

Influence of St. Petersburg Flood Protective Construction on the Eastern Gulf of Finland

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The Neva Bay is the easternmost part of the Gulf of Finland (GOF) of the Baltic Sea. It is half locked shallow water basin (surface area – 380 km², volume – 1.2 km³) where the River Neva flows. The western boundary of the bay is formed by the flood protective constructions (the dam) for the city of St. Petersburg. The construction of the dam is the major cause of the technogenic alteration of the Neva Bay state.

Based on this, the influence of the dam on pollution nature of the water and the sediments of GOF is of particular interest. To determine the pollution extent of GOF basin 3,4-benzopyrene (3,4-BP) (in sediments) was selected as an indicator of the anthropogenic pollution and phenols - as “markers” of the secondary pollution in water.

The fresh and the marine water mix together and the chemical compound of the water changes where the River Neva flows into the Neva Bay. The construction of the dam caused the change of parameters of the Bay currents and turned the Bay into the internal city basin. The samples of the water and the sediments before and after the dam were collected during few years (1994 – 2000). The research indicated that the dam performs a function of a barrier for migration of pollution agent from the Neva Bay into GOF.

The main sources of pollution of GOF are sewage of many industries of St. Petersburg and its suburbs, (about 20 tones phenols is an annual input with the sewage into the River Neva and the Neva Bay. However the phenols are also produced by the biochemical degradation of various water organic substances that causes the secondary pollution of a basin.

Our data displayed that the average annual phenols concentration in the Neva Bay water was within the 5 – 15 µg l⁻¹. Beyond the dam, in the shallow and the deep-water parts of GOF the same concentration did not exceed 3 µg l⁻¹. The annual phenols inflow with the River Neva into the Neva Bay was ranging from 80 to 310 tones. The respective phenols load value was 0.2 – 0.8 g m⁻² y⁻¹. In the GOF the same values were 16 times smaller.

The construction of the dam led to the formation of the silt-clayey mud sediments and increased the volume of polluting components including 3,4-BP accordingly. In the silt-clayey mud sediments samples taken by the dam the 3,4-BP concentration reached 100 – 425 µg kg⁻¹.

In the GOF beyond the dam the great values of 3,4-BP were revealed in the sand-silt mud near the resort area of Zelenogorsk and Sestroretsk (24 - 66 µg kg⁻¹) and in the fairway, on the boarder with shallow-water part (42 µg kg⁻¹). The urbanization and the intense shipping have a big impact on the 3,4-BP distribution. In the fine and coarse sand the average 3,4-BP concentration did not exceed 2 µg kg⁻¹.

Thus, the assumption that the dam designed to protect St. Petersburg against floods accelerated the conversion of the Neva Bay state from mesotrophic to eutrophic one, is very likely. The dam protects the GOF from pollution inflowing the Neva Bay. Since the Neva Bay keeps suffering the high anthropogenic load, the entire ecological state can only be improved through the cessation of non-purified waste emissions into the River Neva, the Neva Bay and the Eastern Gulf of Finland.