

EVALUATION OF THE STATUS OF THREATENED CATFISH *BAGARIUS BAGARIUS* (HAMILTON, 1822) FROM THE PADMA AND MEGHNA RIVER STRETCHES OF BANGLADESH

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Key words: Bagarius bagarius, Biodiversity, Conservation

Abstract

Bagarius bagarius (Hamilton, 1822), a freshwater catfish species, is important as food and game fish in Bangladesh, Bhutan, India and Nepal. In Bangladesh, it is known as Baghair and has been enlisted as critically endangered (CR) species in the IUCN Red List of Bangladesh 2000 and 2015, under the criteria A2cd version 3.1 mentioning declining trend in its population around 80% during the last 25 years (3 generation time). We studied the abundance of *B. bagarius* at 8 sites in three riverine habitats. We identified 8 individuals of *B. bagarius* from the Meghna river only (Shibpur site, Bhola Sadar). However, focus group discussion with fishers revealed that the species was frequently present in the catch from the river, although the abundance reduced considerably over the decade. We also found several other studies which reported the abundance of *B. bagarius* in different natural habitats. The findings from this study in combination with other published literature in the last 5 years indicated that the current status of *B. bagarius* in natural waters in Bangladesh do not fall below the threshold limits of CR species. Therefore, *B. bagarius* should be reclassified into a lower threatened status (but not Least Concern) than the current CR.

Introduction

Though freshwater comprises less than 0.3% of available global water, it contains remarkably more than 15,000 freshwater fish species out of 32,500⁽¹⁾. Developing countries hold about 94% of all freshwater fisheries from where millions of the world's poorest people get their food, nutrition and livelihoods for surviving⁽²⁾. Freshwater fishes have been significant in balancing between ecosystems, regulating food web dynamics and nutrient balances. Freshwater fishes comprised of almost 260 species in Bangladesh⁽³⁾.

Regrettably, freshwater fishes are the most threatened group of vertebrates, based on more than 5,000 species assessed, to date, by the IUCN⁽⁴⁾. In Bangladesh, the abundance of freshwater fishes have been declining from the 1970s because of habitat loss, massive

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siltation, infrastructure development, drying up of water bodies, dewatering, conversion of wetlands, overfishing and aquatic pollution⁽⁵⁾. Consequently, the share of inland capture fisheries has declined remarkably. In 1983-84, the contribution of inland capture fisheries to total fish production was 62.6%, but in 2016-17 it declined to 27.03%⁽³⁾. Meanwhile, several fish species are on the verge of extinction, while many others are facing the risk of extinction in future⁽⁵⁾.

For assessing the risk of species extinction, the International Union for Conservation of Nature (IUCN) is recognized global authority for classifying species into different threat categories varying from high to low expectation of extinction⁽⁵⁾. Following a systematic evaluation, IUCN lists the species under seven different categories in the IUCN Red List of Threatened Species. Among the seven categories, two are for species those are already extinct (Extinct and Extinct in the wild), three are for those considered as threatened (Critically Endangered, Endangered, and Vulnerable), two are for those are not yet threatened (Near Threatened and Least Concern), whereas species without enough information to perform an evaluation are categorized as Data Deficient⁽⁶⁾. Thus, the IUCN Red List of Threatened Species enables conservation planners and decision makers to prioritize species when allocating resources for their conservation.

IUCN first assessed the conservation status of species from Bangladesh in 2000 and 54 fish species had been reported as threatened out of 266 species⁽⁶⁾. Fifteen years later, the second updated Red List of Threatened Species has been published in 2015 where 64 fish species were considered as threatened out of 253 freshwater fish species⁽⁵⁾. Thus more species have become threatened in 2015 compare to 2000. However, there is a decrease in Critically Endangered species by 25% and increase in Endangered and Vulnerable species by 21.4 and 78.5%, respectively, in the 2015 assessment⁽⁵⁾.

Bagarius bagarius (Hamilton, 1822), a freshwater fish in Bangladesh, is important both as food and game fish⁽⁷⁾. It is carnivorous fish; feeds on small fishes, prawns, frogs, insects, etc.⁽⁸⁻⁹⁾. Therefore, *B. bagarius* is also important as a predator in top down control of riverine food web. It has been enlisted as Critically Endangered (CR) species in both IUCN Red lists for Bangladesh in 2000 and 2015⁽⁵⁻⁶⁾. Species listed as CR in the red list categories are facing a very high risk of extinction in the wild. Therefore, CR designated species requires immediate conservation measures from government officials, researchers, conservationists, nature lovers and partner organizations. However, a number of studies have reported the occurrence and/or abundance of *B. bagarius* in riverine catches from various areas in Bangladesh⁽¹⁰⁻¹⁴⁾. The regular availability of this species in wild habitats in contrast to its conservation status in IUCN red list demands a comprehensive and comparative study on abundance of *B. bagarius* in natural habitats. However, high variability in the methodology of these studies limits the comparative analysis of abundance of this species over various water bodies. IUCN assesses the threats level to a species based on the information from published books, research

