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Checklist of Freshwater Mollusca (Gastropoda and Bivalvia) Recorded from the Buriganga and Turag Rivers, Dhaka, Bangladesh

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ABSTRACT Freshwater mollusks have received little attention from conservation scientists. We collected museum records and conducted an inventory of freshwater mollusks to develop a species checklist for the Buriganga and Turag Rivers. The study area extended from the Posthoghola Bridge (90°26´12" E and 23°40´25"N), Buriganga River to the Tangi Bridge, Turag River (90°24´29"E and 23°53´59"N). Surveys were conducted every two weeks from December 2012 to November 2013 in both rivers. During the survey period we collected mollusks by hand picking. A total of 17 species belonging to 8 families (Ariophantidae, Viviparidae, Pilidae, Thiaridae, Lymnaeidae, Unionidae, Cyrenidae and Solecurtidae) were identified from both rivers. Among the 17 species, 14 were identified in the Buriganga River and 12 species were found in the Turag River. *Corbicula fluminea* (O. F. Müller, 1774)*, Lymnaea luteola* (Lamarck 1822) and *Macrochlamys sequax* (Benson, 1859) were found in the Buriganga River and *Bellamya dissimilis* (Müller, 1774)*, Paludomus conica* (Gray, 1834) and *Novaculina gangetica* (Benson, 1853) were found in the Turag River. Muddy, sandy and stony benthic and littoral habitats were observed in both rivers. It is our hope that this study will stimulate additional mollusk research in this area.

KEY WORDS Freshwater Mollusca, Buriganga and Turag Rivers.

INTRODUCTION

Freshwater mollusks (Gastropod: Snails; Mussels: Bivalvia and Unionoida) are an important component of many healthy river ecosystems. In addition, freshwater mollusks often are used by various agencies to monitor environmental quality, including trends of chemical contamination (Rosenberg and Resh 1993; Supian & Ikhwanuddin, 2002). Mollusks are one of the most threatened major taxonomic groups worldwide, comprising 42% of all species extinctions (Lydeard *et al.,* 2004). Within this group, the freshwater mussels of the order Unionoida are highly threatened throughout their distribution (Bogan 1993). Today, the numbers of threatened species and species extinctions have increased at an alarming rate (Baillie *et al.,* 2004; Lydeard *et al*., 2004). Humans, directly or indirectly, are largely responsible for these species losses (Wilson 1989). Freshwater mollusks have been affected by both extrinsic factors such as habitat destruction, land-use practices, water pollution, reduction or loss of host plant and/or organisms like fish or substrates, and intrinsic characters such as growth and reproduction, which evolve in close relation with habitats (Stearns 1992; Petts *et al*., 1993; Richter *et al*., 1997; Primack 2002). One interesting intrinsic character is that of life span. Long-lived species generally grow slowly and have delayed maturity and low fecundity. Thus, long-lived species may tolerate short-term fluctuations in the environment, but if population numbers are severely reduced,

recovery may be slow, increasing the risk of extinction (Drechsler *et al*.,1999; Bauer 2001; Raimondo & Donaldson 2003; Wheeler *et al.,* 2003). Furthermore, the life cycle of all freshwater mussels includes a period during which mussels are dependent on a fish host (Nedeau *et al.,* 2009). Furthermore, mussels provide food for fish, birds, and mammals.

