Journal of Fisheries
Volume 14 Issue 1 April 2026
Peer Reviewed | Open Access

eISSN 2311-3111
pISSN 2311-729X

DOI: https://doi.org/10.17017/j.fish.1176

Original Article

An annotated checklist of ichthyofauna and associated estuarine biota of the Manakudy Estuary, southern Tamil Nadu, India

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Manuscript history
Received 26 December 2025 | Accepted 30 January 2026 | Published online 11 February 2026

Citation
Sahu A, Jayakumar N, Sudhan C, Durairaja R, Padmavathy P, Velmurugan P, Panda D, Ringjonmeilu K, Kashyap N (2026) An annotated checklist of ichthyofauna and associated estuarine biota of the Manakudy Estuary, southern Tamil Nadu, India. Journal of Fisheries 14(1): 141213. DOI: 10.17017/j.fish.1176

Abstract
This study assessed the ichthyofaunal and associated floral diversity of the Manakudy Estuary, southwest coast of India, over a two-year period involving monthly surveys from August 2023 to July 2025. Sampling efforts were stratified across three distinct ecological zones *i.e.*, freshwater influx region (Station 1), mid-mangrove area (Station 2), and estuarine mouth region (Station 3), utilizing traditional fishing crafts and standardized visual census methods to capture spatial heterogeneity. A total of 120 species were recorded, representing 37 orders, 62 families, and 89 genera. The order Eupercaria incertae sedis showed the highest species richness (15.83%), followed by Carangiformes (12.50%) and Clupeiformes (8.33%). Among families, Carangidae was the most dominant with 13 species. Conservation assessment revealed the occurrence of threatened species, including the Endangered honeycomb stingray (*Himantura uarnak*) and the Vulnerable Coromandel whipray (*Brevitrygon imbricata*), along with two near threatened species. These findings provide baseline information essential for long-term biodiversity monitoring, sustainable fisheries management, and conservation planning in the Manakudy Estuary.

Keywords: ichthyofaunal-floral diversity; annotated checklist; Manakudy Estuary; Tamil Nadu

1 | INTRODUCTION

An estuary is a semi-enclosed coastal water body where freshwater mixes with saline seawater, maintaining an open connection to the ocean (Ketchum 1967; Pritchard 1967). Functioning as an ecotone influenced by marine and freshwater fluxes, estuaries support diverse fish fauna with varied life stages and functional groups (Haedrich 1983; Claridge *et al*. 1986; Favero *et al*. 2019). Nutrient inputs from rivers, runoff, and coastal currents enrich these waters and sediments, making them among Earth's most productive ecosystems (Nixon 1980; Morris *et al*. 1995; Bardarudeen *et al*. 1996). Fluctuating environmental conditions within these systems create habitats that facilitate essential ecosystem functions such as nutrient cycling, food web regulation, biodiversity conservation, and nutrient mobilization (Meire *et al*. 2005). Tropical estuaries, in particular, are noted to be more dynamic than their temperate counterparts due to monsoon-driven fluxes and unique biological community structures (Ansari *et al*. 1995).

These highly productive, biodiversity-rich systems support extensive fisheries and generate substantial economic value, especially in tropical developing regions where they provide critical food and employment for millions of people (Costanza *et al*. 1997; Blaber *et al*. 2000; Kiranya *et al*. 2022). Estuaries encompass complex habitats such as mangroves, seagrass beds, salt marshes, and mudflats that function as nursery, feeding, spawning, and growth grounds for diverse life stages of fish and invertebrates, offering abundant food and refuge from predation (Nicolas *et al*. 2010; Beck *et al*. 2001; Elliott *et al*. 2007). Compared with open marine waters, the nutrient-rich and sheltered nature of estuaries underpins traditional fisheries and rural livelihoods, while bentho-pelagic coupling further enhances productivity (Cloern 1982; McLusky and Elliott 2004). However, these biodiversity hotspots linking terrestrial and marine systems are currently under severe pressure from overfishing, industrial effluents, agricultural runoff, and anthropogenic modifications, marking them as some of the most threatened coastal ecosystems globally (Blaber *et al*. 2000; Fujii 2012; Kiranya *et al*. 2022).

