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Threatened Fishes of the Bangladesh *Sperata aor* (Hamilton, 1822): Recommendations for Sustainable Conservation

Bijoya Dash Bisa[1], Sourov Chandra Dey[2], Mst. Rownk Zahan[2], Md. Fahad Hossain[3], Md. Akhtar Hossain[4], Md. Abdul-Aziz[5], Md. Abidul Hasan[4], Md. Ashabul Hoque[4], Md. Yeamin Hossain[4]*

[1]*Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.*
[2]*Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.*
[3]*Department of Zoology, National University, Gazipur-1704, Bangladesh.*
[4]*Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh.*
[5]*Department of Geography and Environmental Studies, University of Rajshahi, Rajshahi-6205, Bangladesh.*

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ABSTRACT

The long-whiskered catfish, *Sperata aor*, is a commercially important freshwater fish species widely distributed across South and Southeast Asia. Despite its nutritional and economic significance, its population has declined sharply due to overfishing, habitat degradation, and lack of effective management measures. This study highlights the taxonomy, biology, distribution, and current conservation status of *S. aor*, emphasizing its ecological role and aquaculture potential. The species demonstrates high environmental tolerance and reproductive plasticity, suggesting suitability for captive culture. However, existing fisheries still rely solely on wild stocks. To ensure sustainable management, strategies such as captive breeding, habitat restoration, regulation of fishing during spawning seasons, and development of formulated diets with essential amino acid supplementation are recommended. Conservation of *S. aor* contributes to achieving several Sustainable Development Goals (SDGs), including SDG 2, SDG 8, SDG 13, SDG 14, and SDG 15. Future research should focus on genetic stock assessment, habitat rehabilitation, and development of sustainable aquaculture protocols to ensure the long-term viability of *S. aor* populations across Bangladesh and the broader South Asian region.

Introduction

The long-whiskered catfish, identified in scientific nomenclature as *Sperata aor* (Hamilton, 1822), is vernacularly recognized as ‘Ayre’ and ‘Aor’ in Bangladesh (Day, 1888; Rahman, 1989; Azadi et al., 1990; Talwar and Jhingram, 1991; Ramakrishnaiah, 1992; Tripathi, 1996; Chondar, 1999; Ferraris Jr., 1999). It belongs to the ‘Bagride’ family and the ‘Sperata’ genus, are widely recognized and prevalent inhabitants of freshwater ecosystems, possessing significant nutritional and commercial worth (Iqbal et al., 2018; Mawa et al., 2022). It is widely distributed in Bangladesh, Pakistan, Nepal, India and Myanmar (Talwar and Jhingram, 1991; Bangladesh, 2000). It has been regarded as one of the most esteemed consumable fishes owing to the minimal presence of intramuscular bones (Talwar & Jhingram, 1991; Chondar, 1999) and its substantial nutritional benefits characterized by commendable protein levels (AJA, 1966; Chondar, 1999). *S. aor* is hardy and can tolerate harsh environments where

*Corresponding author
E-mail address: yeamin.fish@ru.ac.bd (Md. Yeamin Hossain)

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few carps survive (Chondar, 1999), making it suitable for captive culture. Currently, its fishery relies solely on wild catches, as captive culture has not yet been attempted (Gupta, 2015). It is listed as a vulnerable species in Bangladesh (IUCN Bangladesh, 2015). Formerly abundant in rivers and canals across Afghanistan, Pakistan, India, Nepal, Bangladesh, and Myanmar, its population has sharply declined due to overfishing and extensive ecological disturbances (Khan & Nazir, 2018). Moreover, it has been reported that the primary challenges to freshwater fish conservation stem from the absence of adequate management plans and designated protected areas (Barletta et al., 2010; Januchowski-Hartley et al., 2011) highlighted those freshwater fishes receive far less protection and management attention compared to marine species.

To ensure the sustainability of the *S. aor* population in Bangladesh, it is crucial to formulate and implement effective conservation and management measures. Over the years, several studies have investigated different aspects of the species, including its taxonomy, distribution, biology, feeding ecology, growth pattern, reproductive biology, genetics, and nutritional profile, as summarized in Table 1. However, despite its commercial and ecological importance, comprehensive and integrated research focusing on the species within Bangladesh remains limited. This lack of consolidated information poses a major obstacle to designing evidence-based strategies for its conservation and sustainable utilization (Khatun et al., 2022). Therefore, this study aims to compile and analyze the available literature on *S. aor* to provide a scientific foundation for developing appropriate management approaches and conservation programs to ensure the long-term persistence of this vulnerable freshwater species in Bangladesh.