Thirteen species of freshwater bivalves (twelve native, one introduced) have been reported historically in the mainstream Columbia River (Frest and Johannes 1993). Stark (2001) found only rare occurrences of mussels during a study of macro-invertebrates on the Hanford Reach at three locations near several miles from the river. Twenty land, 22 freshwater and 437 marine and brackish water mollusks species belonging to 210 genera, 105 families and 23 orders under 4 classes have been recorded in Bangladesh (Siddiqui *et al.,* 2007). In September 2009, four rivers around the city of Dhaka city, the Buriganga, the Sitalakhaya, the Turag and the Balu, were declared as Ecologically Critical Areas (ECAs) by the Department of Environment, Bangladesh as part of the plan to protect the rivers from encroachment as well as for the conservation of their biodiversity. Current knowledge of freshwater mollusk populations in the Buriganga and the Turag Rivers is limited. Data describing fresh water mollusk species composition and other attributes are needed to aid in assessments of environmental quality of this river ecosystem. The objective of this study was to establish an inventory of mollusk taxa in the Buriganga and Turag Rivers and their tributaries to provide a more comprehensive characterization of the freshwater mollusk species composition in the study area.

MATERIALS AND METHODS

Study area: The study area extends from the Bangladesh - China Motri bridge, Buriganga river (90°26´12" E and 23°40´25"N) to the Tangi Bridge, Turag River (90°24´29"E and 23°53´59"N). Two surveys were conducted per month from December 2012 to November 2013.

Buriganga River: The Buriganga River is one of the most polluted rivers in the city of Dhaka. Half of the slope of the rivers within the study area is covered by concrete block and the remainder is dust, mud and sand habitat. It is also one of the most polluted rivers in Bangladesh.

Turag River: The Turag River is the upper tributary of the Buriganga River, a major river in Bangladesh. The river originates from the Bangshi River. The latter is an important tributary of the Dhaleshwari River which flows through Gazipur and joins the Buriganga at Mirpur. The Tongi khal links the Turag with the Balu River. The River bank covered by dust, mud, sand and vegetation habitat.

Survey Technique: Walking along the river banks and boat based surveys were conducted to locate and identify the freshwater mollusca. Specimens were collected by hand from the dry areas and scoop net were used in shallow waters. All samples were collected and transported to the fisheries laboratory, Department of Zoology, Jagannath University, Dhaka. Specimens were preserved in 95% ethanol for identification.

Identification: Species were identified based upon morphological characteristics of the shell and the taxa recognized by Frest and Johannes 1993, 1999; Amit and Roy 2008; Wayne 2003; Norman 1998 and Siddiqui *et al.,* 2007.

Riverbed Characterization: The river bed was classified into three categories: i. Muddy, ii. Sandy, and iii. Stony. Stony and sandy habitat can be found from Bangladesh to China Motri Bridge to Babu Bazar Bridge. Stony, sandy and muddy habitat can be found from Babu Bazar Bridge to Basilla Bridge. Muddy and vegetation habitat was found from Basilla Bridge to Amin Bazar Bridge. Sandy, muddy habitat was found from Amin Bazar Bridge to Tamanna Shishu Park and most of the muddy habitat was found from Tamanna Shishu Park to Tangi Bridge.

RESULTS AND DISCUSSION

Freshwater mollusks were assessed in the study area because of a lack of detailed surveys and basic biological information about these taxa in Bangladesh. A total of 17 species were recorded in the study area during the study period. The mollusk community was represented primarily by two classes' Gastropoda and Bivalvia. Among the 17 species, a total of 14 belonged to 12 genera, 7 families, and 5 orders. Two classes have been identified in the Buriganga River and 12 freshwater mollusk species belonging to 8 genera, 6 families, and 4 orders were found in the Turag River (Table 1) (Figure A). The gastropod fauna is represented by 10 species in the Buriganga and 7 species in the Turag River. The order Mesogastropoda is the largest in species number and is represented by 8 species of the families Viviparidae, Pilidae, Thiaridae and Lymnaeidae in the Buriganga River and by 6 species of the families Viviparidae, Pilidae, and the Thiaridae in the Turag River. The Viviparidae include three species in one genus. *Bellamya* include *B. crassa* in the Buriganga River and *B. dissimilis* in Turag River only, but *B. begalensis* was recorded from both rivers. The family Pilidae is represented by two species, *Pila globosa* and *P. virens*, which were collected in both rivers. The family Thiaridae included four genera. *Melanoides tuberculata* and *Sulcospira variabilis* were collected from the Buriganga River and *Paludomus conica* was collected from the Turag River, and *Brotia costula* occurred in both rivers. The Basommatophora order is represented by two species in two genera of the family Lamnaiedae. *Lymnea luteola* was documented in the Buriganga River only and *Indoplanorbis exustus* was observed in both rivers. The order Stylommatophora included one species *Macrochlamys sequax* in the family Ariophantida. The gastropod species *Bellamya begalensis*, *Brotia costula*, *Melanoides tuberculata* occurred in muddy, stony and sandy habitat in the Buriganga River. The bivalve fauna comprises 6 species in 4 genera, 3 families and 2 orders (Table 1).

