

ISSN (online): 3006-5542; ISSN (print): 3006-5534

Fisheries Studies



Journal homepage: www.journal.inrrd.com/fs

Threatened species Series

Threatened fishes of the world *Rita rita* (Hamilton, 1822) (Order: Siluriformes) Recommendations for Sustainable Conservation

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ARTICLE INFO

Article history

Received 24 February 2024 Revised 28 April 2024 Accepted 06 May 2024 Available online 11 May 2024

Keywords Rita rita Conservation Endangered species Size at sexual maturity SDGs

ABSTRACT

Rita rita, is a threatened catfish species valued for its high nutritional content, which faces significant survival challenges, primarily due to habitat loss and overfishing. This study provides a comprehensive overview of the biology, ecology, and conservation status of *R. rita*. This paper reviewed the current conservation status of *R. rita*, highlighting its ecological importance and the challenges that it encounters in its native habitats across Southeast Asia. The findings underscore the urgent need for conservation measures, including habitat protection, sustainable fishing practices, and captive breeding programs. By understanding threats and implementing effective conservation strategies, we can enhance the prospects for the survival of this valuable species, and increasing awareness of the species' ecological significance can preserve its existence for future generations. The study supports SDG 14, 15, and 1 by conserving the threatened fish, protecting its habitats, and ensuring sustainable livelihoods via measures like habitat protection and captive-breeding for ecological and economic stability as it is essential for future aquaculture development.

Introduction

The catfish *Rita rita* (Hamilton 1822) belongs to the family Bagridae and the order Siluriformes. The Rita genus includes six extant species; among them, only *R. rita* is available in Bangladesh (DoF 2014; Siddiqui et al. 2007; Rahman 2005). Its habitats include freshwater estuaries and coastal water bodies (Yashpal et al. 2006; Rahman 2005; Shaji 1995; Talwar and Jhingran 1991; Chondar 1999; Mirza 1982). It is a commercially important catfish (Rafiq-

Recently, *R. rita* has also gained attention in the ornamental fish trade and has been exported from India as an indigenous ornamental species. This dual importance, both as a food and ornamental fish, highlights its growing

ue and Khan 2012), contributing significantly to fisheries in the major rivers of the Indo-Gangetic plains (Rahman 2005; Tripathi 1996; Dubey 1994). The Rita fish is highly regarded as a food fish for its excellent taste and potential health benefits, making it popular and commanding a premium price in the marketplace (Jafri et al. 1964).

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economic value (Gupta and Banerjee 2017). According to the IUCN red rist, *R. rita* was facing a very high risk of extinction in the wild and was listed as an endangered fish in Bangladesh (IUCN Bangladesh 2015) and listed as least concerned globally. The primary threats to this species include habitat degradation, overfishing, and changes in its natural habitat causes degradation of breeding grounds.

The conservation status of *R. rita* varies across countries like Bangladesh, India, Pakistan, and Nepal, but it is facing significant challenges in many regions of South Asia. To ensure the sustainability of the *R. rita* population in Bangladesh, it is crucial to develop and implement effective management and conservation strategies. Several studies have been conducted, including those on morphology, length-weight relationships, length-length relationships, reproduction, feeding habits, genetics, and captive breeding, as outlined in Table 1.

Despite the ecological significance of R. *rita* in Bangladesh, there is currently a lack of comprehensive research and documentation on this species. This gap hinders the development of effective management

Fisheries Studies 02 (2024) 21-30

and conservation strategies. Therefore, this document aims to serve as a foundational resource for developing appropriate management and conservation strategies for *R. rita* in Bangladesh.

Taxonomic remarks

Kingdom: Animalia Phylum: Chordata Class: Actinopterygii Family: Bagridae Genus: *Rita* Species: *Rita rita* (Hamilton, 1822)

Synonyms

Pimelodus rita (Hamilton, 1822) *Arius ritoides* (Cuvier and Valenciennes, 1840) *Rita ritoides* (Cuvier and Valenciennes, 1840) *Arius rita* (Cuvier and Valenciennes, 1840) *Rita crucigera* (Owen, 1853) *Rita buchanani* (Bleeker, 1854)

Morphological characters

The fish species *R. rita* has some distinct physical characteristics that make it stand out (Talwar and Jhingran 1991; Day 1888). Its body is stout and solid,

