Original Research Article

FRESHWATER PRAWNS DIVERSITY (CRUSTACEA: DECAPODA) IN THE RIVER KOSHI, NORTH BIHAR

ABSTRACT

Diversity and abundance of freshwater prawns were studied from January 2020 to December 2022 in the Koshi river of district Katihar north Bihar, India. The prawn was collected and preserved in 5% formalin for further study. 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 Bhagalpur Bihar. 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* genius in the river Koshi around Kursella, Katihar district north Bihar. They are namely *Macrobrachium gangeticum, M. gandaki, 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. The current investigation important to the presence of commercially important and environmentally sustainable inhabitants available in the river Koshi, Kursela Katihar, North Bihar. The details of figures & data collected are in the flesh in this communication.

Keywords: Crustacea, Decapoda, *Macrobrachium species*, Fishery, seed production

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 (Camera *et al.,* 2009; Snyder, 2016). 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 (Grave *et al.,* 2008; *Prasad et al.,* 2012). 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 (Pandey, *et al.,* 2010). 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 (Prasad *et al.,* 2010; De Grave *et al.,* 2015), quality of water and anthropogenic pollution can be determined by presence of species and their abundance (Susilo *et al.,* 2020; Slathia and Langer, 2022). Jhingaran (2003) 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 (Prasad *et al.,* 2010; Prasad and Kanaujia, 2014).

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 (Rajanee and Marippan, 2011; Athiyaman and Rajendram, 2014). The size group, sex-ratio, arrangement, spreading, larval biology and incidence of freshwater prawn in the river Ganga has been studied with recorded by Tiwari and Holthius 1996; Kanaujia, 1999, Prakash, 2002; Prasad, 2013; 2020; Singh *et al.,* 2013. 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 documented 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.

MATERIALS AND METHOD

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.mapsofiindia.com). The rivers, which flowed near Purnea in the 18th century, presently it flows west of Saharsa, & South of Katihar district of North Bihar. In the Koshi region, Kursela, Purnea. Araria, Forbesganj, Supaul, Madhepura and Khagaria are the main flood affected cities in North Bihar.

Sampling site and prawn collection: 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 Katihar district, north 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), Purnea, Bihar, India.

Identification and measurement : The species was identified in consultation with related literature previously published by (Ahemad, 1999; K. V. Jayachandran 2001; Kanaujia, 2003; Prasad, 2007; Athiyaman and Rajendaram, 2014). 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 chalet 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 Macrobrachium species. Morphometric measurements collection are given in (Table -1 & plate a,b,c&d).

RESULTS AND DISCUSSION

Populace constraints are essential in order to understand the well-being of any fishery to determine proper management measures. In the present study morphological identification of the freshwater Koshi river prawn specimen showed the presence of four *Macrobrachium species* of commercial important from the river Koshi near Kursella, Katihar north Bihar. The identification of freshwater 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 (Prakash, 2002). All the specimens have been identified up to the species level & described and body measured in millimetre are predicted in the (Table-1 & Figs a,b,c&d).

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

S. N.	Characters	*M. gangeticum*	*M. gandaki*	*M. tiwari*	*M. lamarreii*
1	Rostrum extended	Shorter & not beyond	Short & not reaching as	Elongated reaching upto	Rostrum long sword shaped

		antennal scale	faras antennal peduncle	or beyond antennal scale	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

Macrobrachium gangeticum*:* This is the largest representative of freshwater prawn in the Koshi region. The male attain maximum growth of 200 mm and female attains maximum 180 mm in the Koshi river, whereas, (Prasad and Kanaujia, 2014; Prasad, 2020) 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 is 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 lag) is longer than body also having equal size and carpus as long as merus. The prawns are distributed in the Ganga and Brahmaputra river system detail presented in the (Table: 1 & Plate- a,b,c&d).

Macrobrachium gandaki: This is the third largest medium sized prawns groups in this region. The male and female attains a maximum growth of 75 and 65 mm. These are locally called '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 is 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.

Plate-a. ***Macrobrachium gangeticum***

Plate-b. ***Macrobrachium gandaki***

Plate-c. ***Macrobrachium tiwari***

Plate-d. ***Macrobrachium lamarrei***

Kanaijia (1989) reported two species of prawn, whereas, Prasad (2005) reported 4 species of prawn namely *Macrobrachium gangeticum, M. malcomlsonii, M. lameraii* and *M, lameraii lameraii* 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 Kanaujia *et al.,* 2005 and Prasad, 2008; 2020, and its need to explore this technology from hatchery to pond condition (lab to land programme). It is facts, *M. gangeticum* reported third largest freshwater prawn in India and apparently less in natural system in the Gangetic river (Prasad *et al.,* 2010) however this species needs further observation particularly on aspects like conservation and culture in pond condition, detail presented in the (Table: 1 & Plate-a,b,c&d).

