



Integral assessment of good ecological state of water objects

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The analysis of modern approaches to the evaluation of ecological state (ES) is considered from the point of view of biological integrity and assessment of ES. Efforts to assess the biological integrity of water objects (WO) should be based on a wide range of indicators and various methods for monitoring, analysis, synthesis and summing up. Evaluation of ES can be performed on the basis of biocentrism in the study of WO or anthropocentric approach that takes into account the planning of WO use for various purposes with special attention to conservation of environment and resource reproduction. Such approach determines the choice of criteria and evaluation priorities. Each approach is based on axiology and axiometry of ES. The axiology formulates ideas on ecosystem health and its ecological status, the axiometry - on scales for measurement of ES. These scales were developed with considering of each component evaluation and indicator approach and can use incomplete, inaccurate, non-numerical assessments data. Examples of representative criteria, scale types and their characteristics were given. The ES is an example of system emergent property that combines its ability to produce organic substances in accordance with the natural history of WO, to maintain high quality of the habitat and biota, high biodiversity, resistance to changes of natural conditions and anthropogenic impacts. During assessment of ES the history of impacts on the system should be taken into account; rates, scales and risks of the impact; ability of the system to natural purification and maintaining of good status.

This research is focused on the development of models for quantitative integral assessment of WO state, their systemic (integrative) properties that are characterized by the emergence of new functional units (integral indicators of different groups and levels, summarizing indicators) that reflect the system integrity, serve as the base for taxonomy, and allow to compare the state of systems in space and time or to detect effects of interrelation and interaction.

Integral assessment is a methodological base of this research and assumes the implementation of assessment with some uncertainty, taking into consideration different phases of the unification of heterogeneous (multicriterial) preliminary assessments with evaluation of their significance for overall assessment. This may take into account the significance of various indicators and their input to consolidated value.

The development of integral indicators of ES is discussed in relation to inland WO of North-Western Russia (a small lake in Ladoga area), hypothetical examples of river drainage areas, and small rivers in the North-Western Russia. The ES of the "river-drainage area" system is based on results of ES of river itself and its drainage area, as well as on summarizing of estimates. Axiology and axiometry, models of integral assessment of ES and integral evaluation results for hypothetical areas reflecting the characteristics of river-drainage area systems, as well as examples of integral evaluation of ES of real important systems are also presented.