The estuarine area of Tamil Nadu is estimated to be approximately 56,000 ha, accounting for 3.88% of India's total estuarine area (De 2011). The Manakudy Estuary, the second largest estuarine system in the Kanyakumari district, encompasses an area of approximately 150 ha and is situated about 8 km northwest of Cape Comorin, Tamil Nadu. This study addresses the need for an updated baseline on the ichthyofaunal and floral diversity of the Manakudy Estuary by generating a comprehensive, annotated checklist through systematic, two-year field sampling. By integrating recent taxonomic revisions, broader taxonomic coverage, and conservation-relevant information, it fills existing data gaps and provides a robust reference framework to support long-term biodiversity monitoring, impact assessment, and informed estuarine management.

2 | METHODOLOGY

2.1 Study area

The Manakudy Estuary, the second largest in the Kanyakumari district, spans approximately 150 ha and is situated about 8 km northwest of Cape Comorin between 8°02′–8°04′N and 77°26′–77°30′E (Pearl and Fenreji 2010). Formed at the confluence of the river Pazhayar with the Arabian Sea, this tropical, sand-bar-built estuary encompasses diverse habitats including shallow open waters, sandy beaches, rocky shores and seagrass beds (Pearl and Fenreji 2010; Ajithamol *et al*. 2014). To ensure a comprehensive assessment of ichthyofaunal diversity across the estuary's spatial heterogeneity, three sampling stations were established representing distinct ecological zones (Figure 1). The sampling stations were selected based on hydrological gradients, vegetation distribution, and salinity variation. Station 1 (S1) was located near the freshwater inflow zone (8°6′27.91″N 77°28′52.76″E), Station 2 (S2) within the mid-estuarine mangrove region (8°5′59.76″N 77°29′2.36″E), and Station 3 (S3) near the estuarine mouth (bar mouth) where marine influence is dominant (8°5′32.04″N 77°29′8.01″E). Together, these stations represent the upstream-to-downstream gradient of the Manakudy Estuary and adequately capture its major spatial heterogeneity.

2.2 Crafts and gear used

The primary fishing vessels operating in the Manakudy estuary are traditional vallams and Fibre-Reinforced Plastic (FRP) boats. Gill nets with mesh sizes of 25.4, 6–12, 178–254, 127–178, and 70–80 mm are predominantly used to capture sardines, anchovies, tilapias, milkfishes, and snappers, respectively. Prawns are harvested using trammel nets (locally known as disco nets), which consist of an outer layer with a 254 mm mesh size and an inner layer with a 50 mm mesh size. Fishing activities extend up to the Suchindram bridge within the estuary.

2.3 Data collection and identification

The present study documenting the floral and faunal diversity of the Manakudy estuary was conducted over a two-year period from August 2023 to July 2025 at three selected sampling sites. Mangrove zones along the Manakudy estuary were surveyed, and sampling sites were selected based on tree density and species composition. Malacofaunal and mangrove diversity were assessed using 0.25 × 0.25 m quadrats, with 20 quadrats randomly placed each month at 10 m intervals (Satheeshkumar and Khan 2012; Truchet *et al*. 2019; Yadav *et al*. 2019). Avifaunal surveys were conducted monthly for two years using the Point Count Method (Bibby *et al*. 2000). Each

fish specimen was measured for total length using a digital caliper (precision: 0.1 mm) and weighed using a high-precision electronic balance (precision: 0.01 g). Flora and fauna were identified in the field using standard taxonomic keys and photographs. Unidentifiable specimens were collected, transported in ice-filled containers to the lab, frozen, then washed, photographed fresh, and examined.