Fable 1	1. Available	studies	on Rita	rita from	different	countries
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Aspects	Country/region	Reference
Feeding and Reproductive Biology.	India	Ankita et al. (2023)
Seasonal food items and feeding habits.	Brazil	Haque et al. (2021)
Genetic Diversity and Population Structure Revealed by Heterologous DNA Microsatellite Markers	Bangladesh	Ali et al. (2021)
Broodstock development, captive breeding and seed production	India	Ferosekhan et al. (2019)
Influence of stocking density on the culture potential in raceway	Bangladesh	Ali et al. (2018)
Stocking Density and its Effect on Growth Parameters	Pakistan	Jalbani et al. (2018a)
Highlight Haemoglobin Concentration	Pakistan	Jalbani et al. (2018b)
Nutritional composition	India	Mitra et al. (2017)
Feeding and reproductive behavior	India	Alam et al. (2016)
Food and feeding habit	Bangladesh	Mushaida-Al-Noor et al. (2013)
Length-length and length-weight relationships	Padma river, Bangladesh	Mushaida-Al-Noor (2013)
Breeding season	Bangladesh	Rahman and Mollah (2013)
Induced Breeding and Larvae Rearing.	Bangladesh	Taslima and Mollah (2012)
Morphological characteristics	India	Yashpal et al. (2006)
Biological features	North India	Devi et al. (1990)

lacking any scales, while the belly is flat and broad. Large, broad, and flattened head from both top to bottom, giving it a compressed look. There's a short median groove on the head, though it's not visible from the outside and doesn't extend to the occipital process's base, which is the bony ridge at the back of the head. This occipital process is one to two times longer than it is broad, notched at the back, and it reaches to the dorsal fin base (Gupta 2015).

The mouth of *R*. *rita* is positioned underneath and stretches widely, nearly half the length of its head. Its teeth come in different forms; the upper jaw is lined with villiform (brush-like) and conical teeth in a slight curve, arranged in two separate elliptical patches, sometimes connected at the top. This species has three pairs of barbells, which are whisker-like sensory organs. The maxillary barbells (on the sides of the mouth) extend to the operculum (gill cover), while the nasal barbells are much shorter. The mandibular barbells (on the lower jaw) reach the pre-operculum (Gupta 2015). The thick, robust, hollow spine of the first dorsal fin features little serrations on the rear margin. There's also a second dorsal fin, which is adipose (a soft fin without rays) and well developed. The pectoral fin spine is serrated on both edges and is shorter than the dorsal spine. The caudal (tail) fin is profoundly forked, with both lobes of identical size, while the pelvic fins are spineless. R. rita's coloring is dull white on the bottom and greenish-grey on the sides and upper body (Fig. 1). The available fin formulae are-

D1. 7 (I/6); D2. 0; A. 13-14 (4-5/9); P. I/10; V. 8; C. 19 (Shafi and Quddus 2001)

D. 11/6; P1. 1/10; P2. 8; A. 11-13 (Rahman, 1989 and 2005)

D I 6; A ii 10-11; P I 10; V i 6-7 (Talwar and Jhingran 1991)



Fig. 1. *Rita rita* collected from the Ganges River in Bangladesh on 5th October, 2024 (a) Vertical view and (b) Horizontal view

D1. 7 (I/6); D2. 0; A. 12-13 (4-5/9); P. I/10; V. 8; C. 19 (Bhuiyan 1964).

Common name

The fish *R. rita* is referred to as Ritha or Rida in Bangladesh (Alam et al. 2016; Mollah 2015). Although the common name varies widely among various nations, it is typically referred to as Reta, Reti, Khagga in India (Daniels 2002; Talwar and Jhingran 1991), Belaunda, and Chona in Nepal (Shrestha 1994). The local language and cultural background may influence the particular name.

Distribution and abundance

The species is found in shallow, muddy to clear river, estuary, and reservoir waters in north India, Pakistan, Bangladesh, Myanmar, Nepal, and Afghanistan (Jayram 2006; Talwar and Jhingran 1991) (Fig. 2). Arial Kha, Padma, Barnai river of Rajshahi, Bangali river of Bogra, Baral river of Natore, Choto Jamuna river and Brahmaputra river in Kurigram district, Turag river at Dhaka district, Mahananda river at Chapai Nawabganj district, Chalan beel, Medha beel, Ichhanoi beel at Palashbari upzila of Gaibandha, upazilla of Kolmakanda, Netrokona, Someshari and Kangsha river of Netrakona, Kritonkhola, Barisal, Surma river in Sylhet, Sunamganj, Rupsha river of Khulna, Meghna river in Chandpur and Bhairab, Baleswar river of Pirojpur are among the places in Bangladesh where they are found (Ahmed 2015; Gupta 2015; Hossain et al. 2012).



