

**RESEARCH ARTICLE**

A Comparative Biometric Study on Indian Shad *Gudusia chapra* (Hamilton, 1822) Collected from Two Different River Ecosystems

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Study Area: Rupnarayan River and Kanshaboti River of Purba Medinipur & Paschim Medinipur respectively, West Bengal, India

Coordinates: Rupnarayan River: 22.23°N-22.40°N & 87.3637°E - 88.03°E.

Kansaboti River: 22.15°N - 22.29°N & 87.04°E - 87.33°E.

Key words: Habitat, Rupnarayan, Kangsabati, Fish

Abstract

In the current study, 22 morphometric and 14 meristic features of *Gudusia chapra* were analysed, collected from the Rupnarayan and Kangsabati riverine systems of India. A total of 170 specimens of *Gudusia chapra* were collected from Rupnarayan River and 54 specimens from Kangsabati River separately. Result depicts that the number of pectoral fin rays of specimen from Rupnarayan River ranges from 13 to 14 but it is 14 in all specimens collected from river Kansaboti; anal fin rays vary 19 to 21 for specimen collected from Rupnarayan River while same is from 19 to 20 for specimen from Kansaboti River; lateral line scale vary from 79 to 91 for specimen of Rupnarayan River and the same varies from 80 to 82 for specimen from Kansaboti River. Major differences were noted for abdominal scute counts, it varies from 31 to 32 for specimen from Rupnarayan River and the same varies from 25 to 26 for the specimens from Kansaboti River. Therefore, the morphological and meristic comparison for the same species from two different but similar ecosystems may highlight an insight towards taxonomic variation and species evolution.

Introduction:

The River Shad of India, *Gudusia chapra* (Hamilton, 1822) is a potamodromous and pelagic (Riede, 2004) fish species belonging to the family Clupeidae distributed in the rivers of India (Menon, 1999), Bangladesh (Rahman, 1989), Nepal (Shrestha, 1994), Pakistan (Mirza, 2003). In India this species locally distributed in Bihar, Maharashtra (Krishna River), Odisha, upper parts of the Ganges, West Bengal, Assam (Brahmaputra and Barak drainage system). Although the primary habitats for this species are ponds, beels, ditches, freshwater rivers, and flooded fields (particularly flooding during the monsoon), it is also collected frequently even in estuarine ecosystems (Rahman, 2005; WORMS, 2017). Such diversified habitat may lead to the change to the morphometry of organism leading towards speciation and evolution of animal. The primary target of the present work is to find out any variation on morphological characters of *G. chapra* (Hamilton, 1922) collected from two different river ecosystem.

The Clupeoids are almost always schooling fish thus easily caught by nets and which helps to catch a greater number of schooled fish within a short period of time. Least

concerning is the world conservational status of *G. chapra* (Hamilton, 1822) as mentioned by Froese & Pauly (2019). It has a rich nutritional value, good taste and is popularly used as food fish (Gupta, 2015). It is also used to make animal feed and fertiliser (Whitehead, 1985). The morphometrics were considered as valuable cost-effective tools in stock analysis and identification of fish population (Costa *et al.*, 2003; Murta, 2000). The present biometric study can help to evaluate the said fish species and help to take necessary measure for conservation of the selected river systems and its surroundings of West Bengal.

Materials and methods:

The first study river Rupnarayan (approx. 86 km) is a small range river. It is a combined flow of Shilabati river and Dwarakeswar river meeting together at Bandarghat, Purba Medinipur and after completion of the journey around 86 kilometers it merges with Hooghly river near Gadiara, Howrah. Naturally, the entire river's area is divided into two distinct zones: the upstream portion is low saline (0.255–0.425 ppt) and less tidal, and the downstream portion is high tidal and relatively more saline (1.42– 3.87 ppt). Four study sites (Table-1) were selected along the total stretch of the river Rupnarayan.

