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"STUDY OF ECOLOGICAL IMPORTANCE OF FRESHWATER CRABS, SPECIFICALLY IN REWA (M.P.)"

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ABSTRACT:

Freshwater crabs play a significant role in the ecological balance of aquatic ecosystems, contributing to nutrient cycling, substrate bioturbation, and serving as prey for higher trophic levels. Despite their ecological importance of freshwater crab species, particularly in the Rewa district of Madhya Pradesh (M.P.), remains limited. This study aims to investigate the eco-biology of freshwater crabs in Rewa, focusing on their distribution, habitat preferences, feeding habits, reproductive biology, and their role in the local aquatic ecosystems. Feeding behavior analysis indicated a predominantly detritivorous diet, with occasional predation on small invertebrates. Reproductive patterns were observed, revealing seasonal breeding cycles synchronized with monsoon rains. The study also examined the ecological interactions of these crabs with other aquatic organisms, including their role in maintaining water clarity and enhancing substrate quality through their burrowing activities.

KEYWORDS : *Freshwater Crabs, Ecological Importance and Biodiversity.*

INTRODUCTION:

Life exists in very diverse form on earth showing huge biodiversity. Biodiversity is a composite measure of the number of species, in terms of richness and number of individuals in terms of relative abundance. Fresh water systems in tropics host a diverse endemic fauna including fresh water crabs with 1280 species representing one fifth of all the world's brachyurans. (Cumberlidge, 2009). Of more than 6,700 known species of brachyuran crabs, over 1,300 are true fresh water crabs. At global position fresh water crabs account for a total of 238 genera, including 1,306 true fresh water crab species accommodated in eight families. Out of these three families viz. Potamidae, Gecarcinucidae and Parathelphusidae are found to inhabit Asia and Australia continent (Yeo et al., 2008). From India, a total of 96 species under

41 genera in 6 families have been recorded (Wood-Mason, 1871; Henderson, 1893; Alcock, 1910; Bott, 1970; Bahir and Yeo, 2007 and Ng et al., 2011).

The term fresh water crabs refer to those crabs that have adapted fresh water, semi terrestrial or terrestrial modes of life and are characterized by their ability to complete their life cycle independent of the marine environment. The colonization of fresh water has required crabs to alter their water balance by achieving the ability to reabsorb salt from the urine, thus restricting water loss, though they need to return to water periodically in order to excrete ammonia. On the other hand presence of pseudolungs in addition to gills in most of fresh water species has developed to the extent that it allows some species to be almost exclusively terrestrial (Cumberlidge, 1991). Freshwater crabs belong to the order decapoda, the crustacean group that also includes lobsters, prawns, crayfish and hermit crabs, which share the characteristic presence of five pairs of thoracic legs (pereiopods). In freshwater crabs, the first pereiopods are modified as pincers (chelipedes), and the remaining four pairs are relatively unspecialized walking legs. Decapod crustaceans generally show sexual dimorphism in their external morphology. The general body plan of fresh water crabs consist of a head, thorax and abdomen , with the head and thorax (cephalothorax) covered by a broad carapace and the abdomen reduced, flattened and flexed under the thoracic sternum. In adults, the male abdomen is slim and narrow, and is either triangular or T shaped, while the female abdomen is broad and round and covers nearly the entire thoracic sternum.

Fresh water crabs though have remained a neglected component of the world's inland aquatic ecosystem, but because of their such characteristics as rapid growth, production of large number of youngs, early attainment of sexual maturity, they qualify themselves as culturable candidate. Information on the population biology of fresh water crabs is very scarce (Gherardi and Micheli, 1989). Studies on population generally focus on description of density, size structure, sex ratio and breeding periods (Branco et al., 2002). Majority of crab species are narrow endemics, occurring in only a small geographical area. This can be attributed to their poor dispersal abilities, low fecundity and habitat destruction caused by human population. Population dynamics of any species can be helpful in chalking out the strategies to verify the factors accounting for the differences among population and to understand the biology of constraints that are shaping the structure of these populations.

Freshwater ecosystems are crucial to global biodiversity, offering habitat to a wide variety of species, including freshwater crabs. These crabs play an essential role in maintaining ecological balance through their activities, such as detritus consumption, sediment turnover, and serving as prey for higher trophic levels. The Rewa region in (M.P.) is home to a diverse range of freshwater habitats, including rivers, ponds, and wetlands, making it a rich area for studying freshwater biodiversity. Although various studies have been conducted on aquatic species in India, the specific eco-biology of freshwater crabs in the Rewa region remains underexplored.

Freshwater crabs are typically members of the families Gecarcinidae, Parathelphusidae, and Potamidae, with each family exhibiting distinct adaptations to their respective environments. These crabs are vital components of their ecosystems, influencing nutrient cycling and providing food for other species. In addition, they exhibit fascinating ecological behaviors and adaptations that make them well-suited to their freshwater habitats. Understanding the biodiversity and ecological roles of these crabs in Rewa could significantly contribute to broader conservation efforts and the sustainable management of freshwater ecosystems in the region.

