



Progression of Marketing and Utilization Pattern of Fresh Water Molluscan in Bihar

Suday Prasad ^{a*} and Mukesh Kumar Sinha ^a

^a Veer Kunwar Singh College of Agriculture, (Bihar Agricultural University, Sabour), Dumraon, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Freshwater shellfish like *Pila globosa* and small size prawn species are very useful, beneficial as well as economically viable interacting intimately with local indigenous people especially for middle and lower class families in the rural sector. The survey of famous shellfish market was designed to have a crystal clear a frame work through a direct observations, personal interviews and focus group discussions by using a Rapid Market Appraisal (RMA) approach technique applied to the objective revealed transparent marketing system in Bihar. The shelling time of snail is all day long. The price of shellfishes is influenced by species, quality, and weight of shellfishes. Live shellfishes (with shell) have a lower price of Rs. 100-120/kg. Whereas, in respect of molluscan after removal of the shell the only flesh price is found Rs 150-175/kg. The freshwater crustacean indigenous species like *Macrobrachium lammarii* and *Macrobrachium tiwari*, *M. gandaki* prawn, have a price of Rs. 400-500/ kg and after drying they were sold at Rs. 1000/kg in the Harda fish markets Purnea. During the pick period, the estimated amount of snails sold was approximately 1.5 tons /day. The flesh of

*Corresponding author: Email: sudaybausabour@gmail.com; sudayprasad@yahoo.co.in;

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shellfish is consumed in various forms as food and used for the cure of some ailments by local people. Whereas, *Bellamya bengalensis*, *Pila* and *Lamellidens* species have been used for ethno-medicinal purposes and as fish feed. Meat of *Pila* species has a upright market worth in Bihar, with demand rising among middle and high economic classes. Molluscan and their marketing are a future solution to the developed and developing state for food security and some diseases problems elimination of because its easily availability for low-income population.

Keywords: Snail; biodiversity; medicine; *Pila globosa*; wetland; prawn; India.

1. INTRODUCTION

Shellfishes belong to phylum Arthropoda and Mollusca, which contain the highest animal biodiversity in the biosphere. The shellfisheries sector plays a vital role in the Indian economy through its contribution to various development issues like food and nutrients security, employment livelihood support system and improvement of socioeconomic status of fishing communities. Bihar had been a potential arena for aquaculture, fisheries resources as well as other aquatic crops, like Makhana (*Euryale ferox*), Singhara (*Trapa natans*) and shellfishes like Crustacean and Mollusca. Shellfishes play a vital role in helping to sustain the development of the aquatic environment. The Indian freshwater apple snail *Pila globosa* is a key species in aquatic and grassland ecosystems [1]. Snails are a food stuff for numerous aquatic terrestrial and avian (Jacanas, Herons, Egrets and Lap wings) animals and they play a significant role in the aquatic food chain for many aquatic fishes [2-6]. The *P. globosa* is one of the most commercially valued, and abundant gastropods, providing low-income individuals with a readily accessible supply of affordable animal protein [6-8]. Snail encourage in ameliorating prawn hatchery seed production and culture exploiting its shell and flesh as prawn feeds [9]. Apple snail most abundant and widely found in all types of water bodies like tanks, Makhana crop (field), Singhara field, rice fields, freshwater streams, rivers etc. Ascribed to climate change, scarcity of water, overexploitation of snail as well as, discriminate uses of insecticide & pesticide in respect the ecosystem of macrophytes during Makhana and Singhara culture in North Bihar. Drastically reduction was observed in snail diversity in this region [10]. Even snails are considered as highly digestible and enriched in vitamins, fat, protein and minerals especially calcium [11,7]. Many freshwater snail species are popular foods of Human, along the globe, increasing demand of snail meat in many developed & developing countries [12,13,6,14]. In Bihar, the marketing system of snail is still in the emerging stage and

presently not pertinent in contrast to other fisheries item like finfish, shrimp etc. The price of snail and their derivative products in Bihar is much lower compared to other fisheries items. However, implication in marketing system has not been reported and systematically published practically a very little information is available of shellfish marketing system till now. With this background, the present study was carried out with the following objectives:

1. To study the utilization pattern in different aspect of Mollusca and management strategies of a number of existing diseases in the wetland dominated region of North Eastern Bihar.
2. To assess the existing status merchandising market channel through various supply stream to boost socioeconomic condition of the underprivileged ones who are completely or partially involved.