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Table-1 Study site of Rupnarayan River

Srl. No.	Sampling stations	Geographical Position
Site I	Bandarghat river bank	22.40°N87.3637°E
Site II	Baksi river bank	22.52°N87.89°E
Site III	Kolaghat river bank	22.43°N87.86°E
Site IV	Gadiara river bank	22.23°N88.03°E

The second study river Kangsabati (~465 km) is a freshwater river. It started on the Chota Nagpur Plateau and flows through different districts of West Bengal like Bankura, Purulia, and Paschim Medinipur. Current survey identified four distinct research locations (Table-2) on the lower Kangsabati River in Paschim Medinipur (~83 km long).

Table-2 Study site of Kangsabati River

Srl. No.	Sampling stations	Geographical Position
Site I	Balishira river bank	22.29°N87.04°E
Site II	Payraguri river bank	22.27°N87.05°E
Site III	Pathra river bank	22.24°N87.26°E
Site IV	Shal Dahari river bank	22.15°N87.33°E

During study period seasonal sampling was carried out in the morning time (5.00 A.M.- 8.00 A.M.) from different study sites of the two mentioned rivers, Rupnarayan and Kangsabati. Collected fish specimens were photographed immediately and preserved in 4% formalin solution, brought to laboratory for further studies and identification with the help of existing literature (Talwer & Jhingran, 1991; Jayaram, 1999; Turan, 1999). Total 35 individual of various size ranges of *Gudusia chapra* (Hamilton, 1822) were studied morphometrically and meristically by using a digital slide callipers scale with 0.1mm accuracy (Bagra & Das, 2016). Measurements of different fish morphometric characteristics and meristic counts were given in Table-3,4,5 for both rivers and the counts have been taken for the specimens of maximum length for both river (Fig. 1,2).

Results and Discussion:

The fresh fish have a silvery with golden tinge and the back portion is slightly blackish. A sequence of spots commonly appear along the flank after a dark black mark behind the gill opening, though this spot can occasionally be absent (Figs. 1,2). Body deep and laterally compressed. There is a noticeable notch on the upper jaw. The lower jaw is larger than the upper. Between the basal portion of the tail fin and the apex of the snout, or roughly the centre, is where the dorsal fin is inserted. The meristic analysis shows that the dorsal fin contains 16-17 finrays with soft impression without any spine. The paired pectoral fin with thirteen to fifteen fin rays and the pelvic fin contains 8 rays of fin in each. The caudal fin is forked and has eighteen to twenty soft fin rays, whereas the anal fin has nineteen to twenty-one fin rays. Abdomen keeled with thirty- one to thirty- two abdominal scutes whereas seventeen to eighteen scutes are pre pelvic and rest of thirteen to fourteen scutes are post pelvic. Scales in lateral line 79-91; number of scales above

the lateral line is seven to eight and scales present below the lateral line ten to eleven. Caudal peduncle length is 0.83 cm, and there are seven to eight circumpeduncular scales.

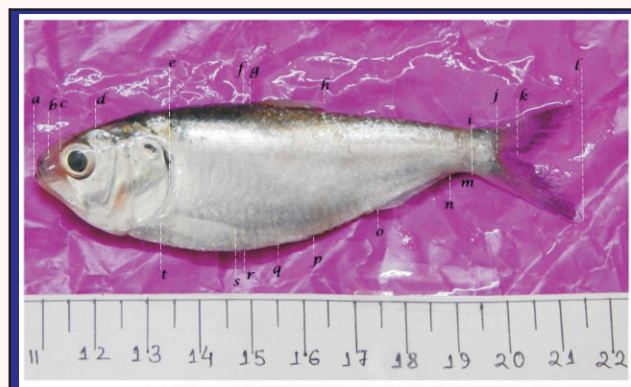


Plate-1: Lateral view of *Gudusia chapra* (Hamilton, 1822) collected from Rupnarayan River, showing different body parts with measurement (Morphometry)

al-Total Length, ak-Fork Length, aj-Standard Length, ae- Length of Head, ab- Length of Snout, cd- Diameter of Eye, ac- Length of Pre-Orbit, de- Length of Post-Orbit, ag- Pre-Dorsal Length, gh- Length of Dorsal Fin, at- Pre-Pectoral Length, ts- Length of Pectoral Fin, aq- Pre-Pelvic Length, qp- Length of Pelvic Fin, ao- Pre-Anal Length, on- Length of Anal Fin, im- Caudal Peduncle, gr-Body Depth



Plate-2: Lateral view of *Gudusia chapra* (Hamilton, 1822) collected from Kangsabati River, showing different body parts with measurement (Morphometry). Legends as above.

