



Dr. Tatiana V. Morozova, Ph.D. in Biology, Research Scientist of the Institute of Marine Biology, Far East Branch of Russian Academy of Science (IMB FEB RAS), Laboratory of the Ecology of Shelf Communities. Educational background: Far Eastern State University, Vladivostok, Russia, M.Sc., Ecology, 1999; Ph.D., Ecology & Hydrobiology, IMB FEB RAS, 2005. Research interests: Marine phytoplankton: morphology, biology, ecology, taxonomy; taxonomy and ecology of harmful algae species, algal bloom monitoring for marine aquaculture farms; dinoflagellates cysts. Membership: Hydrobiological Society of Russia (since 2000); Botanical Society of Russia (since 2002). Publications: Author and co-author of 19 papers.

Monitoring of harmful algae in the area of mollusk farms in the Peter the Great Bay, Sea of Japan

Tatiana V. Morozova,
Institute of Marine Biology, FEBRAS, Vladivostok, Russia

1. Introduction

Russia is facing a significant increase in aquaculture in the next few years. In its biogeographical features, the Peter the Great Bay is thought to be one of the most favorable areas for commercial cultivation of aquatic organisms in the Russian Far East. The planktonic microalgae are critical food for filter-feeding bivalve shellfish, such as scallops and mussels. Usually, the proliferation of planktonic algae is beneficial for aquaculture. However, in some cases, algal blooms caused by harmful or toxic species may have a negative effect causing losses to aquaculture. Every year, the number of species known to be toxic increases in Far-Eastern Russian waters.

2. Locations

The monitoring of harmful algae has been carried out in three mariculture regions in the Peter the Great Bay. Figure 1 provides a map of the location of the stations where harmful algae were studied: station 1 – Minonosok Bay, the area of the oldest scallop farm in Russia, the monitoring has been carried out since 1997; stations 2, 3 – Kitovii Bay, the area of a new, yet the largest scallop farm in Russia, the monitoring has been carried out since 2000; station 4 – Vostok Bay, the area of an experimental mussel farm, the monitoring has been carried out since 1985, in this study data of 2001-2004 was used.

3. Methodology

The samples were collected once to three times a month (weekly in summer). One-liter bathometric samples were collected at different depths with sampling intervals of 2–5 m. Plankton net with the mesh size of 20 μm was used only for qualitative analysis. Samples were fixed immediately after the collection with Utermohl's solution. The numbers of nanoplankton (2.0–20 μm) were counted using Nojotta type Cell (0.05 mL) at total magnification of 300-400, and those of microplankton (> 20.0 μm), using Sedgewick Rafter Cell (1 mL) at 100 X under a light microscope. The cell biovolume was calculated based on cell linear dimensions using appropriate geometric formulae. HABs monitoring data were stored using standard forms including the following fields: sampling site, sampling depth, date, volume of sample, counting cell type, ID of the responsible person.

4. Results

No potentially toxic species were found in Kitovii Bay. The study of phytoplankton samples in Minonosok and Vostok bays revealed 4 species, which caused water blooms in the surveyed areas: the diatoms *Skeletonema costatum* and *Thalassionema nitzschioides*, cryptophyta *Plagioselmis punctata*, and the cyanophyta *Synechocystis* sp. The most significant bloom (19.2 million cells/l) was caused by *Synechocystis* sp. in June 1997 in Minonosok Bay. The numbers of three other species didn't exceed 6.5 million cells/l. In addition, 15 species known to be toxic were found: the diatoms *Pseudo-nitzschia multiseriata*, *P. pungens*, *P. cf. pseudodelicatissima*; dinoflagellates *Alexandrium acatenella*, *A. tamarense*, *A. pseudogonuaulax*, *Dinophysis acuminata*, *D. fortii*, *D. norvegica*, *D. rotundata*, *Karenia brevis*, *Prorocentrum minimum*, *Protoperdinium crassipes*; raphidophytes *Chattonella marina*, *Heterosigma akashiwo*. The species of the genera *Pseudo-nitzschia*, *Alexandrium*, and *Dinophysis* were relatively abundant, with their numbers exceeding the harmful concentration in summer.