Taxonomy

Kingdom: Animalia
  Phylum: Chordata
    Class: Actinopterygii
      Order: Siluriformes
        Family: Bagridae
          Genus: *Sperata*
            Species: *Sperata aor*

Identification

The body is elongated with a depressed head and sub-terminal mouth; the eyes are transversely oval and positioned on the dorsal aspect of the head. There are two pairs of nostrils, four pairs of barbels with the maxillary pair reaching the caudal fin base, robust dorsal and pectoral fins featuring a strong spine and finely serrated dorsal spine posteriorly, a well-developed adipose fin near the caudal fin, a forked caudal fin with the upper lobe slightly longer, and a complete lateral line (Long-Whiskered Catfish, *S. Aor* (Hamilton, 1822) (Fig.1). The reported maximum lengths of the species have been 186 cm (Day, 1879), 24 cm (Bhuiyan, 1964), 94 cm (Rahman, 2005), and 55 cm. In addition, Rahman (1989) documented an individual weighing 5 kg from the Sylhet district of Bangladesh. The available fin formula is–

Fin formula: D. I/7; P1. I/9-10; P2. I/5; A.12-13 (Rahman, 1989).

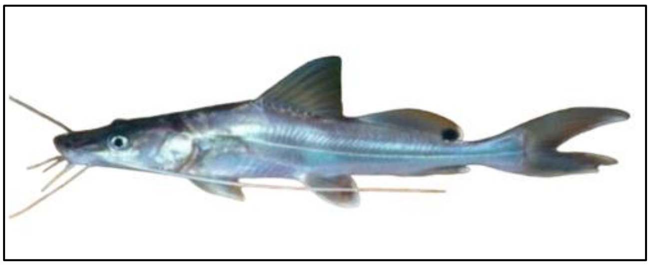

Fig. 2. Photograph of *Sperata aor.* (Source: https://www.wazeersaquariums.co.za/)

Common name

Ayre and Aor in Bangladesh; Aar, Aar-tengara, guji, Kanti, Gaga-tengra, Daryai-tengara, Alli, Addi, seengala, Sauggan, Singari, Singla, thella-jella, Muku-jella, Cumboo-kelutti, Poonai-kelathi, Nadumthalai-kelethis, Manjalatha, Shede, Suragi-meenu and Thorair in India (Rahman, 1989; Talwar and Jhingram, 1991).

Distribution and abundance

According to Talwar and Jhingram (1991), *S. aor* is widely distributed throughout the Indian subcontinent and Southeast Asia, including Bangladesh, India, Pakistan, Myanmar, and Nepal (Fig. 2). *S. aor* is widely distributed in major river systems of Bangladesh, including the Padma, Jamuna, Meghna, Surma, and Dhaleshwari rivers, as well as their tributaries and floodplain channels. It prefers deep, slow-flowing waters of large rivers but also migrates into connected wetlands during the monsoon for feeding and breeding (Rahman, 2005; IUCN Bangladesh, 2015).