Synonyms

Gadusia chapra (Hamilton, 1822)
Clupanodon chapra Hamilton, 1822
Clupea indica Gray, 1834
Clupea champil Gray, 1834
Alausa microlepis Valenciennes, 1847
Clupea suhia Chaudhuri, 1912
Gudusia godanahiai Srivastava, 1968
Gudusia chapra Hamilton, 1822

Local names:

Karati (Assam) Khoira (West Bengal); Palla (Punjab) and Gudua (Orissa)

Type Species: *Clupanodon chapra* Hamilton, 1822 (Hamilton-Buchanan, 1822, Fishes of Ganges: 248-383)

Type locality: Ganges River in northern Bihar (Hamilton-Buchanan, 1822, Fishes of Ganges: 248-383)

Conservation Status: Least concern. IUCN, 2021. The IUCN Red List of Threatened Species. Version 2021-1.

Table-3: Comparison of numerical counts of the fish under study

Citations	Fin rays		Lateral line		Scutes			
	Dorsal	Pectoral	Pelvic	Anal	Caudal	scale	Pre-Pelvic	Post- Pelvic Abdominal
Day, 1880	14-16	13	8	20-21	17	80-110	18-19	9-10
Bhuiyan, 1964	14-16	13	8	21-25	19			
Jayaram, 1981	16			21-24		80-120	18-19	8-10
Shafi & Quddus, 1982	14-15	13	8	21-25	19	80-120		
Rahman, 1989	14-15 (3/11-12)	13 (1/12)	7	23-25 (2/21-23)		85-105	17-19	9-10 26-29
Talwar & Jhingran, 1991	iv 11-13	i 12-13	i 7	(ii) iii 19-22		77-91		26-29
Tandon <i>et al.</i> , 1993	14-15	11-13	8	22-24	17-19	80-97		
Azadi & Rahman, 2008	14-15	13-14	7-8	23-25	18-19	82-118	18-19	9-10 27-28
Present Study (Fig. 1, 2)	16-17	13-14	8	19-21	18-20	79-91	17-18	13-14 31-32 (Rupnarayan River)
	16-17	14	8	19-20	18-20	80-82	15-16	9-10 25-26 (Kangsabati River)

G. chapra (Hamilton, 1822) were recorded from each selected study station of two different rivers during the study period. Present specimens are diagnosed morphometrically and meristically by following the literature of Talwar and Jhingran, 1991. Morphometric characterization is a most cost-effective tool for identification of the fish specimen (Cadrin & Silva, 2005; Chaklader *et al.*, 2015; Sidik *et al.*, 2021). The morpho-meristic characters differ in the same species due to environmental conditions of different geographical areas (Hamilton, 1822; Franicevic *et al.*, 2005). Some previous study also established the meristic counts for the species like Day (1880), Bhuiyan (1964), Jayaram (1981), Shafi & Quddus, (1982), Rahman (1989), Talwar & Jhingran (1991), Tandon *et al.*, 1993; Azadi & Rahman, 2008; Hossain *et al.*, 2021. Present observations agreed with Jayaram (1981) for number of dorsal fin rays and pre-pelvic scutes. This study also agreed with Talwar & Jhingran (1991) except dorsal fin rays and number of abdominal scutes. Literature survey reveals that occurrence of this fish specimen, *G. chapra* (Hamilton, 1822) in Rupnarayan River (Ghorai *et al.*, 2015) and Kangsabati River (Kar *et al.*, 2016) are fifty-two and thirty-two in number respectively. The abundance of the *G. chapra* (Hamilton, 1822) is peck in the month of July and the off or little presence shown in the month of April and rest of the year it is moderate in both river system. Adults are found in middle and upper reaches of rivers. The most important food item is debris, plankton and some algae (Mondal & Kaviraj, 2010). *G. chapra* (Hamilton, 1822) reached its highest size in the current study at 12.10 cm TL from the Rupnarayan River and 8 cm TL from the Kangsabati River, compared to maximum records of 20 cm TL in Bangladesh, 19 cm in Pakistan, and 17.6 cm TL for the specimens from the River Ganga in India (Sarkar *et al.*, 2013). During the study it has been found that the same meristic count for *G. chapra* (Hamilton, 1822) varies from habitat to habitat as shown in Table-3, especially for pectoral fin rays, anal fin rays, fin rays dorsal fin, lateral line scale number and abdominal scute