Lamellidens marginalis, L. jenkinsianus, Parreysia corrugata were found in muddy and sandy habitat in the both rivers. *Corbicula fluminea* (O. F. Müller, 1774) was recorded from the Buriganga River and *Novaculina gangetica* documented from the Turag River. *Lamellidens jenkinsianus* and *Parreysia corrugata* are endemic to the Ganga and lower Brahmaputra River Systems. In the Barak River in India 16 species of mollusks (13 gastropods and 3 bivalve species) have been reported (Seba and Abhik 2010). Altogether 19 species (13 gastropod and 6 bivalve species) were recorded during the period from 2009 to 2010 in the Narmada Ruver, India. (Ankit and Vipin, 2012) (Table 2.) The diversity of mollusks in the Buriganga and Turag Rivervaries significantly. It should be noted that majority of the species on the list here are accepted by Prabakhar and Roy (2008). However, we have taken a morphological approach in reporting taxa; should future anatomical and molecular studies provide definitive taxonomic resolution in these groups, there will be a need to re-evaluate the

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Class & Order	Family	Scientific Name	English Name	Local Name	Habit	Habitat	Distribution	Status
Gastropoda								
Stylommatophora	Ariophantiae	*Macrochlamys sequax*	Disk Snail	Chakti Shamuk	Hr	V	B	R
Mesogastropoda	Viviparidae	*Bellamya begalensis*	River Snail	Guli Shamuk	H	St, S, D	M, Sa, K, R	VC
		Bellamya crassa	Pond Snail	Guli Shamuk	H	S, D	M, Ss, K	VC
		Bellamya dissimilis	Pond Snail	Guli shamuk	H	F	Tp, Pb	R
	Pilidae	*Pila globosa*	Common Apple-snail	Shamuk	H, A	F, M, D	W, B, R	VC
		Pila virens	Apple-snail	Bara Shamuk	H, A, O	F, M	W, B, R	FC
	Thiaridae	*Melanoides tuberculata*	Screw Snail	Pachano Shamuk	S	S	Sh, N, Ba	C
		Brotia costula	Brotia snail	Lomba Shamuk	H	S, St	M, Sh, Tp, Pb	C
		Paludomus conica	Canal snail	Paba shamuk	S	F	Tp	C
Basommatophora	Lymnaeidae	*Lymnaea luteola*	Lymneid Snail	Shamuk	H	St, S	M, K	R
		Indoplanorbis exustus	Ram's Horn Snail	Gari	Hr	S, M, D	M, Sa, Tp	VC
Bivalvia								
Unionoida	Unionidae	*Lamellidens corrianus*	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, Tp, Pb	VC
		Lamellidens jenkinsianus	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, R	VC
		Lamellidens marginalis	Fresh water Mussel	Jhinuk	H, C	S, M	B, Sh, Ba, Tp, Pb	VC
		Parreysia corrugata	Fresh water Mussel	Gol Jhinuk	H, C	S, M	Sh, Ba, Tp, Pb	C
Veneroidea	Cyrenidae	*Corbicula fluminea*	Asian Clam	Jhinuk	C	S, M	K, B	FC
	Solecurtidae	*Novaculina gangetica*	Ganges Clam	Lomba Jhinuk	H, C	M	Tp	C