Table 1. Available studies on *Sperata aor* from different countries

Country	Aspects	References
Bangladesh	Heavy Metal Contamination in Some Important Fishes of Kaptai Lake: Insights into Presence, Concentration and Consumer Health Risk	Akter et al. (2025)
Bangladesh	Development of breeding and fingerling production techniques for endangered long-whiskered catfish *Sperata aor* in captivity.	Rahman et al. (2015)
Bangladesh	Morphological and mitochondrial DNA variation revealed an undescribed lineage under the genus *Sperata* (Bagridae) in Bangladesh.	Iqbal et al. (2018)
Bangladesh	Comparative study of ovarian development in wild and captive-reared long-whiskered *Sperata aor* (Hamilton, 1822).	Kabir et al. (2023)
Bangladesh	Length-Weight Relationships and Condition Factor of Four Threatened Riverine Catfish Species in the Meghna River Estuary, Bangladesh	Ferdous Jerin et al. (2023)
India	Review on *Sperata aor* (Sykes, 1839), A Freshwater Catfish of Indian Subcontinent	Gupta (2015)
India	Assessment of growth zones on whole and thin-sectioned otoliths in *Sperata aor* (Bagridae) inhabiting the River Ganga, India	Khan et al. (2016)
India	Stock discrimination of *Sperata aor* from river Ganga using microsatellite markers: implications for conservation and management	Nazir & Khan (2017)
India	Genetic Characterization of Three Species of the Genus Cornudiscoides Kulkarni, 1969 (Monogenoidea: Dactylogyridae), Parasitizing Long Whiskered Cat Fish *Sperata aor* (Ham) Using Ribosomal and Mitochondrial DNA	Jyoti et al. (2018)
India	Spatial and temporal variation in otolith chemistry and its relationship with water chemistry: Stock discrimination of *Sperata aor*.	Nazir & Khan (2019)
India	Catfishes of the genus *Sperata* (Pisces: Bagridae) in India	Kumar et al. (2021)
India	Length-weight relationship, sexual distribution and condition factor of *sperata aor* (Hamilton, 1822) from Feni River, Tripura, India.	Banik & Singh (2021)
India	Effect of different doses of induced hormone on captive breeding of *sperata aor* (Hamilton, 1822).	Singh & Banik (2021)
India	Molecular evidence indicates the existence of multiple lineages of *Sperata* in Indian Rivers	Yadav et al. (2022)
India	Evaluating the Length-Weight Relationships and Growth Patterns of Seven Catfish Species in the Middle Stretch of the River Ganga.	Jayaswal et al. (2025)

Habitat and ecology

The genus exhibits a broad natural distribution across various freshwater ecosystems in South Asia, ranging from Afghanistan to Thailand (Gupta, 2015; Froese & Pauly, 2025). While it predominantly occupies riverine environments, the species demonstrates ecological adaptability by surviving and reproducing in a range of lentic and lotic habitats, including ponds, lakes, tanks, channels, and reservoirs (Gupta, 2015). Adults and juveniles predominantly occupy the bottom and peripheral zones of aquatic habitats, whereas the fry is typically found in shallow marginal regions of rivers and in peripheral pits connected to the main channel. The larvae, on the other hand, reside within nests constructed among rocks or within soft muddy substrates of streams, rivers, and large tanks. This species exhibits a broad tolerance range to variations in both temperature and salinity (Chondar, 1999). Ranganathan & Radha (1966) documented that, to facilitate its reproductive activities, S. aor in the Bhavanisagar Reservoir requires specific hydrological conditions, including a gentle water flow of 300–400 cusecs, bright sunlight accompanied by a cool breeze, and an optimal temperature range of 25.2–27°C. The breeding environment was further characterized by a transparency of 30 cm, carbonate alkalinity of 1.5–3.0 ppm, bicarbonate concentration ranging from 4.7–92.4 ppm, pH values between 7.4–8.1, dissolved oxygen levels of 6.0–7.4 mg/L, silicate content of 2.0–7.4 ppm, absence of phosphate and carbonate, and chloride levels between 8–27 ppm.

Food and feeding habit

Several researchers have investigated the food and feeding habits of *S. aor*, generally concluding that the species exhibits a carnivorous diet, with adults showing piscivorous and predatory tendencies (Raj,

Fig. 2. Map showing the geographical distribution of *Sperata aor*

1962; Saigal and Motwani, 1964; Ranganathan and Radha, 1966; Sinha and Chakrabarti, 1986 Azadi et al., 1990; Ramakrishnaiah, 1992; Ghosh & Chakrabarti, 2013). However, Agarwal and Tyagi (1969) reported a contrasting view, describing *S. aor* as omnivorous, primarily consuming worms and tender parts of aquatic plants. Saigal & Motwani (1964) observed that adult S. aor primarily feeds on teleosts from the bottom, along with insects from both the bottom and column waters. He also reported that teleosts constituted the major portion of the diet (58.7%), followed by insects (27.73%), crustaceans (8.21%), and a smaller proportion of plant matter and detritus (5.36%). Additionally, cannibalistic behavior in S. aor has been documented by Saigal & Motwani (1964) and Ramakrishnaiah (1992).