count. This variation in the current specimen may be brought on by environmental, seasonal, or food restrictions that prevent the fish from growing and developing properly.

Conclusively, the current study offers fresh and up-to-date details on the distribution, morphometrics, and meristic variation of *G. chapra* (Hamilton, 1822) between two riverine systems in West Bengal. Seasonally, the species was present at all survey locations along the rivers Rupnarayan and Kangsabati. It is important to establish a baseline for the morphometric and meristic analysis of *G. chapra* (Hamilton, 1842) from West Bengal's freshwater rivers Rupnarayan and Kansaboti. The study should be beneficial for *G. chapra* (Hamilton, 1822) stock assessment and management in the Rupnarayan and Kangsabati River and its surrounding habitats.

Table-4: Morphometric measurements (cm) of examined *Gudusia chapra* from Rupnarayan River and Kangsabati River.

#	Morphometric characters	Rupnarayan river	Kangsabati river
1.	Total length	11.2	9.64
2.	Fork length	9.69	8.59
3.	Standard length	8.88	8.06
4.	Head length	2.80	2.37
5.	Head depth	1.96	1.96
6.	Eye diameter	0.74	0.73
7.	Snout length	0.31	0.28
8.	Predorsal length	4.26	3.77
9.	Prepectoral length	2.83	2.34
10.	Prepelvic length	4.41	4.12
11.	Preanal length	6.36	5.59
12.	Dorsal fin length	1.47	1.44
13.	Pectoral fin length	1.66	1.47
14.	Pelvic fin length	1.05	0.78
15.	Anal fin length	1.63	1.55
16.	Caudal fin length	2.28	2.06
17.	Body depth	2.41	2.51

18. Pre orbital length	0.61	0.56
19. Post orbital length	2.19	1.24
20. Lower jaw length	1.10	0.94
21. Upper jaw length	0.93	0.84
22. Length of Caudal peduncle	0.83	0.83

Table-5: Meristic count of examined Gudusia chapra from Rupnarayan River and Kangsabati River

#	Meristic characters	Rupnarayan River	Kangsabati River
1	Dorsal fin rays	16-17	16-17
3	Pectoral fin rays	13-14	14
4	Pelvic fin rays	8	8
5	Anal fin rays	19-21	19-20
6	Caudal fin rays	18-20	18-20
7	Scales on lateral line	79-91	80-82
8	Scales above lateral line	7-8	7-8
9	Scales below lateral line	10-11	10-11
10	Pre dorsal scale	21-24	22
11	Circumpeduncular scale	7-8	7-8
12	Abdominal Scutes	31-32	25-26
13	Scutes (Prepelvic)	17-18	15-16
14	Scutes (Post pelvic)	13-14	9-10

Acknowledgement

We are thankful to Dr. Jayasree Laha, Principal, Raja Narendra Lal Khan Women's College (Autonomous) for providing laboratory facilities and support during the study periods. We are also expressing our deep sense of gratitude to the Department of Science & Technology and Biotechnology, West Bengal Government for sanctioning research grant in the form of a major research Project (ID: 350 (Sanc.)/ST/P/S&T/17G-13/2018) to A. Chanda, under which present work has been conducted.

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