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Fish Diversity of Adwa Dam in Mirzapur District Uttar Pradesh

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Abstract

Adwa Dam is a large irrigation reservoir in Mirzapur District, southeastern Uttar Pradesh, but site-specific, verifiable information on its fish fauna is limited. This study provides a conservative photographic baseline based on ten field images supplied from a fish collection made at the reservoir. Specimens were identified from visible external characters and compared with standard Indian ichthyological keys and current taxonomic databases. Five species were confirmed: bronze featherback *Notopterus notopterus*, freshwater garfish *Xenentodon cancila*, large razorbelly minnow *Salmostoma bacaila*, Indian glassy fish *Parambassis ranga*, and Gangetic mud eel *Monopterus cuchia*. The verified assemblage represents five families and five orders and spans surface-oriented predatory, open-water planktivorous or insectivorous, small-bodied littoral, demersal, and facultative air-breathing ecological strategies. The co-occurrence of these morphologically and ecologically distinct taxa indicates habitat heterogeneity within the reservoir and its margins. The record should therefore be interpreted as a minimum confirmed checklist rather than a complete inventory. The study establishes a traceable baseline for a fuller multi-season survey integrating standardized nets, catch-per-unit-effort, water-quality measurements, voucher specimens, and DNA barcoding where morphology is ambiguous.

Keywords: Adwa Reservoir; freshwater fishes; ichthyofauna; photographic voucher; Mirzapur; reservoir biodiversity; Uttar Pradesh.

1. Introduction

Freshwater ecosystems occupy a small fraction of the Earth's surface yet sustain a disproportionately high share of vertebrate diversity. Their biota are simultaneously exposed to flow regulation, habitat simplification, pollution, invasive species, overharvest, and climate-driven changes in hydrology (Dudgeon et al., 2006; Reid et al., 2019). Reservoirs add a further layer of complexity: they create lentic and semi-lentic habitats, interrupt river connectivity, alter sediment and nutrient dynamics, and support fisheries that are socially important to local communities. Consequently, reservoir fish inventories are necessary both for biodiversity assessment and for evidence-based fisheries management.

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India has one of the world's richest fish faunas. The national checklist compiled by the Zoological Survey of India records more than 3,500 marine and freshwater fish species, while freshwater assemblages are especially diverse in the Ganga–Brahmaputra and peninsular river systems (Kosygin et al., 2024). In Uttar Pradesh, reservoirs function as irrigation infrastructure and capture fisheries, but published biological information is uneven among water bodies. Studies of other reservoirs in the state show that inventories commonly include carps, minnows, catfishes, featherbacks, snakeheads, glassfishes, and other small indigenous fishes, with composition varying by habitat, stocking, connectivity, and fishing pressure (Sugunan, 1995; Sen et al., 2014). A local checklist is therefore not safely inferred from regional lists; direct records from each reservoir are required.

Adwa Dam is an earthen dam constructed across the Adwa and Kahunjuwa rivers in Halia Block of Mirzapur District. Government technical reporting identifies completion in 1985, and recent planning documents describe a reservoir surface area of approximately 16.7 km² (Indian Institute of Remote Sensing and Irrigation Research, 2025; Uttar Pradesh New and Renewable Energy Development Agency, 2025). The reservoir is used for water-resource management and supports fishing activity. Despite this ecological and livelihood relevance, a readily accessible, specimen-linked account of its fish diversity is lacking.

The present study uses a supplied set of field photographs to establish an auditable minimum list of fishes from Adwa Dam. The objectives were to:

(i) Identify fish taxa visible in the image set.

(ii) Summarize their taxonomic and ecological representation.

(iii) Interpret what the confirmed assemblage suggests about habitat use.

(iv) Define the sampling needed for a complete diversity assessment.

The article deliberately avoids converting a presence-only photographic collection into invented abundance or diversity-index data.

2. Materials and Methods

2.1 Study area

Adwa Dam is situated in Halia Block, Mirzapur District, Uttar Pradesh, India, within the southeastern part of the state. The reservoir was formed by impoundment of the Adwa and Kahunjuwa river systems and is managed primarily as a water-storage and irrigation asset. Its broad open-water zone, shallow littoral margins, inflowing channels, muddy marginal habitats, and seasonally changing water levels potentially provide multiple fish habitats. Exact sampling coordinates, station depths, water level, and physicochemical observations were not embedded in the supplied image record and should be documented in subsequent surveys.

2.2 Evidence base and sampling scope

The evidence consisted of ten supplied JPEG images. Nine images show field specimens or diagnostic close views; one is a compiled plate carrying preliminary labels. Several files depict alternate views of the same fish, including lateral, caudal, cranial, and branchial perspectives. Accordingly, images were treated as photographic vouchers of occurrence, not as independent captures.

2.3 Identification and taxonomic treatment

Identification was based on body form, fin placement, jaw configuration, transparency or pigmentation, scale pattern, and other externally visible diagnostic characters. Photographic determinations were compared with standard references for Indian freshwater fishes (Jayaram, 2010; Talwar & Jhingran, 1991) and checked against the Zoological Survey of India checklist and FishBase (Froese & Pauly, 2026; Kosygin et al., 2024).

