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ECOLOGY OF WATER TYPES IN THE MIRZACHUL REGION (PONTASTACUS LEPTODACTYLUS (ESCHSCHSCHOLTZ, 1823): HABITATS AND INDICATOR CHARACTERISTICS IN THE STUDY OF WATER TYPES

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Abstract
The ecology of Pontastacus leptodactylus (Eschschscholtz, 1823) in the water bodies of the Mirzachul region is considered. This species is widespread in the region's freshwater ecosystems and plays an important role as a bioindicator of the state of aquatic ecosystems. The study focuses on the analysis of the habitat of Pontastacus leptodactylus, including the physicochemical parameters of water, such as temperature, oxygen level, transparency, mineralization, and the dynamics of flow velocity and depth. The primary focus is on how this species responds to changes in these parameters and its sensitivity to anthropogenic factors, which allows it to be used as an indicator of water quality. The role of Pontastacus leptodactylus in assessing the ecological state of water bodies is analyzed, and recommendations are proposed for using this species for monitoring water resources in the Mirzachul region.

Keywords Biota, indicator characteristics, assessment of water bodies, water quality, bioindicators, ecological monitoring, hydrobiology, species advantages, anthropogenic impact, resistance to environmental conditions, water parameters (temperature, pH, dissolved oxygen), benthic organisms, zoogeography, species diversity, hydrochemical indicators.

INTRODUCTION

The study of the ecology of river crab in the Mirzachul region (Pontastacus leptodactylus (Eschschscholtz, 1823) is of particular importance for understanding the state of aquatic ecosystems in this region. This species, Pontastacus leptodactylus, plays an important role in the food chains of freshwater systems, which affects the structure of communities and the distribution of organisms in water bodies. Pontastacus leptodactylus is sensitive to changes in water quality and environmental conditions, making it an important bioindicator for assessing the condition of water bodies and identifying environmental problems. Understanding the ecological advantages and requirements of this species allows for the acquisition of information for managing the state of aquatic ecosystems, identifying threats to populations, and developing measures to protect them.[6,14]

A review of existing studies shows that ecological studies of Pontastacus leptodactylus indicate that this species is widespread in Eurasia, preferring

clean and slightly saline water bodies with sandy or clay soils. The literature describes the characteristics of its life cycle, including water temperature, oxygen content, and requirements for mineral composition, highlighting its sensitivity to water quality. As a bioindicator, P. leptodactylus is used in a number of studies to assess the ecological state of water bodies: its presence and the state of populations often indicate the stability and health of the aquatic environment. A number of researchers are also considering its sensitivity to pollution by organic matter, heavy metals, and temperature fluctuations, which allows it to be used for environmental monitoring.[5,6,9,10]. Environmental factors The population of Pontastacus leptodactylus is affected by a variety of environmental factors, including:

- water temperature: the optimal temperature values for this species are in the range of 18-24°C, and increasing the temperature can cause stress and reduce activity.

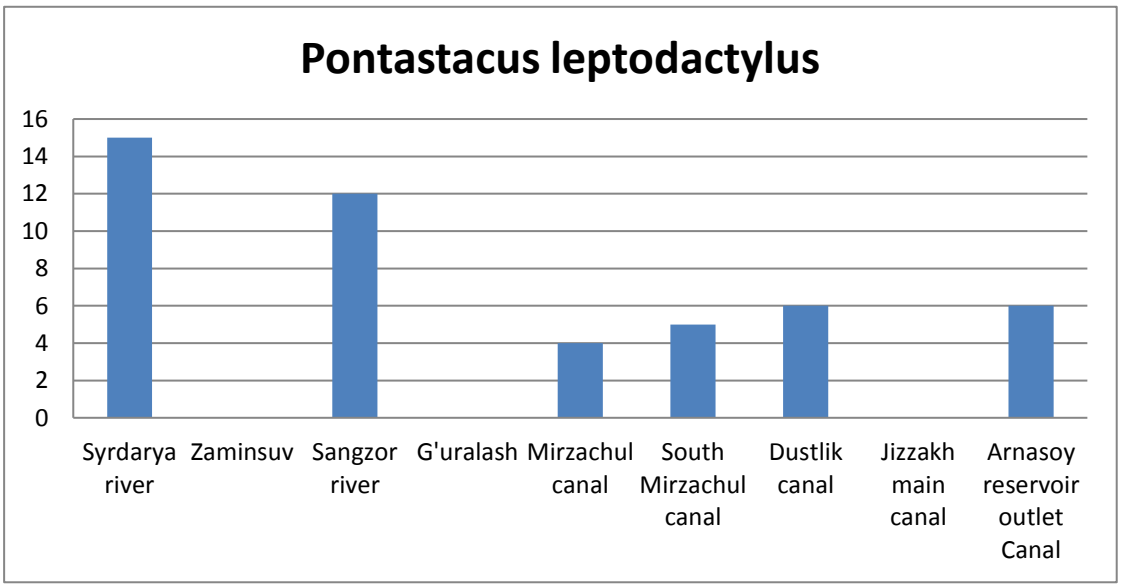
- pH of water: this cancer prefers a neutral or slightly hydroxide environment with a pH of 6.5 to 8.5, as changes in pH can affect metabolism and integument permeability.