Nutritional profile

Alam et al. (2016) reported that the long-whiskered catfish *S. aor* is valued for its high-quality protein, low bone content, and rich nutrient composition. It contains substantial omega-3 polyunsaturated fatty acids (PUFAs), including oleic (22.37%), palmitic (21.96%), linoleic (7.20%), EPA (3.15%), and DHA (1.78%), with a favorable PUFA:SAFA ratio beneficial for health. The amino acid profile indicates superior protein quality (EAA:NEAA ratio 0.86), with glutamic acid (17.06%), aspartic acid (13.01%), and leucine (8.98%) as dominant components. Mineral analysis revealed high levels of potassium (14532.09 mg kg^{-1}), calcium (3978.30 mg kg^{-1}), sodium (1729.36 mg kg^{-1}), iron (54.93 mg kg^{-1}), and zinc (21.30 mg kg^{-1}), with mercury content within safe limits. The species is also rich in fat-soluble vitamins A, D, E, and K, supporting vital physiological functions (Table 2). Hicks et al. (2019) documented that *S. aor* nutritional profile includes calcium, iron, selenium, zinc, omega- 3 PUFA, vitamin A, protein.

Growth pattern

The length–weight relationship of *S. aor* with a= 0.156 and b= 1.98 cm total length, based on LWR estimates, which indicates a negative allometric growth pattern in middle stretch of river Ganga (Jayaswal et al., 2025). Similar findings were also reported by some other researchers, including Sani et al. (2010), Jerin et al. (2013). However, Saigal, 1982 first reported an isometric growth pattern, a finding later corroborated by Azadi et al. (1990) and Sani et al. (2010). Additionally, subsequent research revealed variations in growth patterns, with Dubey et al. (2012), S. Khan et al. (2011) and Kumar et al. (2014) documented a positive allometric pattern for this species (Table 3).

Form factor

The form factor is calculated through this formula $a_{3.0} = 10^{loga-s(b-3)}$, 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 (Froese, 2006). According to Table 3, the computed form factor ($a_{3.0}$) was to range from 0.0053 to 0.0089, which indicates a moderately elongated body shape.

Table 2: Nutritional composition of *perata aor* (Alam et al. 2016)

Category	Component	Value
Saturated Fatty Acids (SFA)	14:0	6.95 ± 0.26
	16:0	21.96 ± 1.75
	18:0	6.46 ± 0.34
	20:0	1.52 ± 0.97
	21:0	1.85 ± 0.16
	22:0	1.45 ± 0.11
	23:0	0.79 ± 0.05
	24:0	0.36 ± 0.07
	∑ SFA	**41.34 ± 2.52**
Monounsaturated Fatty Acids (MUFA)	14:1	0.91 ± 0.08
	16:1	3.24 ± 0.40
	18:1	22.37 ± 1.75
	22:1	1.94 ± 0.54
	24:1	0.20 ± 0.09
	∑ MUFA	**28.66 ± 3.29**
Polyunsaturated Fatty Acids (PUFA)	18:2 ω-3	7.20 ± 0.69
	18:3 ω-3	2.05 ± 1.09
	20:3 ω-3	1.64 ± 0.11
	20:5 ω-3 (EPA)	3.15 ± 0.52
	22:6 ω-3 (DHA)	1.78 ± 0.94
	18:3 ω-6	4.09 ± 0.05
	20:2 ω-6	2.20 ± 0.30
	20:3 ω-6	1.78 ± 0.13
	20:4 ω-6	3.61 ± 0.03
	22:2 ω-6	1.69 ± 0.31
	∑ PUFA	29.19 ± 1.87
	∑ PUFA ω-3	15.82 ± 1.63
	∑ PUFA ω-6	13.37 ± 1.19
	ω-3 : ω-6 ratio	1.18 ± 0.91
	EPA + DHA	4.93 ± 0.94
	PUFA : SFA	0.71 ± 0.30
Essential Amino Acids (EAA)	Thr	8.69 ± 0.15
	Val	6.10 ± 0.19
	Iso	5.85 ± 0.53
	Leu	8.98 ± 0.90
	Phe	5.12 ± 0.21
	His	8.68 ± 2.67
	Lys	0.81 ± 0.03
	Met	2.01 ± 0.10
	∑ EAA	**46.24 ± 3.78**
Non-Essential Amino Acids (NEAA)	Asp	13.01 ± 0.08
	Ser	6.87 ± 0.93
	Glu	17.06 ± 0.36
	Pro	2.08 ± 0.06
	Gly	7.10 ± 0.51
	Ala	4.94 ± 0.89
	Arg	1.56 ± 0.02
	Tyr	1.06 ± 0.09
	∑ NEAA	53.68 ± 4.15
	EAA/NEAA	0.86
	TAA	99.92 ± 11.78
	TAAA	30.07 ± 1.84
	TSAA	2.01 ± 0.10