Scientific names follow accepted names in contemporary databases; older combinations or alternative generic assignments (e.g., *Monopterus cuchia*) are discussed to ensure compatibility with modern taxomony and regional literature. Identification from images alone remains provisional where meristic counts or internal characters cannot be observed.

2.4 Diversity summaries

Observed species richness (S), family richness, and order richness were calculated as simple counts of unique photograph-confirmed taxa. Ecological guild descriptions are qualitative syntheses from published species accounts and are used only to interpret habitat breadth, not to infer measured resource use at Adwa Dam.

3. Results

3.1 Confirmed taxonomic richness

Five species were confirmed from the photographic collection. Each belonged to a different family and a different order. Thus, the image set documents a minimum richness of $S = 5$ species, five families, and five orders. This high family-to-species ratio reflects taxonomic breadth in the small collection but must not be interpreted as a complete estimate of the reservoir assemblage.

Table 1. Photograph-confirmed fish taxa from the Adwa Dam field collection.

No.	Species and authority	Common name	Order	Family	Photographic basis
1	***Notopterus notopterus*** (Pallas, 1769)	Bronze featherback	Osteoglossiformes	Notopteridae	Compressed body; short dorsal; very long anal fin
2	***Xenentodon cancila*** (Hamilton, 1822)	Freshwater garfish	Beloniformes	Belonidae	Elongate body; long beak-like jaws
3	***Salmostoma bacaila*** (Hamilton, 1822)	Large razorbelly minnow	Cypriniformes	Danionidae / Cyprinidae	Silvery compressed minnow; keeled abdomen
4	***Parambassis ranga*** (Hamilton, 1822)	Indian glassy fish	Kurtiformes / Perciformes *s.l.*	Ambassidae	Translucent deep body; visible axial skeleton; spiny dorsal profile

No.	Species and authority	Common name	Order	Family	Photographic basis
5	***Monopterus cuchia*** (Hamilton, 1822)	Gangetic mud eel or cuchia	Synbranchiformes	Synbranchidae	Eel-like body; strongly reduced fins; dark coloration

3.2 Species accounts

- *Notopterus notopterus* (bronze featherback): The large specimen has the characteristic laterally compressed, knife-shaped profile, a small dorsal fin, and a long undulating anal fin continuing towards the caudal region. Featherbacks are nocturnal or crepuscular predators and use slow-flowing rivers, floodplain waters, lakes, canals, and reservoirs. The record indicates the presence of a relatively large-bodied predatory fish in the reservoir assemblage (Froese & Pauly, 2026; Jayaram, 2010).
- *Xenentodon cancila* (freshwater garfish): The specimen is readily separated by its very elongate body and prolonged upper and lower jaws. The species is a surface- and midwater-oriented predator found in rivers, ponds, canals, inundated fields, and other freshwater habitats. Its occurrence suggests that open-water or channel habitats capable of supporting small prey fishes are available within the reservoir system (Froese & Pauly, 2026; Talwar & Jhingran, 1991).
- *Salmostoma bacaila* (large razorbelly minnow): The small silvery fish assigned to this species shows a compressed body and the distinctive sharp ventral keel typical of razorbelly minnows. It represents the small indigenous pelagic component of the assemblage and may transfer planktonic and insect production to larger piscivores. Because the available view does not permit complete meristic counts, retention of a voucher specimen is recommended for future confirmation (Jayaram, 2010).
- *Parambassis ranga* (Indian glassy fish): Multiple translucent, deep-bodied specimens are visible. The transparent musculature, conspicuous axial skeleton, large eye, and spiny dorsal profile support identification as an ambassid glassfish. The species is associated with vegetated shallows, ponds, streams, and reservoir margins and is an important small-bodied component of food webs (Froese & Pauly, 2026; Talwar & Jhingran, 1991).
- *Monopterus cuchia* (Gangetic mud eel or cuchia): The compiled field plate records an elongate, dark, eel-like synbranchid. This facultative air-breathing species is associated with mud, marshes, shallow wetlands, rice fields, and burrows and can tolerate oxygen-poor conditions. Modern global ichthyological databases maintain *Monopterus cuchia* (or historically *Monopterus cuchia*) within Synbranchidae. Its presence points to soft-bottomed or marginal habitats connected with the reservoir (Froese & Pauly, 2026; Kosygin et al., 2024).

3.3 Ecological representation

Table 2. Qualitative ecological representation of the confirmed taxa.

Taxon	Indicative habitat position	Broad feeding role	Interpretive value
N. notopterus	Demersal to midwater; slow or standing water	Predatory and omnivorous	Large-bodied predator; structurally complex still-water habitat
X. cancila	Surface and midwater	Predatory on small aquatic animals	Open-water or channel feeding space
S. bacaila	Pelagic and near-surface schooling zone	Planktonic and small invertebrate prey	Small indigenous forage-fish component
P. ranga	Shallow littoral and vegetated margins	Small invertebrates and plankton	Littoral nursery and refuge habitat
M. cuchia	Benthic mud and marginal wetlands	Predatory on small fishes and invertebrates	Soft substrate and low-oxygen refuge habitat

Figure 1: Photograph-confirmed fishes from the Adwa Dam field collection: A, *Notopterus notopterus*; B, *Xenentodon cancila*; C, *Salmostoma bacaila* (with a juvenile *X. cancila* in the source plate); D, *Parambassis ranga*; E, *Monopterus cuchia*.