2. MATERIALS AND METHODS

The present study was conducted in the agroecological zone II of Bihar, covering districts such as Purnea, Madhepura, Supaul, Araria, Kishanganj, Madhubani, Katihar, Khagaria and Saharsa. The theme of the study was identified through a preliminary discussions with the department of fisheries (Govt. of Bihar) officials Purnia followed by field & marketing survey work consecutively for three year during 2020-2023. Using a Rapid Market Appraisal (RMA) approach, described by Holtzman [15], Snail marketing channel, stockholders and specific inventories were identified by personal interviews and focus group discussion using a questionnaire along with secondary information was also collected from published reports. Apart from this, the author first hired a room on rent for establishment (April, 2019-July, 2023) in city Naka chauk near fish market Purnea. Facts & figures were also collected perse the demand and supply of shellfishes that produced within Purnia jurisdiction and procured from other districts of Bihar.



Fig. 1. a. b. c. d. e. f. g. h & i Different activities of like collection, ecology, transportation, dried fish and Shellfish marketing in Purnia

3. RESULTS AND DISCUSSION

3.1 Snail Harvesting from Wetlands

It is a fact that Northeastern Bihar has a well-developed network of the Mahananda and Koshi river systems. These aquatic ecosystems support the growth of makhana and Singhara crop. Makhana crop fields provide safe growth as well as the reproduction of many shellfishes. Snails are foodstuff for numerous aquatic terrestrial and avian (Bronze-winged Jacanas, Herons, Egrets and Lap wings) animals and they play a significant role in the aquatic food chain for many aquatic fishes, more or less similar observations reported by Thorps and Covich, [2], Subba Rao & Dey, [3], Prabhakar and Roy, [6], Fig. 1, b & c. A huge number of shellfishes caught from wetland areas like rivers Saura, Katua, Kankai, Riga (locally known as dhar) and chaur, ponds, swamps, floodplains, meanders of rivers, water-logged, Makhana and Singhara crops fields came to the notice of Purnia shellfish market near Katihar more Khuskibag (Fig. 1, d&e). According to Mr. Kailu Shahni, engaged in snail collection and marketing, this occupation started two decades ago in the Purnea area. According to the interviewer's in Purnea, one

decay ago snail lot was transported to Purnea by the trading machinery from different districts like Khagaria, Begusarai, Samastipur, Muzaffarpur and Saharsa, Fig. 2. Snail specially *Pila* and *Bellamya* species trading season in these centres (Purnia) ranges from July to March only. In the months from April to June (03 months) its market/selling retained closed due to the non-availability of molluscs, it may face three months of drought and hence undergo a dormant condition by being buried in the mud.

The price of snail may fluctuate due to its availability and demand. The peak season for snail collection lasts for three months i.e. September to October. August to September is the post rainy season when snails are commonly found in high abundances in natural wetlands. Whereas, in the winter season harvesters facing difficulties to collect due to snail going to hibernation stage in mud, snails dig down in the mud during that time and demand of snail meat is high. Traditionally, diggers did not harvest year round however, worked at other manual jobs. In the summer season due to non-availability the snail market, is closed for at least three months from, April, May and June. *P. globosa* is known locally as Genri, Ghongha and Dokka in different part of Bihar. The snail *P. globosa* is the most

popular gastropods species consumed by primarily by tribal, lower-middle income class people in Bihar [6,7]. Sundarbans region of West Bengal and other regions of India [3,14]. The same situation occurs in present study several marketplaces were found in more or less all districts of North Bihar. Many researchers reported a many market places in Bengal, Arunachal Pradesh and Mizoram, where apple snail *P. globosa* is often sold. Snails are collected from the different aquatic resources as a wild foodie and then taken it to markets to be sold. Due to the high CaCO₃ content i.e. 3.04 mg of calcium per gram of snail powder [11], it is regarded as one of the best natural sources of calcium [16,17].