- Oxygen content: A high concentration of dissolved oxygen (at least 6 mg/l) is necessary to maintain normal physiological activity and growth, and a lack of oxygen can lead to a decrease in population numbers.

- Mineral composition: water mineralization plays an important role in metabolic processes and the health of this species; The values from 200 to 800 mg/L are considered acceptable. These factors determine the habitability of ponds for Pontastacus leptodactylus and allow for an assessment of the state of the environment.[4]

The purpose of this study is to investigate rivers in the Mirzachul region. Syrdarya, Zominsuv, Sangzor and Guralash canals; The study of the habitat and indicator characteristics of Pontastacus leptodactylus in the Mirzachul, South Mirzachul, Dustlik, Jizzakh main, and Arnasay reservoir outlet channels [Fig. 1]. This study aims to assess the condition of water bodies using this species as a bioindicator. Identifying factors influencing its population allows for a better understanding of the ecological state of local aquatic ecosystems, developing recommendations for their protection and sustainability conservation.[3,12]

Figure 1. The distribution of hydrobionts in populations of rivers and canals in the Mirzachul region (n= 10, m^2/piece)



Description of the research area of materials and methods: The characteristics of water bodies in the Mirzachul region and their main ecological parameters: the Mirzachul region, the Mirzachul plain, is located between the Kyzylkum desert and the Syr Darya. The northern edge of this region, adjacent to the wide plains, corresponds to the border of Kazakhstan, while the southern border runs along the administrative border of Tajikistan and Uzbekistan. To the south of the Mirzachul region lies the Turkestan mountain range, the Mountains of Malguzar and Nurata, and the Sangzar Valley. The Mirzachul Plain, Turkestan, the northern slopes of the Malguzar and Nurata Mountains, and the Sangzar Valley are part of the Mirzachul Natural and Geographical Region.[3] Administratively, the Mirzachul region corresponds to the Syr Darya and Jizzakh regions. The northern part of the Mirzachul plain is 231 meters above sea level, the central part is 400-450 meters above sea level, and the Syr Darya coast is 240-250 meters above sea level. The highest elevations of the Turkestan mountain range are 4000 meters above sea level. Depending on the fauna and natural regions of the Mirzachul natural and geographical region, it changes from plains to mountains, is characterized by a continental climate with hot and dry summers and moderately cold winters. The area's water bodies include slow-flowing rivers and canals, as well as artificial water bodies. These water bodies serve as the primary habitat for Pontastacus leptodactylus, whose species adapt to various abiotic conditions. The main ecological parameters of water bodies in the Mirzachul region include:

- water temperature: varies depending on the season and time of day, usually in the range of 10-30 °c.

-pH level: from slightly acidic to slightly alkaline, in the range of 6.5-8.5.

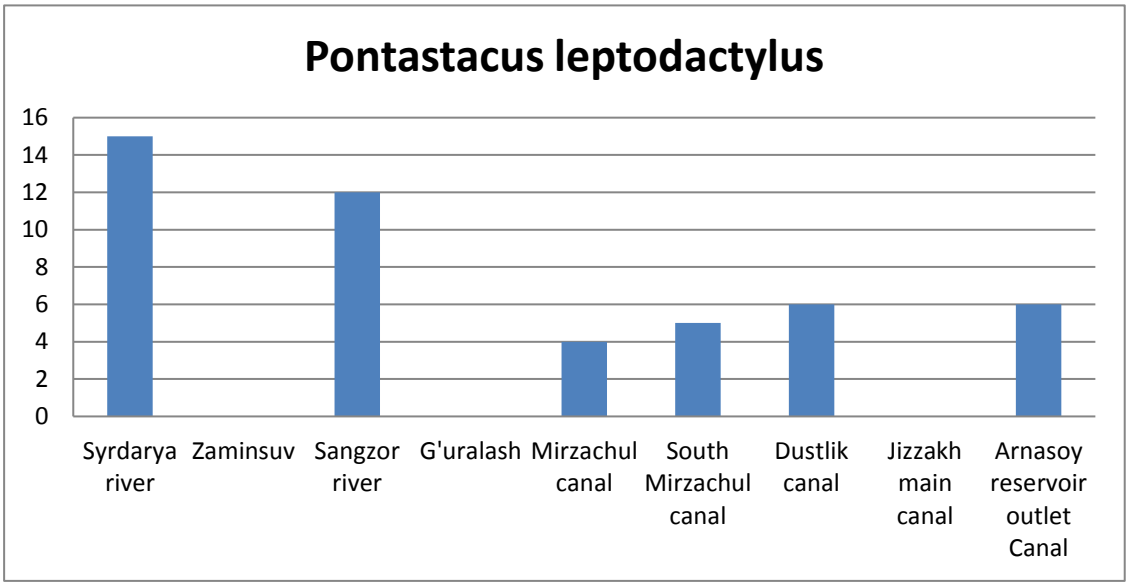
- Dissolved oxygen content: the indicators typically range from 5 to 12 mg/L, depending on the water activity and the level of vegetation cover.