articles, scientific reports and other research findings, but information from the grey literature (unpublished material) and scientists' years of experience and observations are also used⁽⁶⁾. Therefore, we collected primary data on abundance and reviewed the existing literature on *B. bagarius* to investigate its current status in Bangladesh.

Materials and Methods

The study was conducted in the three major rivers in Bangladesh - the Padma, the Meghna and the Tentulia. Fish specimen were collected from eight landing centers (Table 1) from previously contacted fishers. Gear specific fish specimen were collected during pre-monsoon (June), monsoon (August) and post-monsoon (October and February) seasons in 2016. Local fishers were solicited not to throw the non-target species by explaining the implication of both target and non-target species for this study. 10% of the total catch from each type of gear were collected as sample and immediately stored in an insulated box with sufficient ice for investigation in the laboratory. Individuals of *B. bagarius* were identified from the samples based on morphometric and meristic characteristics^(9,15). The number of individuals of *B. bagarius* in each sample were recorded and length (cm) and weight (g) of each individual were also recorded to the first decimal place.

Table 1. Location of fish sampling sites in the three rivers in Bangladesh.

River	Site No.	Landing station	Union	Upazila	District
Tentulia river	S1	Hajir Hat	Dashmina	Dashmina	Patuakhali
	S2	Bogi	Kalaya	Bauphal	Patuakhali
Meghna river	S3	Gosher Hat	Nilkamal	Char Fassion	Bhola
	S4	Shibpur	Shibpur	Bhola Sadar	Bhola
	S5	Bohria Ghat	Sakhuya	Chandpur Sadar	Chandpur
	S6	Meghna Ghat	Boidder Bazar	Sonargaon	Narayanganj
Padma river	S7	Chairman Station	Uttor Tarabonia	Bhedarganj	Shariatpur
	S8	Mawa Ghat	Mawa	Louhojonj	Munshiganj

Information on habitat, food habit, trophic status, threats of reduction, etc. of *B. bagarius* were collected from literature. Focus Group Discussions (FGD) were conducted along the river side at Shibpur, Bhola district during November 2016 to collect fishers' experience on habitats, catch trend, causes of decline/increase in abundance, etc. 15 local fishers were participated in an FGD that lasted for 3 hours.

The abundance data in the present study was combined with FGD findings and published articles and reports to assess the status of *B. bagarius* following the assessment criteria of IUCN summarized in Table 2.

Table 2. Summary of assessment criteria of a species to be listed as critically endangered in Red List of species (IUCN 2015).

CRITICALLY ENDANGERED (CR) A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

- A.** Reduction in population size based on any of the following:
1. An observed, estimated, inferred or suspected population size reduction of 90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following: (a) direct observation (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
 2. An observed, estimated, inferred or suspected population size reduction of 80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood or may not be reversible, based on (and specifying) any of (a) to (e) under A1.
 3. A population size reduction of 80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
 4. An observed, estimated, inferred, projected or suspected population size reduction of 80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.
- B.** Geographic range in the form of either B1 (extent of occurrence) or B2 (area of occupancy) or both:
1. Extent of occurrence (‘‘EOO) estimated to be less than 100 km², and estimates indicating at least two of a - c:
 - (a) Severely fragmented or known to exist at only a single location. (b) Continuing decline, observed, inferred or projected, in any of the following: (i) extent of occurrence (ii) area of occupancy (iii) area, extent and/or quality of habitat (iv) number of locations or subpopulations (v) number of mature individuals. (c) Extreme fluctuations in any of the following: (i) extent of occurrence (ii) area of occupancy (iii) number of locations or subpopulations (iv) number of mature individuals.
 2. Area of occupancy (‘‘AOO) estimated to be less than 10 km², and estimate indicating at least two of a - c: (a) Severely fragmented or known to exist at only a single location. (b) Continuing decline, observed, inferred or projected, in any of the following: i) extent of occurrence ii) area of occupancy iii) area, extent and/or quality of habitat iv) number of locations or subpopulations v) number of mature individuals. (c) Extreme fluctuations in any of the following: (i) extent of occurrence (ii) area of occupancy (iii) number of locations or subpopulations (iv) number of mature individuals.
- C.** Population size estimated to number fewer than 250 mature individuals and either: 1. An
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estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR 2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b): (a) Population structure in the form of one of the following: (i) no subpopulation estimated to contain more than 50 mature individuals, OR (ii) at least 90% of mature individuals in one subpopulation. (b) Extreme fluctuations in number of mature individuals.

