata</i> Kutzing
		<i>Peridinium</i> sp.
		<i>Peridinium latissimum</i> Kofoid
		<i>Peridinium solidicorne</i> Mangin
		<i>Peridinium depressum</i> Baileg
		<i>Proto-peridinium divergens</i>
		<i>Peridinium pentagonum</i> Gran
		<i>Peridinium leonis</i>
		<i>Peridinium</i> sp.
		<i>Peridinium conicum</i> (Gran) Ostfeld et Schmidt
		<i>Peridinium elegans</i> Cleve
	Peridinium	<i>Peridinium mariebourae</i> Paulsen
		<i>Ceratium tripos</i> (Muller) Nitzsch
		<i>Ceratium breve</i> (Ost. et Schmidt) Schroder
		<i>Ceratium kofoid</i> Jorgensen
Pyrroptata		<i>Ceratium fusus</i> Schutii (Ehrenberg) Dujardin
		<i>Ceratium furca</i> v. <i>berghii</i> (Jorgensen) Schiller
		<i>Ceratium intermedium</i> Jorensen
	Ceratium	<i>Ceratium macroceres</i> (Her.) Cleve
		<i>Noctiluca scintillans</i> (Macartney) Kofoid et Swerzy
	Noctiluca	<i>Alexandrium tamarense</i> (Lebour) Balech
	Prorocentrum	<i>Prorocentrum minimum</i>
	Pyrophacus horologicum	<i>Pyrophacus</i> sp.
	Dinophysis	<i>Dinophysis fortii</i>
	Gonyaulax	<i>Gonyaulax</i> sp.
	Cerataulina	<i>Cerataulina bergoni</i> Peragallo
Chlorophyta	Cosmarium	<i>Lithodesmium undulatum</i> Ehrenberg
Chrysophyta	Silicoflagellate	<i>Dictyocha fibula</i> Ehrenberg

## Conclusion

There were 4 phyla, 39 genera and 102 species phytoplankton in Fushan Bay, including *Bacillariophyta*, *Pyrrophyta*, *Chlorophyta* and *Chrysophyta*. There were 29 genera and 75 species for *Bacillariophyta*, 8 genera and 55 species for *Pyrrophyta*, 1 genera and 1 species for *Chlorophyta*, and 1 genera and 1 species for *Chrysophyta*, respectively. Phytoplankton in this bay was dominated by *Bacillariophyta* and *Pyrrophyta*, whose genera and species were increasing from north to south, along with the increasing of water temperature.

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