



Freshwater Prawns Diversity (Crustacea: Decapoda) in the River Koshi, Eastern Bihar

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The river Koshi is one of the major tributary of river Ganga, which originated from the northern slopes of the Himalayas and flows southwards through north Bihar with draining of the Ganga basin near Kursela, in District Katihar, eastern Bihar.

Objectives: Diversity and abundance of freshwater prawns were studied from January 2020 to December 2022 in the Koshi river of district Katihar eastern Bihar, India.

Methodology: The prawn was collected from the bank of Koshi river with the support of fishermen at Kursela in Katihar district, eastern Bihar and preserved in 5% formalin for further study.

Results: Koshi river is also known as Saptakoshi for its seven upper tributaries, that transports a large amount of nutrient and perhaps encourages species prosperity both culturally and individually. The efficiency of water is significant and therefore the freshwater prawns are divers. Prawn is a very important foodstuff in developing countries, due to high protein content and its other nutrition values. In present study we identified & reports commercially and physically important total four species of prawn belonging to *Macrobrachium* genus in the river Koshi around Kursela, in Katihar district eastern Bihar. They are namely *Macrobrachium gangeticum*, *M. gandaki*,

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M. tiwari and *M. lamarrei*. The composition of prawn species among which *M. lamarrei* and *M. tiwari* were dominant species throughout the year. Whereas the catch of *M. gangeticum* and *M. gandaki* were restricted during June to September.

Conclusion: The current investigation important to the presence of commercially important and environmentally sustainable inhabitants available in the river Koshi, Kursela Katihar, eastern Bihar. The suggests to needs appropriate management and conservation strategies to prevent the further loss of populations from this site. The details of data collected are in the flesh in this communication.

Keywords: Shrimp; taxonomy; *Macrobrachium* species; fishery; biology.

1. INTRODUCTION

The Koshi is one of the major perennial river in the peninsular India, originated from Nepal and flows southwards through north Bihar with draining of the Ganga basin near Bhagalpur, district Bihar. Its facts, river Koshi having unstable nature attributed to the heavy silt carried during the flood (monsoon) season and also transports a large amount of nutrient, perhaps encourages species prosperity both culturally and individually. Freshwater prawns play a crucial role in sustaining the food web by recycling nutrients and energy from decay matter as well as structuring and functioning of the ecosystem and also play an important role as scavengers [1,2]. Freshwater prawns are present in all biogeographically regions with the exception of Antarctica, however, the Oriental region reported as harbours and the majority of the prawn species [3,4]. As a matter of facts, large and medium sized freshwater prawns, form economically important group as most of them are harvested from the wild or culture for food as well as aquarium trade [5]. Overall diversity and abundance of freshwater prawns is rapidly declining or under risk category mainly due to competition on from invasive species, change in climate and commercial developmental projects [6,7], quality of water and anthropogenic pollution can be determined by presence of species and their abundance [8,9]. Whereas, [10] reported four species of freshwater prawns in the river Ganga up to Kanpur its availability year around during (1956). However, two major *Macrobrachium* species *M. gangeticum* and *M. malcolmsonii* was reported in limited months and there is significant reduction of the natural stock at middle stretch of the river Ganga documented by [6,11].

It facts, North Bihar is donated with number of perennial rivers with draining and ultimately part