Fig. 2. Distribution of *Rita rita* in South Asian region

Habitat and ecology

The riverine fish *R. rita* prefers clear or muddy water

and lives on the bottom (Mushaida-Al-Noor and Sayeda 2013; Rahman 2005; Sreshtha 1990). This species inhabits both fresh and brackish waters (Bhuiyan, 1964) and is potamodromous, exhibiting carnivorous habits (Mollah 2015). Despite being primarily a freshwater species, it can survive low salinity conditions (Talwar and Jhingran 1991). It has been seen to be fairly tolerant of cold-water conditions in the fast streams of the Darjeeling area as well as the mid- and upper-reaches of the Yamuna and Ganga rivers at higher elevations. Additionally, it can withstand unusual environments (Chondar 1999), high turbidity, and low dissolved oxygen concentrations. Due to its high tolerance limit for changing conditions, additionally, this fish species has been considered as an indicator for monitoring aquatic pollution. (Al-Arabi et al. 2002; Mukhopadhyay et al. 1994).

Food and feeding behavior

Generally, they are carnivorous in nature throughout their life cycle; the bottom and column feeder fry consume microscopic cladocerans and copepods to macroscopic spawn and fry of fishes (Gupta 2015). In adult stage, it mostly eats insects, prawns, molluscs, fish, and rotifers (Rahman 2005; Bhuiyan 1964), but in early stages of life, it also consumes aquatic plants and insects (Mushaida Al-Noor et al. 2013; Bhuiyan 1964).

Nutritional profile

R. rita fish is a rich source of protein and essential nutrients. According to Mitra et al. (2017) compared to other teleosts and catfish *R. rita* fish's muscles have higher protein, lower fat, and a good source of minerals. It is rich in minerals like calcium, iron, zinc, and selenium (Hicks et al. 2019). A comparative nutritional profile of *R. rita* is given in Table 2. Its balanced fatty acid profile supports heart health. *R. rita* fish offers health benefits like muscle repair, heart health, and cognitive function.

Growth pattern

Froese et al. (2014) calculated the Bayesian lengthweight for this species, with a = 0.0100 (0.0060 - 0.0166) and b = 3.01 (2.87 - 3.15) cm TL, according to LWR estimates, which indicates a positive allometric growth pattern. Similar growth pattern was also reported by Laghari et al. (2009) and Devi et al. (1991) cemented cisterns, Jamshoro, Sindh, Pakistan and Yamuna river, north India, respectively. However,

Table 2. Nutrient profile of Rita rita

NT / • /	Values				
Nutrient	Mitra et al. (2017)	Hicks et al. (2019)			
Calcium (mg/100g)	110.00-190.00	128			
Iron (mg/100g)	6.18 - 6.72	4.88			
Selenium (µg/100g)	-	75.1			
Zinc (mg/100g)	3.31 - 4.23	3.31			
Protein (g/100g)	17.6 - 19.6	18.1			
Fat (g/100g)	1.01 - 2.70	-			
Minerals (g/100g)	0.89 - 1.07	-			
Total Omega-3 PUFA (g/100g)	-	0.18			
Vitamin A (µg/100g)	-	9.69			

PUFA; Poly Unsaturated Fatty Acid

negative allometric growth pattern was observed by Kumar et al. (2019); Baitha et al. (2018); and Muhammad et al. (2017) in middle stretch of Ganga River, India, River Ganga, India, and Indus River, Taunsa Barrage, Pakistan (Table 3).

Form factor $(a_{3,\theta})$

We calculate the form factor with the formula: $a_{3,0} = 10^{\log a \cdot s(b-3)}$ (Froese, 2006) where *a* and *b* represent the LWRs' regression parameters and *s* represents the slope of log *a vs. b*. A mean slope (*s*) of -1.358 was used for the regression analysis of log *a vs. b*. The calculated form factor ($a_{3,0}$) was to vary between 0.0053 and 0.0089, indicating moderately elongated body shape, as shown in (Table 3).

Reproductive biology

In *R. rita*, there are a few keys sexually dimorphic traits that make it easier to tell males and females apart. The males have a smooth posterior margin slightly above the base of the pectoral spine. In contrast, females have both an anterior and posterior margin that are serrated, and these serrations run from the tip to the base of the pectoral spine. These differences in the pectoral spine's structure are helpful in distinguishing between the sexes of this species (Devi et al. 1991). During the breeding season, a male's muscular genital papilla