Table 2 Continued

	TarAA	2.01 ± 0.10
Minerals (mg kg⁻¹)	Sodium (Na)	1729.36 ± 13.52
	Potassium (K)	114532.09 ± 75.49
	Calcium (Ca)	3978.30 ± 40.98
	Iron (Fe)	54.93 ± 4.33
	Magnesium (Mg)	1076 ± 10.21
	Manganese (Mn)	3.61 ± 2.30
	Zinc (Zn)	21.30 ± 2.91
	Mercury (Hg)	0.02 ± 0.01
Fat-soluble Vitamins (µg kg⁻¹)	Vitamin A	1802.24
	Vitamin D	16453.31
	Vitamin E	7321.96
	Vitamin K	15439.36

Reproductive biology

According to Saigal (1964), the minimum size at sexual maturity for *S. aor* was recorded as 84 cm. In contrast, Ramakrishniah (1992) reported the length at first maturity to be 57.3 cm and further noted that the species generally attains sexual maturity at approximately 4 years of age. In *S. aor*, sexual dimorphism becomes apparent beyond 300 mm in length. Males possess a papillary outgrowth above the urino-genital pore (Sathyanesan, 1962; Saigal & Motwani, 1964), though Ramakrishniah (1992) reported its presence in both sexes at Nagarjunasagar Reservoir. During the spawning season (July–August), males show an inflamed reddish body with milky-white mucous secretion and a pointed genital papilla, while females exhibit a swollen, soft abdomen and a reddish, protruded genital opening features indicative of spawning readiness (Jabed et al., 2021; Parvin et al., 2022).

Genetics

S. aor possesses a haploid or gametic chromosome number of n = 26 (NBFGR, 1998). According to Lakra & Rishi (1991), *S. aor* exhibits a diploid chromosome number of 2n = 52 and a fundamental number (NF) of 96. Its karyotype formula is 20m + 14sm + 10st + 8a, consisting of 20 metacentric, 14 submetacentric, 10 sub-telocentric, and 8 acrocentric chromosomes. The species possesses two nucleolar organizer regions (NORs). These characteristics differentiate *S. aor* from other congeners such as *S. acicularis* (2n = 56) and reflect moderate karyotypic variation within the genus.

Conservation status

According to Rema Devi and Raghavan (2011), *S. aor* was categorized as least concern (LC) on the IUCN Red List of Threatened Species (2009); however, the species is considered vulnerable (VU) within Bangladesh (IUCN Bangladesh, 2015). In India, *S. aor* is classified as Least Concern, consistent with its global IUCN Red List status (Rema Devi & Raghavan, 2011). Regional assessments, including those from the Umtrew River and Ramsar-listed wetlands, also report a similar status (Bhattacharjee et al., 2021; Thakur et al., 2022;). However, localized studies, such as in the Feni River of Tripura, have noted signs of population decline and referred to the species as near threatened (Choudhury et al., 2021).

Threats

Freshwater fishes face extinction rates higher than most vertebrates, except amphibians, primarily due to threats disrupting freshwater ecosystems (Bruton, 1995; Sarkar et al., 2008; Rahman et al., 2024). *S. aor*, once common across rivers and canals of Afghanistan, Pakistan, India, Nepal, Bangladesh, and Myanmar, has declined significantly due to overexploitation and habitat alterations (Khan & Nazir, 2018). Accordingly, species of the genus *Sperata* are now considered part of the diminishing indigenous ichthyofauna of the Indian subcontinent(Khan et al., 2016; Nazir & Khan, 2017).