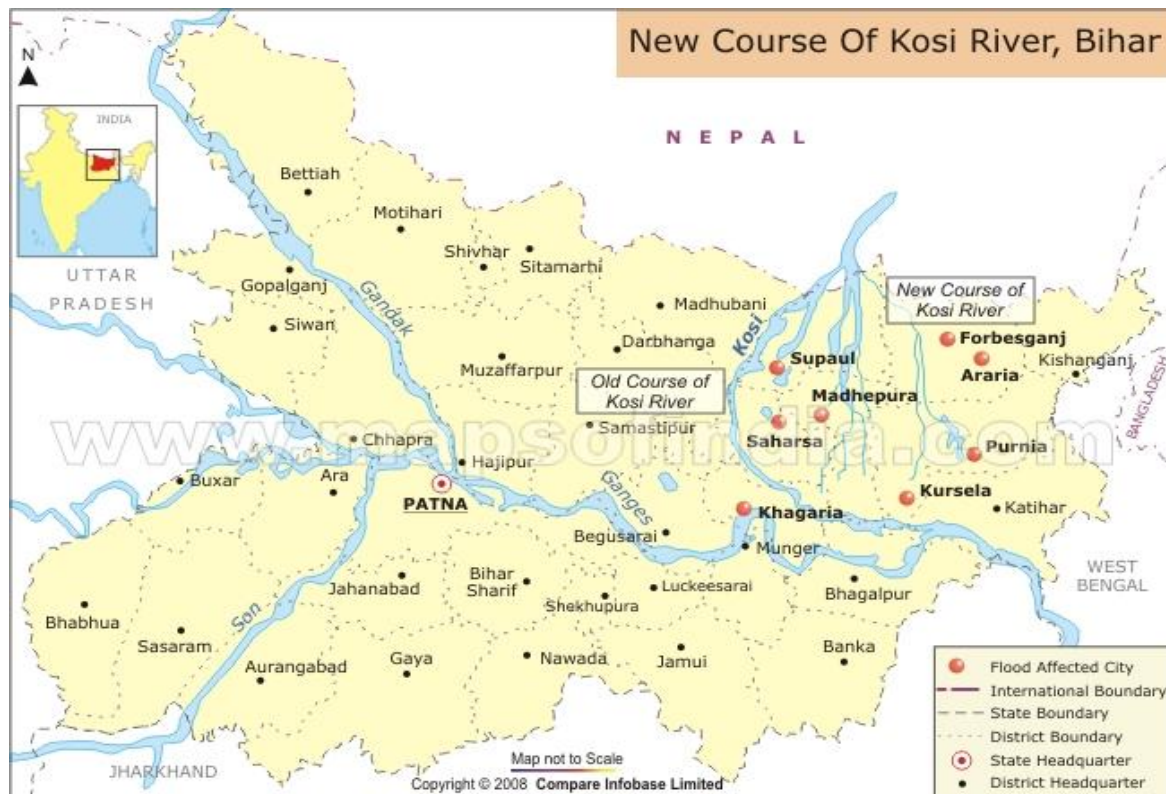
of Ganges river system. The Koshi river is one of them and also known as 'Sorrow of Bihar' that flow in north east region of Bihar as the annual floods effect of fertile agricultural lands thereby disturbing the rural economy and also abundant fishery resources. Since freshwater fauna especially prawn resources are at risk of being carried away from their respective habitats [12,13]. The size group, sex-ratio, arrangement, spreading, larval biology and incidence of freshwater prawn in the river Ganga has been studied with recorded by [14,15,16,17]. The information about Koshi river prawns data is not available, therefore, it is necessary to have a reliable data based on surveys and identification of prawns from this natural habitats.

Thus the aim of the present study is to document the diversity and abundance of *Macrobrachium* species in the lower stretch of the river Koshi near Kursela Katihar, south Bihar. These records are prerequisite for further biological studies related to hatchery seed production and cultural aspects.

2. MATERIALS AND METHODS

2.1 Study Area

The Koshi region is sedimentary zones appearances like fan and covering 180 km long and 150 km wide northeast Bihar and eastern Mithila to the Ganges,. It shows evidence of twelve major lateral channels shifting exceeding 120 km during the past 250 years: (www.mapsofindia.com). The rivers, which flowed near Purnea in the 18th century, presently it flows west of Saharsa, & South of Katihar district of eastern Bihar (Map 1). In the Koshi region, Kursela, Purnea. Araria, Forbesganj, Supaul, Madhepura and Khagaria are the main flood affected cities in North Bihar.



Map 1. Showing alluvial flood affected areas of Koshi river (Source: www.mapsofindia.com)

2.2 Step for the Collection of the Species

In the present study freshwater prawns specimen were collected from the Koshi river of near between the road Bridge and the Rly Bridge on Koshi river at Kursela in Katihar district, eastern Bihar. They were collected from the bank with the support of fishermen. The each species of prawn individual was preserved in 5 percent neutralized formalin for further identification. Further studies on the biology, classification and allied aspects of the collected prawn specimens as live and preserved were brought at Shellfishes Biodiversity Lab, at Bhola Paswan Shastri Agricultural College (BAU, Sabour), in Purnea, district Bihar, India.

2.3 Identification and Measurement

The species was identified in consultation with related literature previously published by [13,18, 19,20,21]. The total length of individual specimen of all the group were recorded from the tip of the rostrum to the tip of the telson, tip of the second pair of chelate leges to tip of the telson were recorded to nearest millimetre. The appendix

masculine was clearly visible only in the male specimens of 50 mm size and above which formed the base of identification of sex in the commercial catches. The measurements of these species were compared with the others *Macrobrachium species*. Morphometric measurements collection are given in (Table 1 & Plates a, b, c & d).