3.2 Channel of Snail Marketing

Shellfish marketing channels has been found a significant role to become a successful entrepreneur in facilitating to mee the demand for fish and development of socioeconomic condition of many people [18], Prasad and Singh, [9]. System providing a source of income for all the men and women involved in the marketing chain from harvester to consumers strengthens the stakeholders. Marketing channels are the distribution paths through which the snail is transported from the point of source to reach the consumers Ghosh, [19]. Snail before reaching to the consumers a number of snail marketing channel players included harvester, small trader, large trader, retailer. First of all, snail is

harvested by harvester, then the harvester sells the snail to the small trader, the small traders then sell it to the large trader and after that snail sold by retailers. The following marketing channels were identified in Bihar are shown in the Fig. 3.

Traders bought snail from the collectors and sold it to retailers. Retailers earned profit through buying and selling. In facts, snail was the low- and medium-priced commodity, the snail collectors were poor, their profession was partial livelihood option. Some harvester, harvest the snail during day and sold it the same day in the markets. Some households of large-scale traders were identified whose snail was the main livelihood option and the harvesting place in different districts of North Bihar. Some trader, collected the snail mass from harvesters/small traders and sold it to retailer for marketing. They used sometimes boat for the harvesting of snail from Chauras, Maun, oxbow lake etc. Small traders transport the snails to another market/district using two, three-wheelers. They pack the snail mass into jute bags each bag, containing 50-55 kg of snail, Fig. 1,d. During long distance transportation some snail meat was spoiled. The conveyance system of *Pila globosa* also regulates demand and hygienic conditions, because with the change of time *P. globosa* will perish. The shellfish (*P. globosa*) was transported from one to another districts using vehicles like bicycle, motorcycle, van, tempo etc. as per suitability.

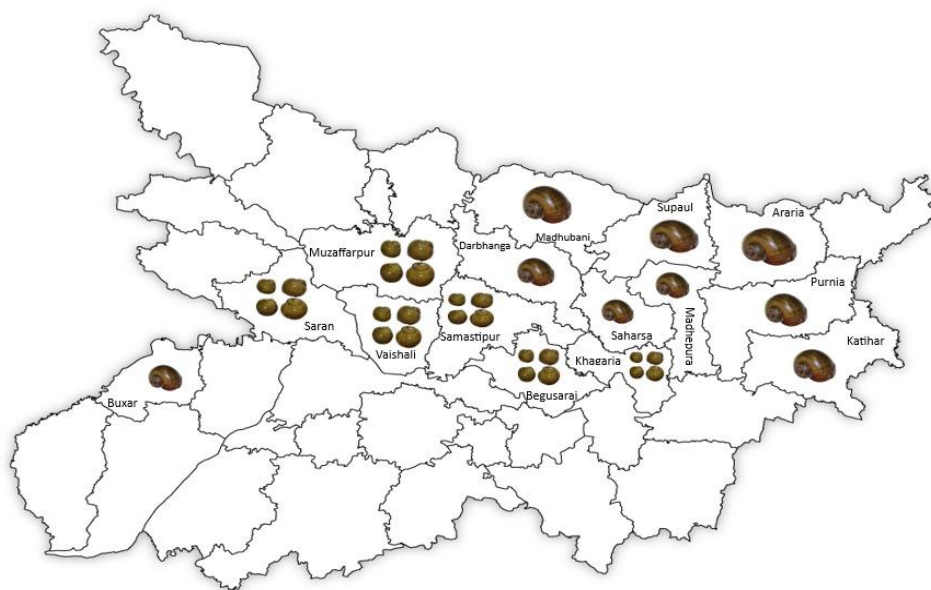


Fig. 2. Showing the Shellfish harvesting and marketing system of Bihar

1. Harvester→ Collectors→ Retailers→ Consumers
2. Harvester→ Collectors→ Traders→ Retailers→ Consumers

Fig. 3. Flow chart of snail marketing chain in Bihar

Table 1. The extracting chart of snail & sell in market, Purnia Bihar

S. N.	Extracting	Price (Avg.)/kg
1	Snail/with shell (whole)	Rs.100/kg
2	Flesh with all part/de shell	Rs.140/kg
3	Fine meat- removal of gastrointestinal tract	Rs.175/kg
4	Waste water/use for many ailments	Rs.50/lit.