***Macrobrachium tiwari*:** This is comes under second largest prawn group in the Kosh region. This species are capture to be marketable importance in different state of India. Jayachandran and Indira (2010) 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 is 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 teltion. 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 & Plate-a,b,c&d).

***Macrobrachium lamarrei*:** Length of the rostrum of this decapodis long sword shaped, tip sharper and unturned, reaching past the antennal scale. Distal end of rostrum is slender and turned upwards. the most important features of this species is the wide irregular gap between first two and third dorsal teeth. The second pair of pereopods is much shorter than the total length of the body, merus but carpus is 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). Kanaujia 2003, reported regarding this species is 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 Decapodes Crustacean the juveniles of *M. lamarrei* from those of *M, rosenbergii, M. malcolmsonni* and *M. gangeticum,* detail presented in the (Table: 1 & Plate-a, b, c &d).

Abundance of prawn species: Among all the species *M. gangeticum, M. gandaki, M. tiwari, M. lamarriae* occurred at both the sampling cites showing its cosmopolitan distribution and its highest relative abundance was at lower side (Table -1). There was a slight seasonal variations observed in the species availability. The number of individuals are more in lower part which may be due to the suitability and its populations by migrant freshwater species from upstream region to lower saline areas. similar observation were reported by earlier workers (Marippan *et al.,* 2002). Whereas Bahuguna (2013) reported, regarding sex population observed season wise varied from a maximum in winter season and minimum in summer season of *Macrobrachium assamense peninsuliric* in the Khoh river Uttrakhand, India. 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. *Macrobrachium tiwari* and *M. lameraii* are available in all inland water bodies. Both natural and manmade though in different

proportions, separately of some times in combination also. These are small prawns, in spite of it very much liked by domestic consumers both in fresh or dried condition. These two prawn species which are categorized as minor prawn species constitute a small scale natural fisheries in different habitat throughout the year and play an important role in local economy providing food and income to the consumers and producer. So the capture fisheries of these prawns in a sustained way requires sincere consideration. The only way to propagate and augment their production is to initiate their culture. Prasad, (2005) 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. lameraii, M. lameraii lameraii* , however, *M. gangeticum* only available in the rainy season. Ahmed *et al.,* 2013 reported the impact of climate change on prawn post larvae fishing in coastal Bangladesh. Whereas, Kanaujia (2003) documented commercially important availability and distribution of 12 species of freshwater prawn fauna occurring in India, detail presented in the (Table: 1 & Plate- a,b,c&d).

CONCLUSION

Food security is regarded as longer index of the development of a country. This study will serve as starting point evidence regarding freshwater prawn *Macrobrachium* diversity and assortment in the Koshi region of North Bihar. Freshwater Decapoda Crustacean prawns forms an important Doller earning, commodity, biologically rich in diversity. It is facts, diversity and abundance of prawn species is affected by the anthropogenic factors that has significant effect on them. The study suggest that appropriate management develop prawn hatchery technology and proper planning for its conservation strategies to prevent the further loss of populations from this region.

REFERENCES

1. Ahmed, N. Ambrogi, AO, Muir, J. F. 2013. The impact of climatic change on prawn post larvae fishing in coastal Bangladesh. Socioeconomic and ecological perspective, Mar. Policy, 39:224-233.
2. Ahmad, J. 1999. Freshwater prawn fisheries resource and opportunities for their development: Book Cinrarens, D, 39; Raipur. Allied Printers New Delhi. Pages 1-136.
3. Pandey, A. K. Upadhyay, A. K. and Lakra, W. S. 2010. Diversity of commercially important freshwater prawns and their aquaculture potential in India. *J. Exp. Zool. India*, 13 (1):121-128.
4. Camara, I. A. Konan, M. K. Diaman, D. Edia G. and Gourence E.O. 2009. Ecology and diversity of freshwater shrimp in Bonco National Park, Cote dlvoire (Banco River Basin) Knowledge and Management of Aquatic Ecosystem 393:05.