3. RESULTS AND DISCUSSION

Populace constraints are essential in order to understand the well-being of any fishery to determine proper management measures. Structural identification of the prawn specimen demonstrated the presence of four species of commercial important from the river Koshi near Kursela, Katihar eastern Bihar. The identification of prawn belonging to genus *Macrobrachium* (Bate) is mainly based on the proportion of different segments of the second chelipeds in addition to the characterization of rostrum. All the specimens have been identified up to the species level & described and body measured in millimetre are predicted in the (Table 1 & Plates a, b, c & d).

Table 1. A comparative morphological study of *Macrobrachium* species

S. N.	Characters	<i>M. gangeticum</i>	<i>M. gandaki</i>	<i>M. tiwari</i>	<i>M. lamarreii</i>
1	Rostrum extended	Shorter & not beyond antennal scale	Short & not reaching as far as antennal peduncle	Elongated reaching upto or beyond antennal scale	Rostrum long sword shaped reaching past antennal scale
2	Basal crest deviation	Basal crest highly elevated to forma keel	Basal crest moderately elevated	Basal crest moderately elevated	Basal crest moderately elevated
3	Distal end of rostrum	Distal end directed forwards	Distal end directed forwards	Distal end directed forwards	Distal end directed forwards
4	Rostral formula	9-11/4-6	8-10/2-3	9-10/2-0	8-9/10-12
5	Second pereopods	Largest, equal & larger than body length	Largest, & unequal	Larger, equal & shorter to body length	Smaller, equal & larger than other pereopods
6	Maximum size	200 mm	75 mm	85 mm	80 mm

3.1 *Macrobrachium gangeticum*

The gangetic prawn *M. gangeticum* was the largest representative of freshwater prawn in the Koshi region. In the present study male attain maximum growth of 200 mm and female attains maximum 180 mm in the Koshi river, whereas, [15,16,22,21] reported regarding *M. gangeticum* male attain maximum growth of 215 mm and female attains maximum 200 mm in the middle stretch of the river Ganga near round Patna, Bihar. These are called 'Gangetic river prawn' it also known as *M. birmanicum choprai* (Tiwari) it was yellowish brown, it has an elevated dorsal rostral crest. Rostral formula of the species was found with 9-11 dorsal teeth and 4-6 ventral. The rostrum of this species was also found elongated short extended & reached upto the length of the antennal peduncle scale, which is highly convex, and slightly elevated upturned. The dorsal rostral teeth on elevated crest usually found closely set up with each other, whereas, ventral teeth were separated from each other. The second pair of pereopod (chelate lags) was longer than body also having equal size and carpus as long as merus. The prawns are distributed in the Ganga and Brahmaputra river system [19,24] detail presented in the (Table 1 & Plates a, b, c & d).

3.2 *Macrobrachium gandaki*

The Gandak river Prawn *M. gandaki* was the third largest medium sized prawns groups in this region. The male and female attains a maximum growth of 75 and 65 mm. Whereas, [17] reported a new species of *Macrobrachium gandaki* (Bate, 1868) in middle stretch of the river Ganga India, sized ranging from 60-70 mm in total length (tip

of the rostrum to tip of the telson) They are locally known as 'Gandak river prawn' possesses un-equal size of pair of 2nd chelate legs. Rostrum moderately short, elevated, not reaching up to antennal peduncle. The distal end of rostral tip directed forward upper margin moderately convex, with 8-10 teeth placed at distal half of the rostrum. Small setae were present the teeth of both dorsal & ventral margin. The chelipeds are either the left of right in male unequal, one big, strong and another smaller, body colour was translucent blue. Shape of telson were found triangular pointed at the tip, slender with a dorsal spines, antenna segmented. It is distributed middle stretch of the river Ganga, Gandak and Koshi. *Macrobrachium gandaki* having black band on the abdominal dorsal part were characteristics to the present species.

Kanaujia et al. [23] reported two species of prawn, whereas, [24] reported 4 species of prawn namely *Macrobrachium gangeticum*, *M. malcomsonii*, *M. lamarreii* and *M. lamarreii* in the middle stretch of the river Ganga around Patna, Bihar. The matter of facts, *M. gangeticum* is aquaculture importance and developed its hatchery technology (outdoor & indoor) by the different researcher like [25,26] its need to explore this technology from hatchery to pond condition (lab to land programme). Its facts, *M. gangeticum* reported third largest freshwater prawn in India and apparently less in natural system in the Gangetic river [6] however this species needs further observation particularly on aspects like conservation and culture in pond condition, detail presented in the (Table 1 & Plates a, b, c & d).



