



Dynamics of the bloom-forming genus *Skeletonema* from the Peter the Great Bay (Sea of Japan)

Anna A. Ponomareva¹, Olga G. Shevchenko¹, Kirill O. Tevs²

¹A. V. Zhirmunsky National Scientific Center of Marine Biology, Far Eastern Branch, Russian Academy of Science, Vladivostok, Russia

²Far Eastern Federal University, Vladivostok, Russia

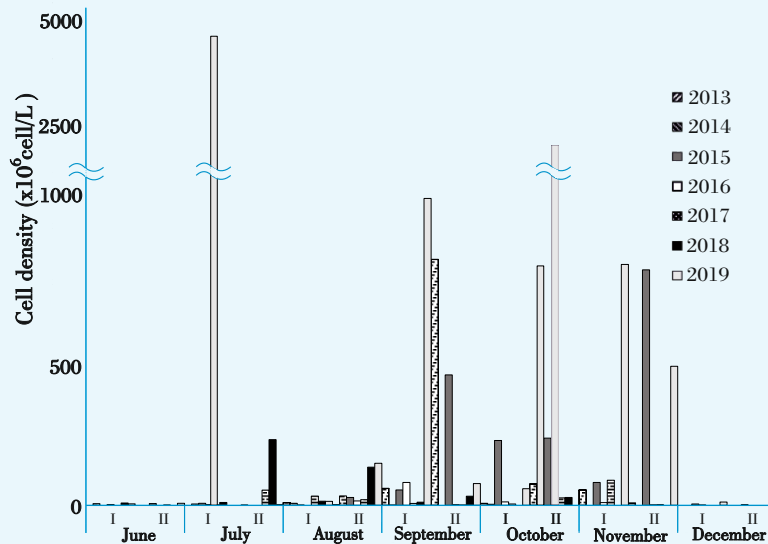
E-mail: anna_andreevna7@mail.ru

Diatoms of the genus *Skeletonema* are known to form harmful blooms; they are non-toxic but can cause mortality of marine wildlife. Six species, namely *Skeletonema costatum*, *Skeletonema dohrnii*, *Skeletonema japonicum*, *Skeletonema grethae* and *Skeletonema menzelii*, have currently been identified in the northwestern Sea of Japan. *Skeletonema menzelii* is a new record for Russian seas.

Phytoplankton was sampled year-round at the Peter the Great Bay from 2013 to 2019. Samples were taken a 5-liter Niskin bottle from the surface horizon twice a month. One liter of sample water was fixed with Utermöhl's solution and concentrated by sedimentation (Utermöhl, 1958). To specify the main diagnostic features of the species, the material was examined with a scanning electron microscope (SEM) Carl Zeiss Sigma 300 and transmission electron microscope (TEM) Carl Zeiss Libra 120. Material for SEM and TEM was prepared according standard procedure (Truby, 1997; Hasle, Fryxell, 1970).



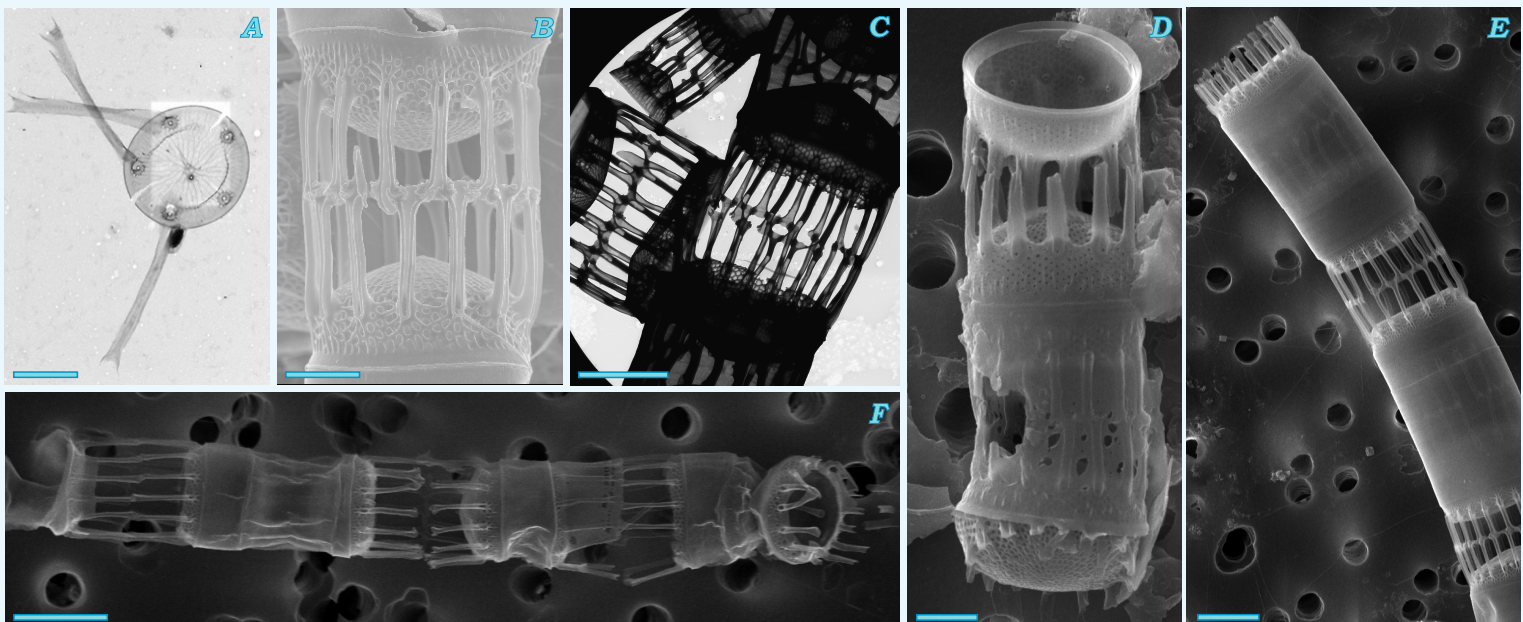
Map of the study area



Long-term density dynamics of the genus *Skeletonema* in 2013—2019 in the study area

The density of *Skeletonema* species ranged from 87 cell/L to 4.6×10^6 cell/L in the study area in 2012—2019. Clonal cultures were isolated for further identification of *Skeletonema* species under light microscopy. Colonies of *S. dohrnii* were mainly observed in June, *S. marinoi* — in September, *S. japonicum* — in November. These species' abundance varied significantly between years. Over the observation period, the highest density of *Skeletonema* species was noted in 2019: *S. dohrnii* formed a bloom in summer (4.6×10^6 cell/L), an excessive growth of *S. japonicum* (2.3×10^6 cell/L) was recorded in fall. In previous years of the study (2012—2018), such significant outbreaks in *Skeletonema* population were not noted: their density remained under 884.2×10^3 cell/L. An exception was *S. dohrnii* that flourished in fall of 2015 (1.8×10^6 cell/L).

The other species were at low levels. Single colonies of *S. costatum* were present in plankton in June; small numbers of *S. grethae* and *S. menzelii* were found in September. *Skeletonema* species are indistinguishable from each other under light microscopy. Since some of them could co-occur in plankton, we used a more accurate method to clarify the species composition and quantitative characteristics.



A - *Skeletonema menzelii*, B - *S. japonicum*, C - *S. grethae*, D - *S. costatum*, E - *S. marinoi*, F - *S. dohrnii*. A, C - TEM; B, D-F - SEM. Scale bars: 2 μ m (A, B, D, E), 5 μ m (C, F)