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Protection of Lake Baikal requires more stringent, not more lenient, environmental regulation

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Multiple features of L. Baikal rank as world records that indeed can be even found in the book of Guinness World Records. First, we may call it "grandfather Baikal", because it is the oldest lake on the planet. Second, we may call it the "well of the Earth" as it is the deepest (1640 m) lake on the planet holding ca. 20% of the total amount of unfrozen freshwaters of the globe. UN data project that by 2025–2030 natural sources will provide only 60% of the population's demand for freshwater. So, Lake Baikal is an unmatched source of freshwater in a drying world. Third, Baikal is a true "freshwater Australia" as the lake occupies first place among all other lakes in the uniqueness of its animal and plant diversity. It is a real record-holder among lakes. Of 2650 animal species dwelling in the Lake, about 60% are endemic. The lake harbors not only endemic species, but it also hosts unusual and unique freshwater communities: endemic Baikalian families of sponges, turbellarians, crustaceans and fishes; as well as highly unusual cryophilic, psammophilic, abyssal, hydrothermal vent, and oil seep communities. In these aspects of diversity, Baikal shares many features with marine ecosystems, including the world's only freshwater endemic seal. Fourth, as the deepest continental rift depression, the lake holds 6–7 km thick layers of sediment which contain a uniquely long climate chronicle of the Eurasian continent. Finally, the lake has immense cultural value for local native communities and all Russians. It was recognized as such with its designation as a UNESCO World Heritage Site.

However, not even its uniqueness can protect this lake from increasing anthropogenic stressors. Beginning in 2010–2011, independent groups of scientists have reported negative environmental impacts on the ecology of the lake's coastal zone. These include: 1) a change in the dominant species of macrophytes and the massive development of alien filamentous algae, *Spirogyra* and *Oedogonium* spp.; 2) mass development of benthic blue-greens capable of producing cyanotoxins dangerous for humans and animals; 3) mass disease and death of the main filter of nearshore Baikal waters, the endemic Lubomorskiidae sponges; 4) regular mass growth of algae and macrophytes resulting in coastal wash-ups in some parts of the lake (up to 90 kg of wet biomass per m^2), 5) significant changes in the structure and composition of macrozoobenthos communities; 6) significant contamination by sanitary-indicative microorganisms in the lower parts of the tributaries of Lake Baikal, in interstitial waters of beaches and in waters of the coastal zone near the settlements. These processes are accompanied by a year-round injection into the tributaries, and – further – into the coastal zone of the lake of inadequately treated wastewater with very high concentrations of nutrients. For example, phosphate (P) concentrations in wastewaters often reach shocking values of 20–23 mg/L (from the cities of Severobaikalsk, Babushkin, Slyudyanka) (Kravtsova et al., 2014; Timoshkin et al., 2016; supported by RF Pr. No 0345-2019-0009).

Recently the Ministry of Natural Resources and Ecology of Russian Federation proposed amending effluent regulations for Lake Baikal (https://regulation.gov.ru/projects#npa=8810) which, if accepted, will allow companies, hotels and other organizations, located around the coasts, to significantly increase the total load of sewage and the concentration of nutrients and different pollutants in the sewage. The proposed regulation provides for the possibility of a significant increase in the concentration of many chemicals (from 2 to 25 times or more! — including nutrients, petroleum products, synthetic components of detergents, etc.) in the wastewater discharged into the coastal zone of this unique lake. The report of the Baikal Institute for Nature Management of the Siberian Branch of the Russian Academy of Sciences (Ulan-Ude), which has been repeatedly criticized by leading environmental scientists and Baikal researchers, has been used as the "scientific basis" for the changes proposed by the Ministry of Natural Resources. In the explanatory note accompanying the proposed regulations, the Ministry of Natural Resources states that this report allegedly provides "… a scientific substantiation of the standards for maximum permissible impacts on the unique ecological system of the Lake Baikal and methods for their determination". However, multiple recent studies in international journals have already documented degradation of the coastal zone even under current regulation. In our opinion, allowing substantial increases to permissible discharge rates (for example, concentrations of phosphates and nitrates) will lead to irreversible consequences in the ecology of the coastal zone and a sharp deterioration in the water quality of Lake Baikal.

We question the methodological basis of the so-called "Norms of permissible impact", at least in relation to Baikal, and find it detrimental and unacceptable. The uniqueness of the lake ecosystem does not allow the development of any "norms of permissible impacts" as there is only one Lake Baikal. It is obvious that any such "norms" a priori cannot have any real scientific substantiation, and, in fact, are an attempt to legitimize the gradual poisoning of the world's oldest, largest and most diverse freshwater lake. The only rational decision in relation to Lake Baikal is to develop scientific recommendations for 1) termination of the discharge of any direct effluent (without treatment) into the lake; 2) elimination of usage of P-containing detergents in the drainage area of Lake Baikal, 3) building adequate septic tanks in coastal settlements, 4) increasing the number of tankers that collect bilge and waste water from cruise ships, isolated communities and industries on the lake, 5) exporting Russian Railways effluent from Severobaikalsk to outside the lake's ecological zone, among other urgent measures that would be protective of the lake and its biota.

We urge the Government of the Russian Federation, with the help of scientists, to develop such an appropriate program of action of reducing pollutant loadings and to put this approach into practice in order to keep the lake at least in its present condition. This will be a unique

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and positive example of a far-sighted environmental approach to nature conservation for the world. It is known, that in most developed countries, as populations and industry developed, people first ruined their lakes, and only then tried to restore their ecosystems at great cost. The global community should not allow the same fate for Lake Baikal.

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