Table 2. Individual, daily selling and income of snail in Purnia Bihar

Days	Snail Rs./Kg buying price	Snail Selling/ day in kg	Avg. rate 120 Selling price/kg	Retail
Sunday	50	37	4440	
Monday	40	31	4560	
Tuesday	40	30	3770	
Wednesday	45	35	4200	
Thursday	40	31	3770	
Friday	50	37	4440	
Saturday	45	35	4200	

Table 3. Some edible snail uses as nutritional and medicinal

S. N.	Species used to cure diseases	Diseases control	Procedures
1	<i>Pila sp</i>	Rickets	Prepared soup from the eggs used to cure rickets in children.
2	<i>Pila & Bellamya sp</i>	Night blindness	Foot curry is eaten regularly by aboriginal people for better eye sight.
3	<i>Bellamya & Pila species</i>	Asthma joint pain & Arthritis	Soup prepared from the <i>Bellamya sp</i> is used to cure
4	<i>Bellamya bengalensis</i>	Conjunctivitis	Species are kept in clean fresh water in an earthen pot for overnight, water is used like eye drop.
5	<i>Lamellidens Parreysia</i>	& Cardiac ailments	Curry prepared from these spp is used to cure cardiac ailments.
6	<i>Parreysia sp</i>	Blood pressure	Soup prepared from these species is used to control blood pressure.
7	<i>Lamellidens & P. globosa</i>	Nervousness giddiness & dehydration	Shell powder of both species prepared and then mixing with honey and used for remedy of giddiness & dehydration.

3.3 Shellfish Marketing in Purnea

The small retailers in the snail market buy the snails from trader at lower price there after they de-shell the snail and sell the snail meat at higher rate. Small groups consisted of 5-8 people and large group of 10-15, most of which are women. The shelling time of snails is a whole day in Purnea. The woman members also have household duties besides that they break snails' and sell their meat in part of the day, occasionally they get the help of their men. One large group buy 10-15 bag/day from the large traders during peak season on the credit.

An efficient member can break up to 10 kg of snail per hr. Two hand-made small devices

(locally called Futauni and Kholani) made of wood and iron pin are used for this purpose. Prasad and Singh, 2006; Prasad, 2020; Prasad *et. al.*, 2023, reported marketing of fish either in the morning or in the evening or morning and evening both session in Bihar and Punjab. The details of processing channel & chart are shown in the Table 1. Daily Shellfish marketing was taken place in Katihar more, Khuskibag, in Purnea, Bihar. The fish selling price (with shell) is Rs. 100/kg with all part/ de shelling price was Rs.140/kg were as fine flesh (after removal of gastrointestinal truck price was Rs. 175/kg) despite of molluscan marketing price of dry fishes like prawn was found Rs. 1000/kg only at Harda fish market Purnea Fig. 1,f.

3.4 Use as Food and Supplements

Snail meat is a superior source of protein next to that found in fish and prawns. Both the foot and hepatopancreas of *P. globosa* have edible value [20]. Snail meat contains a special sterol and a vital fatty acid [21]. Many studies have confirmed that *P. globosa* meat is consumed as food because of its high protein and low-fat content [22,23,6,7]. The price of *P. globosa* turns out to fluctuate with the day and season of the year and the quality of the flesh. It was observed, everyday supply of *P. globosa* in market places is varying based on catches (harvest) during peak or off season. Effectively disposal of most of the *P. globosa* was found more in Sunday, Monday, Wednesday, Friday and Saturday, in comparison to Tuesday and Thursday which may be religions point of view, details of which presented in Table 2.