- Water mineralization: the degree of mineralization can vary from 200 to 1000 mg/l, reflecting the diversity of the chemical composition of water bodies.

- Water transparency: varies from 0.5 to 2 meters depending on the degree of suspended particles. These parameters vary depending on the season and local pollution sources, including the agrarian impact that can affect the hydrobiota, including the Pontastacus leptodactylus population.

Sampling and material processing methods for identifying populations of Pontastacus leptodactylus Sampling was performed manually and using a trap set in areas with a high probability of their survival. The sampling frequency to account for seasonal changes is monthly. The traps were left for 24 hours, after which they were removed and the samples were recalculated.[8,14, 15]. The collected samples were placed in containers that preserve environmental conditions to minimize stress factors (Fig. 2). Each sample of Pontastacus leptodactylus was measured and weighed to determine the biomass. The samples were stored in ethanol solution, if necessary, for further morphological and genetic research. Methods of measuring abiotic factors The following methods of measurement were used to assess environmental conditions:

Figure 1. The distribution of hydrobionts in populations of rivers and canals in the Mirzachul region (n= 10, m^2/piece)



- the water temperature was measured using a digital thermometer at a distance of 1 meter from the water surface.

- the pH of the water was determined using a calibrated portable pH meter before the measurements began.

- The amount of dissolved oxygen was measured using an oximeter, which allows for accurate values at the sampling site.

Water mineralization was determined using a conductor that measured water conductivity and converted to salt concentration values.

The transparency of the water was measured using a Sequoia disc, lowered to different depths until visibility was completely lost, which gave an indication of the degree of suspended particles in the water. Correlation and regression analysis methods were used to analyze the abundance of Pontastacus leptodactylus and their correlation with environmental parameters. The main stages of the analysis were as follows:

The Shannon Index and Simpson's Index were used to assess biodiversity through population indicators for data analysis, allowing for an assessment of species diversity and the uniformity of species distribution.[11]

The ecology of Pontastacus leptodactylus in various aquatic species of the Mirzachul region is an interesting area of research, as this species is an indicator, meaning its abundance and physiological parameters can reflect the state of the aquatic ecosystem. Features of habitats Pontastacus leptodactylus inhabits rivers, lakes, and artificial water bodies (such as canals and water bodies) in various water types in the Mirzachul area. These water bodies differ in a number of parameters, such as oxygen content, mineral composition, temperature, pH level, transparency, and anthropogenic load level.

Rivers: water Pontastacus leptodactylus, which is often high in oxygen and high in water exchange, exhibits more stable numbers. Optimal conditions include a temperature from 15 to 25°C and a dissolved oxygen level from 6 to 12 mg/l. The transparency and steady flow of water also contribute to a good oxygen regime and stable mineral composition[1,12].

Lakes: In stable water bodies such as lakes, the oxygen content may be low, especially during hot seasons, due to reduced water circulation. Pontastacus leptodactylus may exhibit decreased numbers and low activity due to increased

mineralization and reduced oxygen concentration under such conditions. However, if the water in the lake is often refreshed, the species can maintain their numbers at a normal level[9,14].

Artificial water bodies (channels and water bodies): These water bodies are often strongly influenced by humans, such as the flow of wastewater, resulting in a change in the chemical composition of the water. High levels of pollutants and consequent decreased transparency may worsen conditions for Pontastacus leptodactylus, which is reflected in decreasing numbers. The relationship between Pontastacus leptodactylus and abiotic factors of water bodies The abundance of Pontastacus leptodactylus in the Mirzachul area is largely due to several main abiotic factors: water temperature: the optimal water temperature is 18-24°C. At temperatures above 25°C or below 10°C, their number is decreasing, as such conditions negatively affect human metabolism and activity levels. Dissolved oxygen: The shrimp requires an oxygen concentration in the range of 6-12 mg/l. A decrease in oxygen level (less than 6 mg/L) leads to a decrease in numbers, as the shrimp is stressed and may move to more favorable locations.