- D. Population size estimated to number fewer than 50 mature individuals.
 - E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).
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'EOO: The area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy.

**AOO: The area which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats.

Results and Discussion

Habitat: *Bagarius bagarius* was found only from Shibpur site (S4) at Bhola Sadar Upazila in the Meghna river area out of eight sampling sites (Table 1, Fig. 1). The Meghna river is one of the largest and deepest rivers of Bangladesh. *B. bagarius* was found at midstream areas of the sampling locations where only medium wave actions were observed. The area was connected to local canals and experienced two times high and low tide daily. Strips of sandy land were raised in the river bed areas.

From author's Personal Communication (2017) with Department of Fisheries (DoF) officials, it is informed that *B. bagarius* has been noticed at Kala Badar river, Barisal in 2016⁽¹⁶⁾. Recently, it was found from the Padma river at Goalondo Upazila, Rajbari district⁽¹⁷⁾.

B. bagarius lives in large rivers, particularly in deep areas⁽¹⁸⁾. It prefers fast flowing waters and lives under stones and bog logs. *B. bagarius* has also been reported from the Padma, Jamuna, Meghna, Daleswari, Bangali, Baral, Choto Jamuna, Surma, Kushiya, Manu Baral, Mahananda, Kangsha, Brahmaputra, Titas and Karnafully Rivers, Chalan Beel and Kaptai Reservoir⁽⁵⁻⁶⁾.

Habitat types: *B. bagarius* samples were found in freshwater during this study period. Generally it lives in freshwater and the pH of the habitat usually ranges from 6.5 to 7.8⁽¹⁹⁾. Temperature of the water usually ranges from 18 - 25°C⁽²⁰⁾.

Seasonal abundance: *B. bagarius* was found only at monsoon period in the month of August. A total of 8 individuals were identified at Shibpur station, Bhola district in the Meghna river.

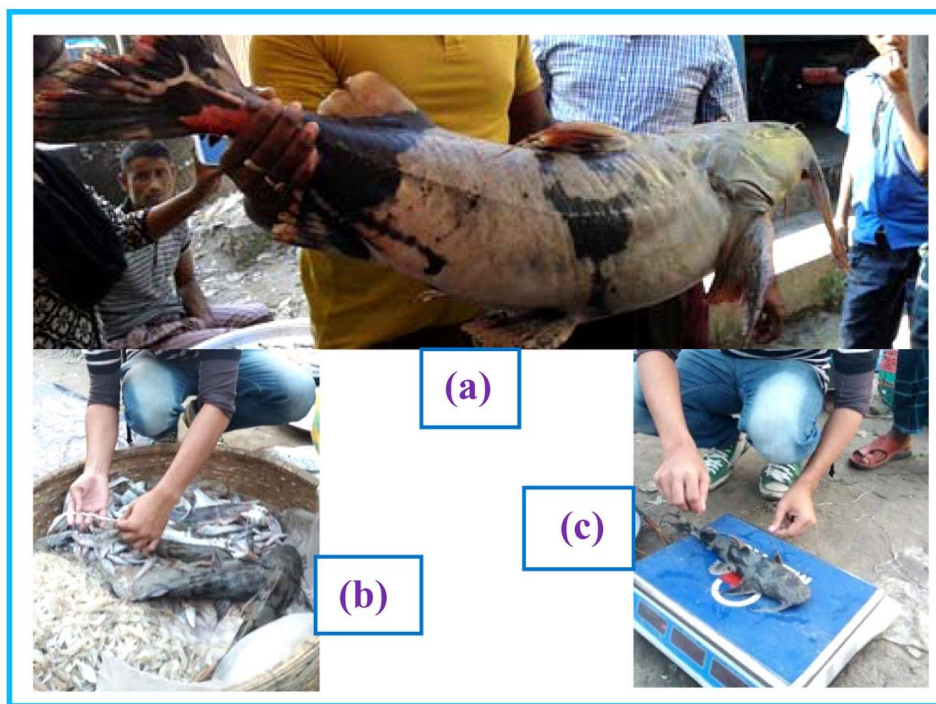


Fig. 1a-c: *B. bagarius* samples of different sizes. Photographs were taken by one of the authors from the Meghna River, in August 2016

Table 3. Length and weight of *B. bagarius* samples.