It was observed that in Purnia district; among imported Pila and Bellamya species from other districts like Samastipur, Khagaria of Bihar, *P. globosa* and *B. bengalensis* have good demand and an average retail price found to be Rs.120/kg bought by middle and lower-class families in this region Fig. 1, g & h.. The amount of snail production/supply reduced considerably due to over harvesting and development of Makhana crop field where uncontrolled uses of insecticides and pesticides in the Makhana and other aquatic crops. As a result, their natural stock has also been decreased and destruction of young as well as brood feeding was also there along with spawning grounds of desired snails. Due to seasonal occupation i.e. July to March people engaged in snail harvesting are good source of income. Survey information from Purnia revealed that snail business has a great impact on the income of local people. Individual sellers average net profit was found more than Rs. 1500/day. Documented several snail's species exist in more quantities and are more valuable, because they can feed and breed on a wide range of agricultural and aquatic crops waste, such as shed leaves of Banana (*Musa acuminata*), Singhara (*Trapa natans*) and also in Makhana (*Euryale ferox*) plantation [24].

3.5 Nutritional and Medicinal Uses

The Local indigenous human, inhabitants in rural areas believe that snail food has some special healing properties. They are treated as medicinal value to treat a variety of illnesses including high blood pressure, heart disease, anxiety, nervousness as well as to regulate high

temperatures in the body along with to treat-circulatory issues, controls digestive ailments, including constipation dysentery and diarrhea.

The details of the cure are presented in Table 3. The foot of *Pila*, *Bellamya*, *Lamellidens* and *Parreysia* species are large, muscular and rich in protein, vitamins (A, B, D) and minerals with zero fat [6]. It is used as main nutritional element in the form of soup, curry as well as roasted by aboriginal and their allied of Kosi region of North Bihar. In present study, the tribals and middle-income groups people used snail as a meet food and after elimination of gastrointestinal tract it is also prepared the soup from the flesh. Primarily the snail is eviscerated and reserved in water for limited hours and then the water is used as an 'eye drop' to treat-conjunctivitis. In addition to that flesh soup is used as medicine that they believed to cure joint swelling arthritis, asthma and rheumatism as well as in quick heating, of wounds. In Tamil Nadu *P. globosa* snail are used in the preparation of "Nathai parpam" which is used as medicine in the Siddha form of medical practice to cure bleeding, piles fistula, burning sensation of the anus, enlargement of the spleen, diabetes and tuberculosis [25]. Roy and Singh [26] described the ethno-medicinal practices of the people in the Santhal Pargana district of Jharkhand state, India ethno-medicinal practice of animal assortment along with *P. globosa* are taken as food for the cure of rheumatism, asthma, anaemia, promote digestion, muscle dystrophy, tuberculosis, cure paralysis regulate menstrual disorder etc. the local treatment procedure using indigenous method to cure a numeral of ailment is called 'horopathy' in the region. *P. globosa* is used as in the treatment of bond disorders [27]. Pregnant women also have a high intake of snail haemolymph for its medicinal benefits, particularly in cases of labour pain and to avoid blood loss during birth [28]. The Nagaland tribes use snail to cure asthma [29]. The Saharia people of Rajasthan are reported to treat weakness with Pila shells in traditional medicine [30]. Snail meat have an important source to derive bioactive compounds that exhibit antimicrobial, anti-inflammatory, anti-oxidative, anti-cancer and immune boosting properties [31]. Shell fishes cultivation with paddy, Makhana (*Euryale ferox*) Singhara (water chestnut) and additional aquacultural programmers offer a highly well-organized way of increasing animal protein supportive in a protein starving world. Keeping these characteristics in view, the government of Bihar should make higher &

Judication allocation for shellfisheries development [32].

4. CONCLUSION

Bihar is marching progress with blue and pink revolution. The flesh of shellfish is used in aquaculture as well as a human protein supplement, and it has been employed in traditional medicinal practices to treat various diseases. It can be benefited in many aspects to mankind. The shell fish marketing system in developing stage depend on the utilization pattern of snail meat. The future, snail culture will open a new field for food production and earn foreign currency. Fish / snail farmers are looking forward for upgrading of freshwater aquafarming from a domestic activity to an industrial activity.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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