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Hydroecological status of Kultuchnoe lake (Petropavlovsk-Kamchatskiy)

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Lake Kultuchnoe applies to lakes of lagoon type and is located in the historical center of Petropavlovsk-Kamchatskiy. The area and volume of the lake in connection with human economic activity was repeatedly reduced during backfilling. In the early 90s of the last century the lake was divided into two parts. The area of the water mirror of both lakes is about 2 km². The maximum depth of the Big lake – 7 m, Small lake– 1.2 m. Compared to the conditions that took place 30 years ago, there is an improvement in the state of the aquatic ecosystem and a decrease in the level of pollution. This is due to the reconstruction of urban sewage systems, in the 2000s, the release of fecal and industrial wastewater stopped. During the open water period a direct stratification is formed in the lake, and in the deepest part of it during the summer, low water temperatures remain in the bottom horizons and there is a lack of oxygen. The stratification is due to the insufficient length of wind acceleration for mixing the lake to the bottom and creates prerequisites for the formation of oxygen-free conditions below the boundary of the mixed layer (2-3 m). The systematic discharge of drainage wastewater into Lake Kultuchnoye through sewers with three outlets in the littoral part of the Big Lake and one in the Small Lake was revealed. According to the complex of components and indicators of water quality, the water in the Big and Small Lakes has a high level of, although the concentrations of many pollutants have decreased during the last 30 years. Compared to the state of the lake in 1990s, there was a decrease in the lake water of copper and manganese, phenols, petroleum products, ammonium nitrogen and BOD. Silty bottom sediments had a uniform composition, olive color. The content of organic matter reaches 14.4-16.9%, which indicates the active mineralization of organic residues. According to the content of mineral phosphorus (more than 10 µg/l), due to the influx of polluted waters, water masses do not experience a limit for the development of biota. In the Big Kultuchnoe Lake, the content of mineral phosphorus in the bottom horizons is 74-163 µg/l. In Small Kultuchnoe Lake, the content of mineral and total phosphorus is lower – up to 60 µg/l, which may be due to a more active process of its consumption by higher algae, which the lake is almost completely overgrown. Methane emission is the highest from the surface of the Small Lake (37.4 mgC / m²h), which is due to its high content in the water and low (up to 1 m) depth. For Big Kultuchnoe lake specific flow rate not exceeding 20,7 mgC/m²h. To preserve the ecosystem of the lake, which is located in the historical part of the city near important tourist infrastructure and has great recreational value, it is proposed to create phyto-treatment facilities that would intercept drainage runoff and not violate the overall appearance of the landscape.

