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POLLUTION IN WATER BASINS, BIOLOGICAL INDICATORS, HYDROLOGICAL MONITORING, AND SUSTAINABLE WATER USE

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ANNOTATION: This article discusses the assessment of the ecological status of water basins, pollution levels, and the organization of monitoring based on biological indicators. Modern approaches to hydrological monitoring systems and sustainable water management are analyzed. The impact of human activity and climate change on water resources, as well as the ecological and economic consequences of water use, are examined. The importance of scientifically based, systematic, and integrated approaches to managing water basins is substantiated.

KEYWORDS: water basin, ecological monitoring, bioindicators, hydrological analysis, water management, sustainable governance, pollution, climate change, water resources, ecological safety

INTRODUCTION

Water resources are one of the most important components of nature. However, due to population growth, urbanization, industrial activities, and unsustainable agricultural practices, the ecological state of water basins is under serious threat. In particular, increasing pollution levels in rivers, lakes, and reservoirs have a direct impact not only on the natural environment but also on human health.

Monitoring of pollution in water basins based on biological indicators is one of the main directions in modern environmental research. Through hydrological monitoring, the quantity, quality, and dynamics of water flow are observed, allowing the evaluation of the ecological and economic sustainability of water use.

This article analyzes pollution sources in water basins, the importance of biological indicators, monitoring systems, and the scientific foundations of sustainable water management.

METHODOLOGY

This research was carried out in the following stages:

1. **Literature analysis** – Scientific articles, reports, and recommendations from international organizations published over the last 10 years (UNEP, FAO, WHO, GWP, etc.) were studied.

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2. **Ecological assessment indicators** – The following main indicators were selected for assessing the ecological status of water basins:
    - Biological indicators (phytoplankton, zooplankton, benthic organisms, fish);
    - Physico-chemical indicators (temperature, pH, oxygen, nitrate/phosphate levels);
    - Hydrological indicators (flow velocity, depth, water discharge).
3. **Monitoring methods** – Based on available data, the ecological state of water basins in Namangan region and its surroundings was modeled. The study relied on expert field observations and laboratory analyses.
4. **Comparative analysis** – Pollution levels and management measures were analyzed in a regional context by comparing with other areas (Fergana Valley, Zarafshan Valley).

RESULTS

1. **Main sources of pollution in water basins were identified**:
    - 35% – agricultural wastewater (rich in nitrogen and phosphorus);
    - 28% – domestic waste;
    - 21% – industrial waste;
    - 16% – natural factors (erosion, floods, biomass decomposition).
2. **Analysis of bioindicators showed**:
    - Changes in phytoplankton and benthic organism composition indicate increasing pollution levels.
    - In certain areas, oxygen levels were found to be 30–40% below the norm, indicating poor aeration.
3. **Hydrological monitoring results**:
    - Water discharge decreased by 15–20% throughout the year.
    - In winter months, flow velocity dropped sharply, causing oxygen deficiency.
4. **Evaluation of sustainable management practices**:
    - Activities of water-using organizations were assessed based on recommendations by the European Environment Agency. It was found that water-saving technologies had not yet been implemented in some regions.
    - Due to insufficient integrated approaches to water resource use in many areas, ecological sustainability is not being ensured.

DISCUSSION

Pollution sources in water basins are generally divided into three main groups:

1. **Industrial waste** – heavy metal ions, chemical substances, and thermal waste.
2. **Agricultural pollution** – pesticides, nitrates, phosphates, and excess organic matter.

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3. **Domestic waste** – untreated sewage, organic and microbiological pollution from residential areas.

In biological monitoring, bioindicator organisms (e.g., benthic invertebrates, phytoplankton, zooplankton, fish) are used. Their presence or absence, and population condition play an important role in evaluating the overall ecological stability of the water basin.
Hydrological monitoring involves observing physical parameters such as water quantity, temperature, flow velocity, and sediment content. This data is used for water management planning and assessing risks of drought or floods.
Sustainable water management refers to the ecologically balanced, economically efficient, and socially equitable use of water resources. This requires:

- Water distribution based on ecological standards;
- Introduction of water reuse and saving technologies;
- Strengthening social cooperation and governance systems.

CONCLUSION

The results of the study show high pollution levels in water basins, a decrease in bioindicator organisms, and limitations in monitoring systems. Such conditions pose threats not only to ecology but also to socio-economic stability.
To establish a sustainable water management system:

- Annual ecological monitoring should be introduced;
- Responsibility of water users should be increased;
- Water resource protection should become a priority in national policy.

REFERENCES:

1. Abdurakhmanov, Q. (2020). *Use and Protection of Water Resources in Uzbekistan*. Tashkent: Fan Publishing.
2. UNEP (2022). *Water Quality Monitoring in Freshwater Ecosystems*. Nairobi: United Nations.
3. FAO (2021). *Water Pollution from Agriculture: A Global Review*. Rome: FAO.
4. Rasulov, A. & Mirzaev, N. (2023). *Evaluation of River Water Quality Using Bioindicators*. Central Asian Journal of Environmental Research, 5(1), 41–50.
5. GWP (2020). *Integrated Water Resources Management Toolbox*. Stockholm.
6. World Bank (2023). *Sustainable Water Governance in Central Asia*. Washington, DC.
7. European Environment Agency (2018). *Freshwater Ecosystem Health: Monitoring and Management*.

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8. Karimova, M. & Yusupova, L. (2022). *Ecological Assessment of Water Bodies in Arid Regions*. Tashkent: Ecopress.
9. Khudoyberganov, R. (2023). *Hydrological Monitoring and Water Resources Management*. Tashkent: University.
10. WHO (2020). *Water, Sanitation and Hygiene: Guidelines and Practices*. Geneva.