Aubic of O of the pattern of filler from anterent frater of our	Table 3.	Growth	pattern	of Rita	rita fror	n different	water	bodies
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Locality/Habitat	TL (cm)	a	b	Sex	r^2	References	<i>a</i> _{3.0}
Middle stretch of Ganga river,	5.7 - 65.8	0.017	2.96	Unsexed	0.97	Kumar et al. (2019)	0.0150
India							
River Ganga, India	9.7 - 64.9	0.016	2.94	Unsexed	0.98	Baitha et al. (2018)	0.0133
Indus River, Taunsa Barrage,	5.5 - 64.9	0.0158	2.92	Unsexed	0.97	Mohammad et al. (2015)	0.0120
Pakistan							
Cemented cisterns, Jamshoro,	13.9 - 41.7	0.0024	3.56	Combined	-	Laghari et al. (2009)	-
Sindh, Pakistan							
Yamuna river, north India	-	0.0114	3.166	Female	0.97	Devi et al. (1991)	0.0192
Yamuna river, north India	-	0.0167	2.952	Male	0.897	Devi et al. (1991)	0.0143

TL; total length; a, Intercept; b, Slope; r^2 , coefficient of correlation; $a_{3.0}$, form factor

becomes more noticeable and distinct. Due to the proliferation of blood vessels, the papilla's tip turns a deep red color during this time (Devi et al. 1991; Saxena 1972). In males, the genital aperture is slit-like and introverted, but in females, it is big, extrovert, and inflated (Chondar 1999). Mature males and females were identified by sexual dimorphism and a macroscopic inspection of the gonads. Male fish have a pale, slit-like vent, while female fish have a circular, reddish vent (Ankita et al. 2023) (Table 4).

Saxena (1972) reported that females tend to dominate the population, with the length at first maturity for females being around 29.5 cm. In addition, we calculated the minimal size at sexual maturity (L_m) of *R. rita* using the maximum length-based model formulated by Binohlan and Froese (2009) as log (L_m) = -0.1189 +0.9157 *log (L_{max}) given in Table 5.

The fecundity, or the number of eggs a female can produce, has varied across different studies. Das (1964) and Khan (1934) documented fecundities of 20,800 and 12,000 eggs, respectively. However, Saxena (1972) observed a much broader fecundity range, between 40,377 and 169,581 eggs. Another study by Rahman and Mollah (2013) observed a fecundity range of 37307 to 60114 eggs.

Additionally, breeding season of *R. rita* differs by location. In India, in Punjab, it breeds in June (Khan 1934), whereas at Uttar Pradesh, the natural spawning season occurs in July (Das 1964). Depending on the availability of its larvae and juveniles, in the Ganga the species would reproduce from March to August (Karamchandani and Motwani 1955). On the other

breeding season, which runs from May to September and peaks in July and August. In Bangladesh's ancient Brahmaputra River, the species breeds from June to July (Rahman and Mollah 2013) (Table 6).

Genetics

According to Arkhipchuk (1999), NBFGR (1998), Klinkhardt et al. (1995), and LeGrande (1981), *R. rita* possesses diploid chromosome number 54. Ali et al. (2021) conducted a genetic analysis of 200 *R. rita* catfish from four rivers in Bangladesh. Their findings revealed significant differences in genetic diversity among the populations. The Meghna population exhibited high genetic diversity, while the Kangsa population displayed low diversity. Furthermore, all populations deviated from the Hardy-Weinberg equilibrium, suggesting that they were not randomly mating and were likely subject to factors such as genetic drift, selection, or migration.

Conservation status

Due to habitat degradation, in Bangladesh it is classified as endangered fish (IUCN Bangladesh 2015). This classification reflects the species very high risk of extinction in the wild due to several significant threats, near threatened in India (Molur and Walker 1998). In recent time it is listed as least concerned worldwide (IUCN 2025).

Threats

Due to overexploitation and the loss of breeding grounds, *R. rita* populations are presently in very high risk of being extinct in the wild. Several changes in ecology, such as habitat degradation, water pollution,

and the destruction of natural spawning areas, have significantly impacted their ability to survive and

and Taslima and Mollah (2012). Both studies recommended 100 mg/kg of body weight pituitary

Table 4. Macroscopic description of gonadal maturation in *Rita rita* (source: Ankita et al. 2023)

Ovarian classification	Morphological description	Testis classification	Morphological description
Immature	Oocytes are invisible to the human eye; the ovary is slender and ribbon-like; it is whitish, transparent, and has fewer blood vessels.	Immature	The testis was thin, white, translucent, and ribbon-like.
Maturing	Oocytes were visible to the unaided eye; the ovary was reddish in colour; and there were blood capillaries all throughout it.	Maturing	Larger than stage one and ranging in colour from whitish to bright pink. There are more blood capillaries.
Mature	The ovaries were enlarged and both lobules were the same size; the colour was yellowish; The ovary took up the whole cavity, and vascularization was noticeable; Under little pressure, the oocytes extruded.	Mature	Testis with maximum size and coloured as possible is creamy; Vascularization was clearly visible; Intense and extensive.