Scientific name	Sample No.	Length (cm)	Mean \pm Sd	Weight (g)	Mean \pm Sd
<i>Bagarius bagarius</i>	1	21	± 1.51	45	± 0.009
	2	18.1		36	
	3	16.6		24	
	4	18.6		42	
	5	17.1		25	
	6	16.1		20	
	7	17.9		32	
	8	18.5		40	

Length and weight: The length (cm) and weight (g) of all the collected samples are mentioned in Table 3. Among them the maximum length and weight of the collected *B. bagarius* specimens were recorded as 21 cm and 45 g, respectively. Length of this species was previously recorded as 20 - 39 cm (6), 39 cm (8 - 9), 19 cm (21). It is to be noted

that *B. bagarius* breeds before the commencement of the monsoon rains (21) which might be the reason of availability of smaller size or juvenile fish.

Food and feeding habit: *B. bagarius* is carnivorous and predatory in nature feeding on small fishes, prawns, frogs, etc. (known from FGD at site S4: Table 1). It usually feeds on small fishes, but also preys frogs and shrimps⁽⁹⁾.

Threats of reduction: The population of *B. bagarius* has been declining since the 1990s and the cumulative population decline would be around 80% during the last 25 years (3 generation time)⁽¹⁸⁾. A further reduction may happen because of habitat loss and its export potential⁽¹⁸⁾. Although the studied species was recorded only during monsoon in the samples, FGD revealed that it was recorded frequently in fishers' catch from Meghna river, specifically using hook and line. The FGD participants also reported that the availability of larger size (>30 cm) *B. bagarius* was extremely rare in recent years (~5 years).

Reassessment of threatened category: To conserve open water fish biodiversity, the Department of Fisheries, Government of Bangladesh in collaboration with NGOs has been implementing a set of interventions like establishment and maintenance of fish sanctuaries, fish habitat restoration, establishment of beel nurseries, stocking of fingerlings including endangered species, introduction of coordinated management approach, excavation and re-excavation of different connecting canals of rivers, dead rivers and beels, enforcement of fish conservation acts, adoption of climate-smart technologies etc.⁽³⁾. While the various management and conservation interventions can improve the status of a species, increased fishing pressure, habitat loss and other causes can lead to the opposite scenario. Therefore, IUCN periodically updates its Red List of Threatened Species to address the potential positive or negative change to a degree of extinction risk of a species. The findings from the present study emphasize the necessity of revising threat categories assigned on *B. bagarius* over IUCN red list assessment criteria for critically endangered species.

According to IUCN (2015)⁽⁵⁾, a taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria of A to E in the Table 2. *B. bagarius* was assessed as CR species in IUCN Red List of Bangladesh (2015) under CR A2cd ver 3.1 referring the declining trend in its population would be around 80% during the last 25 years (3 generation time)⁽¹⁸⁾. But, FGD participants of the present study remarked that although the abundance of *B. bagarius* has been reducing comparing the decade before, they have noticed the good presence of this species in their catch.

According to the criteria B1 and B2, EOO estimated to be less than 100 km² and AOO estimated to be less than 10 km², respectively for CR species. For *B. bagarius*, the recorded EOO was 82,772 km² and AOO was 9,432 km²⁽⁵⁾ which are too much greater than the thresholds of CR category. The findings of the present study will also increase the EOO and AOO for *B. bagarius*.

On the other hand, according to criteria C, the population size estimated to number fewer than 250 mature individuals and according to the criteria D, the population size estimated to number fewer than 50 mature individuals. The number of individuals reported in this study accounts for only 10% of the total catch at the study site. Therefore, total number of individuals caught by all gear types is potentially as high as 80 which was also higher than the threshold limit for criteria D. Based on the abundance in the current study and other studies in Bangladesh it can be inferred that the total abundance of mature *B. bagarius* is expected to be well over 250 in the natural habitats. Therefore, the current status of *B. bagarius* in natural waters in Bangladesh do not fall below the threshold limits of CR species.

Critically endangered species are of high conservation concern among the policymakers, as they are at high risk of extinction. Although *B. bagarius* is enlisted as critically endangered species in the IUCN Red List of Bangladesh, the findings from this study suggests that the species possess lower risk to extinction based on the criteria for CR in the IUCN assessment. Therefore, *B. bagarius* should be reclassified into a lower threatened status (but not Least Concern) than the current CR.

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(Manuscript received on 3 June, 2018; revised on 18 November, 2018)