5. Grave, C. D. Cai, Y, and Anker, A. 2008. Global diversity of Shrimps (Crustacea: Decapoda: Caridea) in freshwater. Hydrobiologia 595: 287-293.
6. De Grave, S.Smith KG, Adeler, NA, Allen, D. J. Alvarez, F. Anker A. Cai V, Carrizo SF. Kiotz W. Mantelatto FL Page TJ, Shy Jy and Villalobos J L 2015. Dead Shrimp Blues: A global assessment of extinction risk in freshwater shrimp (Crustacea Decapoda: Caridea) PLOS. ONE 10:e0120198.
7. Prakash, S. 2002. Studies on affinities of Ganga river prawn *Macrobrachium gangeticum* in proceeding of the fifth Indian fisheries forum (Eds) : S. Ayyappan, J. K. Jena and M. Mohan Joseph. Bhubaneswar, India. 241-244.
8. Jhingran, V. G. 2003. Fish and Fisheries of India. (Revised 3rd edition) Hindustan Publishing Corporation (India) Delhi, 750.
9. Prasad, S. 2005. Studies on the freshwater prawn fishery of river Ganga with special reference to the larval biology of larger *Macrobrachium* Species. Ph.D thesis, Utkal University, Bhubaneswar Orissa.
10. Prasad, S. 2020. Maturation and fecundity of large freshwater prawn *Macrobrachium gangeticum* (Bate) and *Macrobrachium malcolmsonii* (Edwards). In the Ganga river system in India, *Current Journal of Applied Science and Technology*. 39(21):148-155.
11. Prasad, S. and Kanaujia, D. R. 2014. An observation on reproductive potential of Ganga river prawn *Macrobrachium gangeticum* (Bate). *Progressive Research- An International Journal*. 09 (Special III):1028-1032.
12. Prasad, S., Kanaujia, D. R. and Patra, A. K. 2012. Diversity Abundance and Composition of large freshwater prawn species in the Ganga river system. *The Bioscan*, 7 (4):685-689.
13. Prasad, S., Khan, M. A. & Kaushal, D. K. 2010. Depletion of the Ganga river prawn *Macrobrachium gangeticum*: Need to conservation. *Proc. Zool. Soc. India*. 9(2):85-90.
14. Kanaujia, D. R.1989. Biology of Freshwater prawn *Macrobrachium malcolmsonii* (Edwards)of river Ganga, Buxar, Bihar. In Proceeding National Seminar on Freshwater Aquaculture CIFA, Bhubaneswar India. 51-54.
15. Prasad, S. 2013. Size group, Sex- Ratio, Male and Female Percentage of Indian River Prawn *Macrobrachium malcolmsonii* (Edwads), *Progressive Research - An International Journal*. 08 (Special Issue):656-659.
16. Prasad, S, 2015. Comparative larval biology of Ganga river prawn species *Macrobrachium malcolmsonii* (Edwards) and *Macrobrachium gangeticum* (Bate) in Hatchery Condition *Progressive Research - An International Journal*.10 (Special Issue-8):4426-4431.

17. Prasad, S. 2020. Outdoor hatchery larval biology and seed production of Ganga river prawn *Macrobrachium gangeticum* (Bate), Curr. J. of Appl. Science &Tech. 33 (3); 1-7.
18. Kanaujia, D. R. 2003. Indian River Prawn, *Macrobrachium malcolmsonii* and minor species of commercial important, International Symposium Souvenir on Freshwater prawn 2003, College of fisheries, Agricultural University, Kochi, India 51-56.
19. Snyder, M. N. and Freeman M. C. Purucker S. T. and Pringle CM 2016. Using occupancy modeling and logistic regression to assess the distribution of shrimp species in lowland streams Coata Rica Does regional groundwater create favorable habitat. Freshwater Science 35 (1):80-90.
20. Susilo, V E, Suranto and Fadillan, N. Narulia E and Wowor, D. 2020. Diversity of freshwater shrimp (Decapoda) from bandealit river Meru Betri National Park East Java, Indonesia. Journal of Physics: Conference Series 1465012009.
21. Tiwari, K. K. and Holthuis, L. B. 1996. The identity of *Macrobrachium gangeticum* (Bate), 1868 (Decapoda, Caridea, Palemonidae), *Crustaceana*. 69 (7):922-925.
22. Bahuguna, P. 2013. Sex population structure of *Macrobrachium assamense peninsularie* (Tiwari) (Crustacea, Decapoda, Palaemonidae) in Khoh River, Uttarakhand, India. Int. J. Curr. Microbiol. App. Sci. 2 (10): 382-390.
23. Athiyaman, R and Rajendran. 2014. Diversity of freshwater prawns (Crustacea: Decapoda: Paaemonidae and Atyidae) in the river Cauvery. Elixir Appl. Zoology, 74 (2014): 26975-26977.
24. Jayachandran, K. V. and Indira, B. 2010. Sustainable exploitation of freshwater prawn diversity of India for foods and livelihood security with emphasis on planning. Indian J. Sci. Res. 1(2): 127 – 132.
25. Kanaujia, D. R. Mohanty, A. N., Mitra, G., Prasad, S. 2005. Breeding and seed production of the Ganga river prawn *Macrobrachium gangeticum* (Bate*)* under captive condition. *Asian Fisheries Science* 18 (3); 371-381.
26. Salathia, S. and Langer, S. 2022. Study of freshwater prawn diversity from different rivers of Jammu, India. *Indian Journal of Ecology*. 49 (1): 183-186.
27. Ranjanee, S. S. and Marippan, N. 2011. A general and ecological diversity of freshwater prawns *Macrobrachium canarae* and *Caridina gracilirostins* from Kanyakumari Dist. Tamil Nādu, India. *International J. of Genetic Engineering and Biotechnology*, 2: 23-32.