Table 1: **Mollusca in the Buriganga and Turag Rivers, Dhaka**
Note: Millbarak = M, Sadarghat = Sa, Kamrangichar = K, Basilla = B, Washpur = W, Sholmasi = Sh, Nabinagar = N, Barabordasi = Ba, Rustampur = R, Tamanna park = Tp, Prothasha bridge = Pb, Hermaphroditic = Hr, Herbivorous = H, Amphibious = A, Oviparous = O, Carnivorous = C, Scavenger = S, Freshwater = F, Stony = St, Sandy = S, Muddy = M, Dust = D, Vegetation =.V. Very Common = VC, Fairly Common = FC, Common = C, and Rare = R

Specimens collected in this study as well as museum records in order to refine this list. There is currently uncertainty in mollusk taxonomy; taxonomy of some of the genera is in a highly confused state (Burch 1982); and there is extreme phenotypic variation in many groups (Dillon *et al.,* 2002; Britton and McMahon 2004). In this document, freshwater mollusks were included as part of the development of a long-term strategy for protection of these sites. This is a promising step toward the conservation of aquatic gastropods and bivalve in Buriganga-Turag Rivers and the listing of 17 species as being considered vulnerable due to water pollution and habitats loss, and larger distribution information for these taxa is certainly lacking. Additional efforts dedicated to studying freshwater mollusks will be needed to help identify key species and populations to support these efforts. We hope that the information presented in this paper will be useful to resource managers and welcome any future refinements of this initial list.

CONCLUSION

The present study elucidated the Mollusca diversity in the study area. Long term freshwater monitoring is required to develop ongoing estimates of the abundance, populations, and for the design of conservation and management programs.

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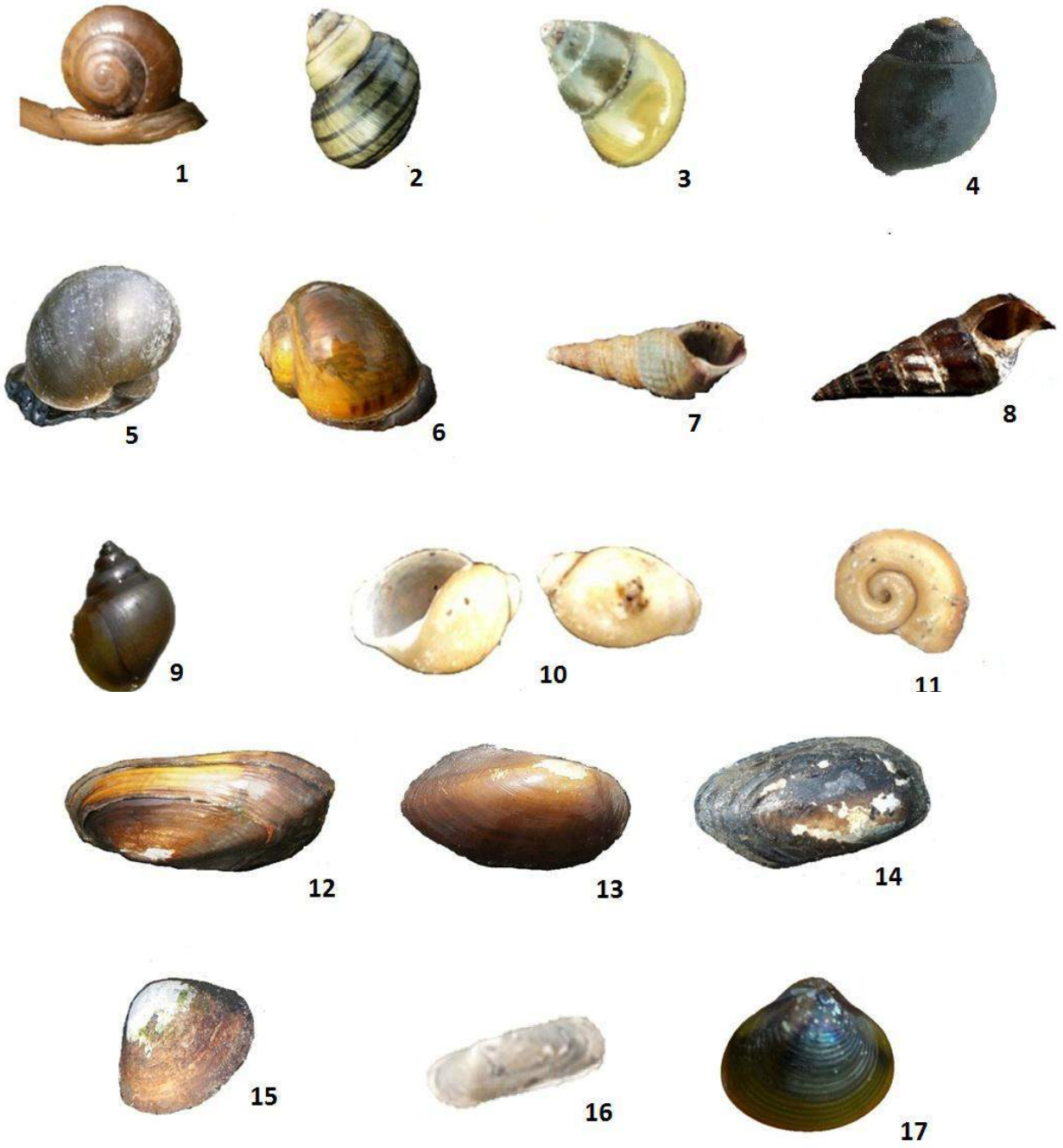