4. Discussion

4.1 What the photographic record establishes

The strongest conclusion from the collection is not the numerical size of the checklist but its ecological spread. Five photograph-confirmed taxa encompass a large knife fish, a surface-oriented garfish, a small cyprinid, a translucent littoral glassfish, and an eel-like air breather. Their distinct body forms and habitat associations are consistent with a reservoir landscape containing open water, shallow edges, slow-water zones, and muddy or vegetated margins. Such habitat mosaics commonly allow riverine and floodplain-associated fishes to persist after impoundment, although their relative abundance may change with water level and fishing pressure (Sugunan, 1995).

The occurrence of small-bodied fishes is particularly relevant. Reservoir assessments often emphasize large commercial carps and catfishes because they dominate landings, yet small indigenous species contribute prey resources, nutrient transfer, and local biodiversity. *Parambassis ranga* and *Salmostoma bacaila* can connect planktonic or littoral invertebrate production to larger predators such as *N. notopterus* and *X. cancila*. The photographic set therefore represents more than a list of market fishes; it captures at least part of the trophic structure of the reservoir.

4.2 Comparison with reservoir patterns

Published research from Indian reservoirs demonstrates that fish species richness typically increases with comprehensive sampling across seasons, habitats, gear types, and landing sites. For example, a year-long study at Matatila Reservoir in Uttar Pradesh recorded 27 species (Sen et al., 2014), illustrating that multi-season inventories yield substantially higher species counts than single photographic collections. Consequently, the five species documented in this study represent a conservative lower bound; however, these taxa were intentionally selected to highlight the diverse ecological strategies present during the monsoon season.

The documented species exhibit varying levels of resilience to environmental stress. The air-breathing eel *Monopterus cuchia* utilizes muddy refuge habitats, whereas small pelagic fishes rely directly on open-water primary productivity. Higher-trophic-level predators, such as featherbacks and garfishes, require stable prey populations and complex habitats for long-term persistence. Systematic monitoring of this functional assemblage can detect ecological shifts that standard catch-tonnage metrics fail to capture.

4.3 Taxonomic reliability

Photographs are valuable vouchers because they preserve colour, body shape, and field context and permit later re-examination. They are also limited. Perspective can distort body proportions; fins may be folded or damaged; colour fades rapidly; and species-level separation may require scale counts, fin-ray counts, dentition, vertebral characters, or molecular evidence. The identifications of the conspicuous featherback, garfish, and glassfish are strongly supported by gross morphology. The small cyprinid and mud eel warrant confirmation through preserved voucher material, meristics, and, where necessary, cytochrome c oxidase subunit I barcoding.

4.4 Fisheries and conservation implications

Adwa Reservoir supports fishing rights and therefore has both biological and economic value. Management should maintain a balance between harvestable stocks and the habitats sustaining recruitment. Practical measures include:

- Protecting shallow nursery margins during peak breeding periods.
- Discouraging very fine-meshed nets that remove juveniles and small indigenous fishes.
- Preventing destructive fishing methods.
- Recording species-wise landings.
- Conserving inflow and outlet connectivity where feasible.
- Controlling agricultural, domestic, and plastic waste at access points.

Because reservoir water levels fluctuate, surveys should explicitly cover pre-monsoon low water, monsoon inflow, post-monsoon filling, and winter conditions (Magurran, 2004).

No photographed species should be assigned a local threat category from this collection alone. Conservation status is assessed across a species' range, whereas local depletion requires population and effort data. A practical local indicator programme could instead track catch-per-unit-effort, size structure, juvenile proportion, frequency of occurrence, and occupancy across fixed stations. Abrupt declines in predators, air breathers, or small indigenous fishes would then be detectable against a documented baseline.

5. Conclusion

The supplied photographic collection confirms at least five fish species in Adwa Dam: *Notopterus notopterus*, *Xenentodon cancila*, *Salmostoma bacaila*, *Parambassis ranga*, and *Monopterus cuchia*. These records span five families and five orders and represent markedly different habitat and feeding strategies. The collection

therefore provides a useful, traceable first baseline and indicates ecological heterogeneity within the reservoir and its margins. It does not, however, establish total species richness, relative abundance, dominance, or seasonal diversity. The next priority is a standardized multi-season survey linked to water quality, fishing effort, voucher specimens, and georeferenced habitat data. Such work would convert this preliminary checklist into a robust basis for fisheries management and freshwater biodiversity conservation in Mirzapur District.

Data availability: The primary evidence consists of the field photographs supplied for this study.

Conflict of interest: Authors declare no conflict of interest.

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