4.1. Causative organisms of domoic acid poisoning (DAP)

Diatoms of the genus *Pseudo-nitzschia* are known as domoic acid producing species. *Pseudo-nitzschia* species are common in the Peter of Great Bay. Potentially toxic species of the genus *Pseudo-nitzschia* were most abundant in Vostok Bay. In this bay, the total number of *Pseudo-nitzschia multiseries*, *P. pungens*, and *P. pseudodelicatissima* reached 330 000 cells/l (Fig. 2).

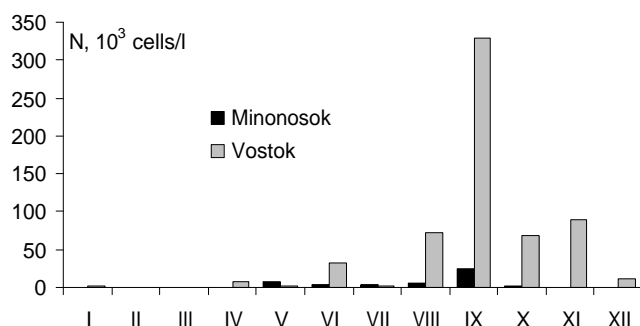


Figure 2. Changes in the numbers of *Pseudo-nitzschia* species (N) in Minonosok and Vostok bays (interannual maxima).

4.2. Causative organisms of diarrhetic shellfish poisoning (DSP)

Dinoflagellates of the genus *Dinophysis* are known as species producing ocadaic acid and other DSP-toxins. Out of four species observed in the Peter the Great Bay (*D. acuminata*, *D. acuta*, *D. fortii*, and *D. rotundata*), *D. acuminata* was the most common toxic species in the Sea of Japan. The total numbers of *Dinophysis* spp. reached 520 cells/l in Minonosok Bay and 660 cells/l in Vostok Bay (Fig. 3).

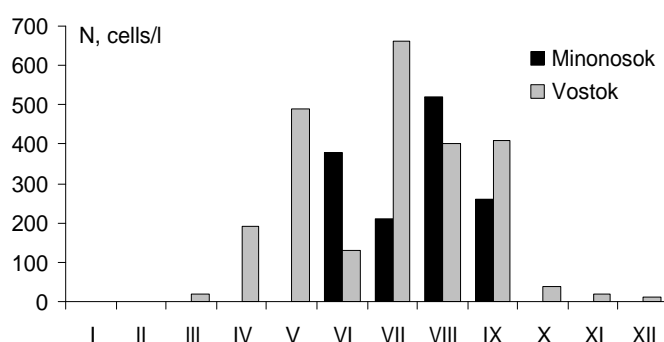


Figure 3. Changes in the numbers of *Dinophysis* species (N) in Minonosok and Vostok bays (interannual maxima).

4.3. Causative organisms of paralytic shellfish poisoning (PSP)

Dinoflagellates of the genus *Alexandrium* may produce PSP-toxins. In the Peter the Great Bay, three potentially toxic species of the genus *Alexandrium* (*A. tamarense*, *A. acatenella*, and *A. pseudogonyaulax*) were found. *A. tamarense* was most widespread. The total number of *Alexandrium* spp. reached 6000 cells/l in Minonosok Bay and 1600 cells/l in Vostok Bay (Fig. 4).

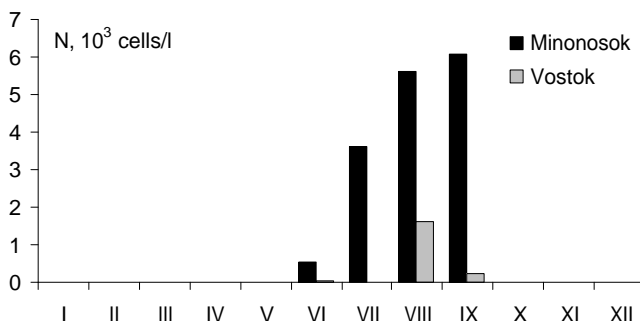


Figure 4. Changes in the numbers of *Alexandrium* species (N) in Minonosok and Vostok bays (interannual maxima).

Cases of human poisoning or any damage were not recorded. There are no data on mitigation activity and its effectiveness in Peter the Great Bay. But due to the presence of potentially toxic microalgae, regular monitoring of phytoplankton in the Sea of Japan is a necessity.