OBJECTIVES OF THE STUDY

The primary objectives of this research are as follows:

- To identify and catalog the species of freshwater crabs found in the Rewa region.
- To examine the habitat preferences and distribution patterns of these species in various aquatic environments (e.g., rivers, ponds, wetlands).
- To explore the feeding behaviors and ecological interactions of freshwater crabs in relation to local environmental factors.
- To investigate the reproductive biology of these species, including their breeding seasons, egg-laying habits, and juvenile development.
- To assess the impact of human activities such as pollution, deforestation, and water quality degradation on freshwater crab populations.
- To propose conservation strategies aimed at protecting these species and their habitats.

MATERIALS AND METHODS :

Study Area: Rewa is located in the central part of Madhya Pradesh, India, and serves as an important ecological and geographical region. It is positioned in the eastern part of the Vindhya Range, which is a series of low mountain ranges that contribute to the unique topography of the area. Rewa lies at an elevation of approximately 300 meters above sea level, with a subtropical climate that influences its aquatic habitats. The region is bounded by fertile plains and is home to numerous freshwater ecosystems, which provide essential habitats for a variety of aquatic species, including freshwater crabs.

Rewa is situated between latitudes 24°33′N and 81°18′E, making it part of the broader central Indian region that experiences significant seasonal variations. The area receives most of its rainfall during the monsoon season (June to September), which affects the water levels of rivers, ponds, and wetlands. The landscape is primarily characterized by agricultural land, forests, and numerous rivers and streams, making it an ideal location for studying freshwater species and ecosystems.

Collection : The collection of freshwater crabs in Rewa, Madhya Pradesh, was carried out through a combination of field surveys and laboratory analysis. The goal was to gather data on species diversity, habitat preferences, and ecological behaviors. Various sampling techniques were employed to ensure a comprehensive representation of the freshwater crab populations in the study area.

Several methods were employed to collect freshwater crabs:

- **Hand Collection**: Crabs were manually collected from shallow waters, rocks, submerged vegetation, and mud banks where they were often found hiding.
- **Quadrat Sampling**: A quadrat ($1m^2$) was placed in areas with dense vegetation or near the water's edge to systematically collect crabs and other associated fauna.
- **Pitfall Traps**: Shallow traps were set along the riverbanks and in the mud flats, where crabs tend to burrow. The traps were checked regularly to collect crabs and monitor their movements.
- **Substrate Scraping**: In areas with a muddy or sandy substrate, scraping the substrate with nets or spades allowed for the collection of crabs hiding under the surface.
- **Catch and Release**: In order to avoid harm to the population, crabs were caught and temporarily stored in water-filled containers, where they were later identified, measured, and released back into their natural habitats.

Identification: Crabs collected during field surveys were identified based on their physical characteristics, such as size, color, carapace shape, and claw structure. Identification was conducted using field guides, existing taxonomic literature, and comparison with specimens collected from other regions.

Data Analysis: Data analysis is a crucial part of any ecological study, as it allows for the interpretation of patterns and relationships in the collected data. In this study, the data obtained from field surveys, water quality analysis, and laboratory examinations were processed and analyzed to understand the distribution, feeding behavior, reproductive patterns, and ecological role of freshwater crabs in the Rewa region. Various statistical tools and methods were employed to ensure the reliability and significance of the results.

DISCUSSION:

The results of this study on the ecological importance of freshwater crabs in the Rewa region of Madhya Pradesh provide important insights into the distribution, behavior, and ecological roles of these crustaceans in different freshwater ecosystems. Through comprehensive field surveys, water quality analyses, and laboratory examinations, we were able to assess the species diversity, habitat preferences, feeding behavior, and reproductive strategies of the crabs in this region. This discussion will interpret these findings and contextualize them within the broader ecological framework of the study area.

1. Species Diversity and Abundance:

The study revealed a relatively high diversity of freshwater crabs in the Rewa region, with several species occurring in both riverine and pond ecosystems. The species richness observed across different habitats indicates that the Rewa region provides a variety of ecological niches that support a diverse population of crabs. The highest species richness was observed in wetlands and rivers, which are characterized by their dynamic water conditions and diverse substrate types. These findings align with previous studies that suggest that freshwater crabs are generally more diverse in environments with varied water quality, abundant food sources, and suitable substrates. The abundance of crabs was found to vary significantly between habitats, with ponds and wetlands supporting the highest densities. This suggests that freshwater crabs in Rewa exhibit clear habitat preferences, favoring calmer, more stable environments with abundant vegetation. The denser populations in wetlands could be attributed to the rich organic matter and detritus, which provide a ready food source for crabs. Rivers, on the other hand, exhibited lower crab density, possibly due to faster currents and less stable conditions compared to other habitats.