Plate a. *Macrobrachium gangeticum*



Plate b. *Macrobrachium gandaki*



Plate c. *Macrobrachium tiwari*



Plate d. *Macrobrachium lamarrei*

Plates a-d. Photographs of four *Macrobrachium* species found in the river Koshi

3.3 *Macrobrachium tiwari*

This prawn comes under second largest prawn group in the Koshi region. This species are capture to be marketable importance in different state of India. [27] reported also having aquaculture potential, but unutilized and produced in hatchery system. These are relatively medium / small prawns, maximum size of male is 65 mm and female 85mm which are looking in pale grey colour. The rostrum of this species was found elongated reaching up to beyond the length of the antennal peduncle. It may be curved or slightly curved upwards. The 2nd pair of chelate legs shorter that the body length. Antenna having dot marking looks like segmented. Uropod consist of accessing spine on the telson. Black band on lateral side of the rostrum from base to tip. Entire elongated pair of cheliped legs in which carpus is distinctly longer than merus. However, the percentage composition in fish landing is comparatively less than *M. lamarrei*, detail presented in the (Table 1 & Plates a, b, c & d).

3.4 *Macrobrachium lamarrei*

Length of the rostrum of this decapods observed long sword shaped, tip sharper and unturned, reaching past the antennal scale. Distal end of rostrum was slender and turned upwards. the most important features of this species the wide irregular gap between first two and third dorsal teeth. The second pair of pereopods was much shorter than the total length of the body, merus but carpus was longer than merus. Body were bulky and broader shape. Telson possesses two pairs of dorsal spines and uropod does not have accessory spine (Plate d). [20], reported regarding this species was found in the Indo-west Pacific: India, Pakistan, Bangladesh. In India, it occur mostly in north-east coast and contributed local fishery. The bulk quantity of prawn available during monsoon at the landing centre. Aquaculture has been attempted but no record for production. It fetches good price in local market. It is often difficult to distinguish Decapods Crustacean the juveniles of *M. lamarrei* from those of *M. rosenbergii*, *M.*

malcolmsonni and *M. gangeticum*, detail presented in the (Table 1 & Plates a, b, c & d).

3.5 Abundance of Prawn Species

The species *Macrobrachium gangeticum*, *M. gandaki*, *M. tiwari*, and *M. lamarrei* occurred at the sampling sites. The *Macrobrachium lamarrei* and *M. tiwari* were found dominant species present in year around, whereas in case of *M. gandaki* and *M. gangeticum* were observed restricted during May to October and June to September during the investigation period in the Koshi river near Kursela, Katihar. There was a slight seasonal variations observed in the species availability. The number of individuals were found more and subsequently decreases as *Macrobrachium lamarrei*, *M. tiwari*, *M. gandaki* and *M. gangeticum* respectively during the investigation period. It may due to water temperature, depth and abundance of food resources present in these site like algae and planktons. Therefore, there is significant correlation between its abundance and food resources as indicated by [20,24,27] documented commercially important availability and distribution of 12 species of freshwater prawn fauna occurring in India. Whereas [28] reported, regarding period wise sex population varied from a maximum in winter whereas minimum in summer season of *Macrobrachium assamense peninsuliric* in the Khoji river Uttarakhand, India. [29] studied taxonomic and identification of freshwater prawn *Macrobrachium assamense peninsuliric* in Garhwal region, this prawn characterized by small rostrum with 5 to 10 dorsal teeth and 0 to 3 ventral. [24], recorded four species of freshwater prawns in the middle stretch of the river Ganga near Patna belonging to genera *Macrobrachium* such as *Macrobrachium gangeticum*, *M. malcolmsonii*, *M. lamarrei*, *M. lamarrei lamarrei*, however, *M. gangeticum* only available in the rainy season. In current survey, low rate of wealth of species was studied in sampling site warning loss of its suitability for nourishing life due to devastation of ecological habitats, increased level of pollution and over exploitation of the species. [8] reported 5 species of freshwater shrimp consisting of 2 families, they also determine diversity and the abiotic conditions of freshwater shrimps habitat in Indonesia and [30] reported relationships between water quality constraints and the development rate of white shrimp (*Litopenaeus vannamei*) in concentrated ponds. [31], reported the impact of climate change on prawn post larvae fishing in coastal Bangladesh. [32]

observed similar reasons for declined diversity and low abundance in one of the studied habitats.

4. CONCLUSION

This study will serve as starting point evidence regarding freshwater prawn *Macrobrachium* diversity and assortment in the Koshi region of eastern Bihar. Variety and richness of prawn species is affected by the human caused factors that has considerable impact. The report recommends that site requires proper management and develop hatchery technology for its conservation and to prevent the further loss of populations from this region.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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