Table 5. Minimum size at sexual maturity of Rita rita from different region

Locality/Habitat	$L_{max}(\mathbf{cm})$	Sex	References	Estimated (<i>L_m</i>)
Middle strech of Ganga River,	65.8 TL	Unsexed	Kumar et al. (2019)	35.16
India				
River Ganga, India	64.9 TL	Unsexed	Baitha et al. (2018)	34.72
Indus River, Taunsa Barrage,	64.9 TL	Unsexed	Mohammad et al. (2017)	34.72
Pakistan				
Cemented cisterns, Jamshoro,	41.7 TL	Combined	Laghari et al. (2009)	23.16
Sindh, Pakistan				

reproduce (Mishra et al. 2009; Mollah et al. 2008; Devi et al. 1991). Unfortunately, these fish are struggling to adapt to the rapid environmental changes in their natural habitat, putting their populations at risk. Conservation efforts are urgently needed to protect this species from further decline.

Conservation action

Experts have recommended that one of the noblest methods for promoting the conservation of any fish species to date is captive breeding. To be successful in this endeavor, one must have adequate knowledge of the dietary habits and reproductive biology of the target species of fish. Numerous studies have been conducted on these two characteristics of *R. rita* (Bezbaruah 2025; Waseem et al. 2025; Ferosekhan et al. 2022; Ali et al. 2021; Haque et al. 2021; Gupta 2015). Carp pituitary extract has been used in attempts to induce-bred for this species by Mollah et al. (2008)

extract to maximize ovulation, fertilization, and hatching success.

Conservation recommendation

The conservation status of *R. rita* has not been updated for over a decade. Therefore, a new study is necessary to assess its current population in Bangladesh and India. It is crucial to identify the remaining habitats and take measures to protect the species, including: banning fishing during the breeding period to safeguard brood-stock, implementing size-specific catch to conserve juveniles, curbing overharvesting, and addressing ecological factors threatening breeding grounds (Gupta 2015). Carp pituitary extract has already been used to successfully induce bred *R. rita* in captivity by Mollah et al. (2008) and Taslima and Mollah (2012); but further investigation is needed to ascertain the potential of artificial inducing agents for captive breeding (Hossain et al. 2015). While induced

breeding using carp pituitary extract has been successful, further research on synthetic agents and proper rearing techniques is needed to ensure

Table 6. Spawning season of *Rita rita* from different waterbodies

Region	Spawning Season	References		
Punjab, India	June	Khan (1934)		
Uttar Pradesh, India	July	Das (1964)		
Ganga River, India	March to August	Karamchandani and Motwani (1955)		
Ganga River, India	May to September (peak: July and August)	Saxena (1972)		
Bangladesh	June to July	Rahman and Mollah (2013)		

maximum survival of fry. Public awareness campaigns are essential for gaining support and promoting conservation through education and community involvement.

The *R. rita* catfish requires habitat protection, sustainable fishing practices, community engagement, research and monitoring, legal protection, aquaculture development, and restoration projects. These measures aim to reduce pollution, manage water quality, and preserve critical habitats. Sustainable fishing methods, such as catch limits and selective gear, can prevent overfishing (Hossain 2014). Community engagement can raise awareness about the catfish's importance and monitor populations. Legal protection, aquaculture development, and restoration projects can help maintain the species' survival and biodiversity in aquatic ecosystems.

In connection to the Sustainable Development Goals (SDGs)

The conservation of the threatened fish species *R. rita* in Bangladesh can be aligned with several Sustainable Development Goals (SDGs). These goals include life below water (SDG 14), life on land (SDG 15), no poverty (SDG 1), zero hunger (SDG 2), and responsible consumption and production (SDG 12). Conservation practices can help maintain biodiversity, promote sustainable fishing practices, and ensure the

health of freshwater habitats. By implementing these measures, the conservation of *R. rita* can contribute to broader goals of sustainability, economic stability, and food security in Bangladesh, promoting a holistic approach to environmental and social wellbeing.

Conflict of interest

There is no competing interest that might influence the research work.

Acknowledgement

The authors are very grateful to the PIU BARC NATP-2 PBRG-154 for supporting this study.

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Akhi et al. 2024

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How to cite this article: Akhi TA, Kona MAA, Nadia NC, Hasan MA, Akhter N & Khatun D (2024). Threatened fishes of the world *Rita rita* (Hamilton, 1822) (Order: Siluriformes) Recommendations for Sustainable Conservation. Fisheries Studies, 02, 21-30.