Mineralization: this species prefers moderate water mineralization (200-800 mg/L). Excessive mineralization, especially with high water hardness, reduces their number, as cancer is less active and can reproduce less frequently.

pH: The optimal pH range for Pontastacus leptodactylus is 6.5-8.5. Outside this range, for example, under acidic conditions (less than 6.5), their number can be significantly reduced due to altered water composition and the possibility of toxic compounds.

According to the flow rate indicators; -0.05-0.015 m/s.

The characteristics of Pontastacus leptodactylus can serve as an indicator of the ecological state of Pontastacus leptodactylus water bodies, depending on environmental conditions. The abundance of this species and changes in its physiological state allow us to draw conclusions about the state of water, its chemical composition, and the degree of anthropogenic impact. For example: in water bodies.

DISCUSSION

The discussion on the ecology of Pontastacus leptodactylus (Eschschscholtz, 1823) in the water bodies of the Mirzachul region: interpretation of the obtained data on the abundance and indicator characteristics of Pontastacus leptodactylus in the study of water bodies during research on Pontastacus leptodactylus or river shrimp, it was noted that its abundance and population density in the water bodies of the Mirzachul region are directly related to the ecological conditions of the water bodies. Key parameters such as water transparency, mineralization level, dissolved oxygen content, temperature, pH, and depth have a significant impact on the distribution and population of this species. Pontastacus leptodactylus prefers an environment with moderate oxygen content (6-12 mg/L) and mineralization (200-800 mg/L), which is also confirmed by field observations. These data indicate a high sensitivity of Pontastacus leptodactylus to changes in water quality. The river crab acts as a type of indicator that is sensitive to changes in environmental parameters. For example, with an increase in water pollutants, especially nitrogen and phosphates, the population's number and activity decrease, making Pontastacus leptodactylus a useful biological indicator of the water body's degree of pollution. The use of crustaceans in monitoring is associated with their slow movement and relatively long life cycle, which allows for more reliable and long-term data on changes in water bodies. As in other studies, Pontastacus leptodactylus in Mirzachul has proven its role in assessing the ecological state of water bodies and can be used for sanitation control.

CONCLUSION

Conclusion on the ecology of Pontastacus leptodactylus in water species in the Mirzachul region (Eschschscholtz, 1823): the study of the habitat and indicator characteristics of water bodies in the Mirzachul region. The study of Pontastacus leptodactylus in the Mirzachul region showed that this species of crustaceans is an important indicator of the state of water bodies in

the region. The main conclusions are as follows:

1.Pontastacus leptodactylus prefers freshwater basins with sufficient oxygen and moderate mineralization. The species is sensitive to changes in parameters such as dissolved oxygen, water temperature, and its transparency, making it an important indicator of the ecological state of water bodies.

2. Sensitivity to environmental change: Pontastacus leptodactylus exhibits high sensitivity to anthropogenic changes such as pollution and changes in water chemistry. This species prefers clean water, and with an increase in pollutants, their number decreases, especially when the permissible level of mineralization and concentration of dissolved oxygen are exceeded.

3. Features of the indicator: Pontastacus leptodactylus can serve as a bioindicator for assessing water quality, as its condition and abundance reflect the degree of water pollution. Specifically, the presence of a stable population of Pontastacus leptodactylus indicates favorable conditions for other members of the hydrobiota, while a sharp decline or absence of humans may indicate a negative environmental impact.

The results showed that the crab is an ecological valence-bearing organism only in the Syr Darya and Sangzar rivers. In channels; Mineralization of water from abiotic factors led to a decrease in the number of species in the Mirzachul, Southern Mirzachul, Dustlik, and Arnasay reservoir outlet channels.

Recommendations for the use of Pontastacus leptodactylus as an indicator of the state of water bodies in the Mirzachul region. Water quality monitoring: the use of Pontastacus leptodactylus in monitoring programs can improve the accuracy of assessing the condition of water bodies. Regular monitoring of the crab population and analysis of its population reveal the first signs of deterioration of conditions in the water bodies. Role in biodiversity assessment systems:

Pontastacus leptodactylus can be included in the biodiversity system as a key indicator characterizing the overall state of the ecosystem. The abundance and distribution of this species may reflect the balance of the ecosystem and the presence of negative factors. Comparison with other indicator species: The combined use of Pontastacus leptodactylus and other indicator species, such as mollusks and fish, may be more useful.

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