Figure: A. Freshwater mollusks in the Buriganga and Turag Rivers: **1**.*Macrochlamys sequax* (Benson, 1859) (9mm), **2.** *Bellamya begalensis* (Lamarck, 1822) (22 mm), **3**. *Bellamya crassa* (Benson, 1836) (18 mm), **4**. *Bellamya dissimilis* (Müller, 1774) (21 mm), **5**. *Pila globosa* (Swainson 1882), **6**. *Pila virens* (Lamarck, 1822) (38 mm), **7**. *Melanoides tuberculata* (Müller, 1774) (32 mm), **8**. *Brotia costula* (Rafinesque, 1833) (152 mm), **9**. *Paludomus conica* (Gray, 1834) (20 mm), **10**. *Lymnaea luteola* (Lamarck, 1822) (18 mm), **11**. *Indoplanorbis exustus* (Deshayes, 1834), **12**. *Lamellidens corrianus* (Lea, 1834) (70 mm), **13.** *Lamellidens jenkinsianus* (Benson, 1862) (68 mm), **14**. *Lamellidens marginalis* (Lamarck, 1819) (76 mm), **15**. *Parreysia corrugate.* (Müller, 1774) (42 mm), **16**. *Novaculina gangetica* (Benson, 1853) (45 mm); **17**. *Corbicula fluminea* (O. F. Müller, 1774) (26 mm).

Total Species	Gastropod	Bivalve	Water Body	Reference
23	18	5	Gialova lagoon, Greece	D. Koutsoubas *et al.* (2000)
16	13	3	River Barak, India	Seba and Abhik (2010)
19	13	6	River Narmada, India	Ankit and Vipin (2012)
34	34	-	Curonian Lagoon, Baltic Sea, Russia	Dmitry Filippenko (2011)
9	7	2	River Chenab, India	K. K. Sharma *et al.* (2010)
17	11	6	Buriganga -Turag river, Bangladesh	Present Study

Table 2: Mollusks collected from different rivers based upon the present study and literature reports.

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