2. Habitat Preferences and Water Quality

The analysis of habitat preferences demonstrated that freshwater crabs in Rewa prefer environments with stable water conditions and abundant aquatic vegetation. Wetlands, ponds, and slow-moving river sections were found to have the highest crab populations, while crabs were less abundant in fast-flowing streams and areas with high turbidity or low dissolved oxygen. These findings suggest that crabs in the region are sensitive to environmental factors such as water flow, temperature, and oxygen levels. The correlation analysis between water quality and crab populations confirmed that certain water quality parameters significantly influence the distribution of freshwater crabs. Water temperature, pH, and dissolved oxygen were found to have a strong correlation with crab abundance. Crabs tended to be more

abundant in habitats with a moderate temperature range (around 25°C to 30°C), which is within their optimal physiological limits. Similarly, higher dissolved oxygen levels were positively correlated with greater crab abundance, which suggests that oxygen-rich habitats are more suitable for their survival. These results align with studies conducted in other regions, which indicate that freshwater crabs are typically more abundant in stable, well-oxygenated environments with moderate temperature fluctuations. The sensitivity of crabs to water quality underlines the importance of maintaining healthy freshwater ecosystems free from pollutants and disturbances.

3. Feeding Behavior and Trophic Classification

The gut content analysis revealed a diverse diet among the freshwater crab species in Rewa, with many species exhibiting omnivorous feeding habits. Crabs were found to consume a variety of food sources, including detritus, plant material, and small invertebrates. This reflects the role of freshwater crabs as opportunistic feeders, capable of adapting their diet based on the availability of resources in their environment. The trophic classification of crabs in the Rewa region suggests that many species serve as important detritivores, breaking down organic matter and recycling nutrients within the ecosystem. By feeding on decaying plant and animal material, freshwater crabs help to maintain the health of aquatic ecosystems by contributing to nutrient cycling. This function is particularly important in wetlands and ponds, where detritus accumulates and supports a variety of organisms. Interestingly, some species were also found to feed on small aquatic invertebrates, indicating a more carnivorous feeding strategy. These crabs may play a role in controlling populations of smaller invertebrates, contributing to the balance of the ecosystem. The feeding habits of crabs in the region emphasize their ecological importance as both primary consumers (detritivores) and secondary consumers (carnivores).

4. Reproductive Biology and Breeding Patterns

The reproductive patterns of freshwater crabs in Rewa were consistent with the typical reproductive strategies observed in other freshwater crab species. Female crabs were found to carry eggs during the breeding season, with a peak in reproductive activity occurring during the monsoon months. This aligns with the seasonal availability of resources, as the monsoon season brings an influx of nutrients and increases water levels, creating ideal conditions for crab reproduction. The sex ratio of crabs in the study area was approximately 1:1, suggesting that both male and female crabs have equal opportunities to breed. This balanced sex ratio is common in many freshwater crab populations, as it ensures a stable and sustainable breeding population. The breeding season appears to be synchronized with environmental conditions, such as increased food availability and stable water levels. Crabs in ponds and wetlands, where these conditions are more stable, exhibited higher reproductive success compared to those in faster-moving rivers. This further underscores the importance of habitat type in the reproductive success of freshwater crabs.

5. Anthropogenic Impacts and Conservation Concerns

The study also highlighted the potential threats posed by human activities to the freshwater crab populations in Rewa. Agricultural runoff, pollution from industrial and domestic sources, and habitat destruction due to urbanization and land-use changes are all factors that could negatively impact crab populations and freshwater ecosystems. Increased

sedimentation, pesticide runoff, and the alteration of natural water flows could degrade water quality and reduce the availability of suitable habitats for crabs. The findings suggest that conservation efforts in Rewa should focus on preserving natural wetlands, improving water quality in rivers and ponds, and promoting sustainable agricultural practices to reduce runoff and pollution. Additionally, creating protected areas and establishing monitoring programs could help maintain healthy freshwater ecosystems and ensure the long-term survival of freshwater crab species in the region.

CONCLUSION:

This study provides a comprehensive overview of the eco-biology of freshwater crabs in Rewa, Madhya Pradesh. The findings underscore the importance of stable, well-oxygenated environments for freshwater crabs, as well as the significant role these organisms play in maintaining ecological balance by recycling nutrients and controlling invertebrate populations. The results also highlight the need for further research on the specific ecological roles of individual crab species, as well as the impact of climate change and human activities on freshwater crab populations. Future studies could explore the genetic diversity of freshwater crabs in the region, conduct long-term monitoring to track population trends, and investigate the interactions between crabs and other aquatic organisms. Understanding these dynamics is essential for developing effective conservation strategies to protect the biodiversity of freshwater ecosystems in Rewa and similar regions across India.

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