Impact of climate and environmental change

Climate change, in particular, rising temperatures, can have both direct and indirect effects on global fish production (Hossain et al., 2024). With increased global temperature, the spatial distribution of fish stocks might change due to the migration of fishes

Table 3. Growth pattern of *Sperata aor* from different water-bodies.

Study area	*a*	*b*	r^2	Growth type	Form factor ($a_{3.0}$)	Author
Betwa River, India	0.0059	2.98	0.97	Allometric (−)	0.0055	Sani et al. (2010)
Gomti River, India	0.0043	3.02	0.98	Allometric (+)	0.0045	Sani et al. (2010)
Ganga River, India	0.0020	3.25	0.98	Allometric (+)	0.0044	Khan et al. (2010)
River Ken, India	0.0029	3.12	0.97	Allometric (+)	0.0042	Dubey et al. (2012)
Meghna Estuary, Bangladesh	0.1274	2.91	0.88	Allometric (−)	*	Jerin et al. (2013)
Ganga main channel, India	0.0934	2.30	0.95	Allometric (−)	0.2655	Sarkar et al. (2013)
River Gomti, India	0.0934	2.30	0.95	Allometric (−)	*	Sarkar et al. (2013)
River Rapti, India	0.0076	2.22	0.92	Allometric (−)	*	Sarkar et al. (2013)
Ganga River, Bangladesh	0.1560	1.98	0.71	Allometric (−)	0.0064	Present study

from one region to another in search of suitable conditions. Climate change will have major consequences for population dynamics of marine biota via changes in transport processes that influence dispersals and recruitment (Barange & Perry, 2009).

In this context, geospatial and remote sensing analyses can play a pivotal role in monitoring and quantifying climate-induced habitat changes. Mapping riverine flow patterns, floodplain inundation, and habitat connectivity over time can provide critical insights into habitat vulnerability, inform adaptive management, and support targeted conservation interventions. Integrating such technical approaches with ecological data strengthens the development of effective conservation strategies that can mitigate climate-related risks while sustaining fisheries and local livelihoods.

Conservation action

Stock discrimination of *S. aor* from river Ganga using microsatellite markers were conducted by Nazir, & Khan. (2017). Furthermore, some particular physico-chemical characters of Feni river were statistically analyzed by Banik & Singh (2019).

Recommendations for conservation

The long-whiskered catfish, *S. aor* for its hardy nature and remarkable tolerance to adverse environmental conditions, even under circumstances where most carps fail to survive (Chondar, 1999; Gupta, 2015). Owing to these attributes, the species holds great potential for captive culture. However, the existing fishery of *S. aor* still relies predominantly on natural stocks, as its captive breeding and culture have not yet been widely attempted (Gupta, 2015) . To ensure sustainable utilization and conservation, research focusing on captive culture techniques and reproductive management is essential. Recent findings indicate that improving aquaculture technology for *S. aor* requires the development of species-specific formulated diets, particularly with amino acid supplementation such as phenylalanine and lysine, to overcome the reproductive plasticity often observed under captive conditions compared to wild populations (Kabir et al., 2023). Moreover, understanding the reproductive biology of *S. aor* is crucial for effective planning, conservation, and management strategies for this threatened species. Information derived from reproductive studies can serve as a basis for developing management and protection measures aimed at sustainable conservation, broodstock development, and potential inclusion of *S. aor* as a promising candidate species in commercial aquaculture in Bangladesh and other parts of South Asia (Jabed et al., 2021).

In connection with the Sustainable Development Goals (SDGs)

The conservation of *S. aor* is closely aligned with several United Nations Sustainable Development Goals (SDGs). It directly supports SDG 14 (Life Below Water) by promoting sustainable management and conservation of freshwater ecosystems, and SDG 15 (Life on Land) through maintaining ecological balance in connected habitats. Furthermore, its sustainable aquaculture contributes to SDG 2 (Zero Hunger) by enhancing food and nutritional security and to SDG 8 (Decent Work and Economic Growth) by generating livelihood opportunities for rural communities. Additionally, conserving *S. aor* populations strengthens ecosystem resilience, contributing to SDG 13 (Climate Action) through improved adaptation and sustainability of aquatic resources.

Conflict of interest

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

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