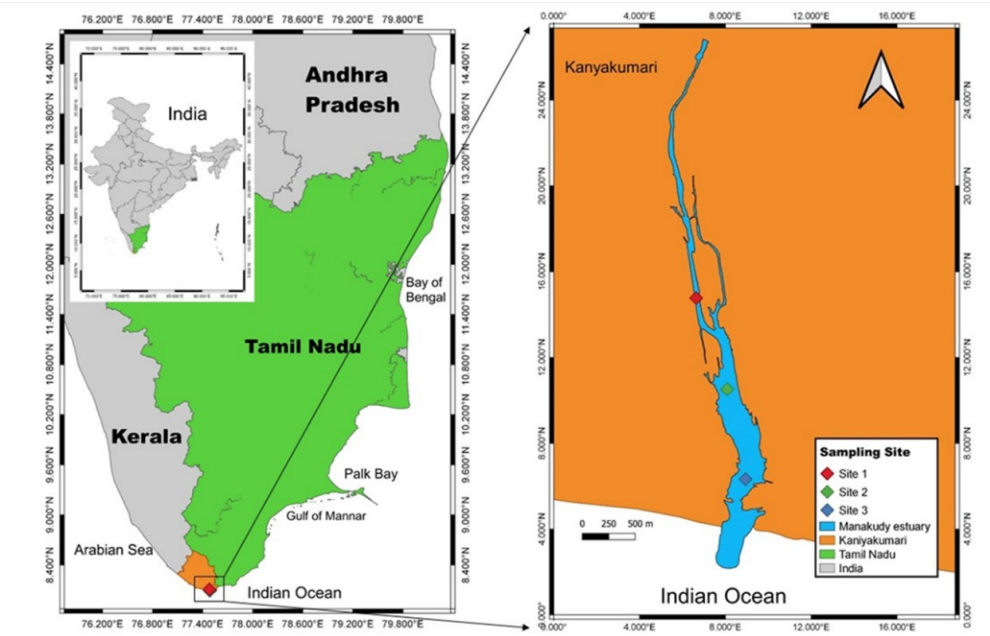

FIGURE 1 Map showing Study Area in the Manakudy Estuary, Tamil Nadu, India.

Ichthyofaunal and floral species were identified using classical taxonomic approaches based on morphometric measurements, meristic counts, and diagnostic morphological characters. Fish and shellfish identifications were verified using standard taxonomic keys, including FAO species identification sheets (Fischer and Bianchi 1984). Finfishes were identified following Gopalakrishnan (2017) and Murugan and Namboothri (2012), and mangrove species and their associates using CMFRI (2005). Malacofauna were identified using FAO standard keys (Bieler *et al*. 2010; Dholakia 2013; Sonak 2017), with taxonomic updates from FishBase (Froese and Pauly 2021). All scientific names were validated against the World Register of Marine Species (Horton *et al*. 2017) and the latest FishBase database (Froese and Pauly 2024). Avian species were identified using eBird (Sullivan *et al*. 2009) and Avibase (Lepage 2005). Detailed species information, including occurrence, habitat, maximum length and weight, length at first maturity (L_m), trophic status, fishery status, threat status, and IUCN Red List status, as derived from the FishBase database (Froese and Pauly 2024).

3 | RESULTS

A comprehensive survey was conducted in the Manakudy estuary and identified a total of 120 species of flora and fauna across three sampling sites, encompassing 37 orders, 62 families, and 89 genera. The order Eupercaria incertae sedis [Eupercaria incertae sedis refers to taxa placed within the Eupercaria clade whose precise familial relationships remain unresolved under recent molecular-based taxonomic revisions] exhibited the highest species richness, accounting for 19 species (15.83%), followed by Carangiformes with 15 species (12.50%), Clupeiformes with 10 species (8.33%), Acanthuriformes with 9 species (7.50%), and Decapoda with 8 species (6.67%), while other orders contributed less than 5% (Figure 2). Among the families, Carangidae was the most species-rich, comprising 13 species, followed by Lutjanidae with 6 species, Engraulidae and Penaeidae with 5 species each, and Leiognathidae, Sciaenidae, and Mugilidae with 4 species each (Table 1). Taxonomic positions of all fish species in this study were assigned following FishBase (Froese and Pauly 2024) and cross-checked with the latest World Register of Marine Species (Horton *et al*. 2018). The conservation assessment of the study area revealed that five species are under threat according to IUCN (2023), including one endangered species (*Himantura uarnak*), two vulnerable species (*Oreochromis mossambicus* and *Brevitrygon imbricata*), and two near threatened species (*Brevitrygon walga* and *Mycteria leucocephala*). This indicates that a notable portion of the recorded ichthyofauna and associated fauna are facing conservation risks, highlighting the ecological importance of the area (Figure 3).

4 | DISCUSSION

Comparative studies across Indian estuaries consistently highlight the remarkable diversity and richness of ichthyofauna, though the magnitude of diversity varies with geographic location, hydrological characteristics, and anthropogenic pressures. Historical data from the

Manakudy estuary itself indicated relatively modest diversity, with Kannappan and Karthikeyan (2013) documenting 38 species. Subsequent surveys, however, have revealed higher richness, with Mogalekar *et al*. (2018) reporting 91 species, wherein families such as Engraulidae and Lutjanidae were particularly well represented. These findings underscore the temporal variability of faunal records in the same system, likely reflecting differences in sampling effort, methodological approaches, and environmental changes.

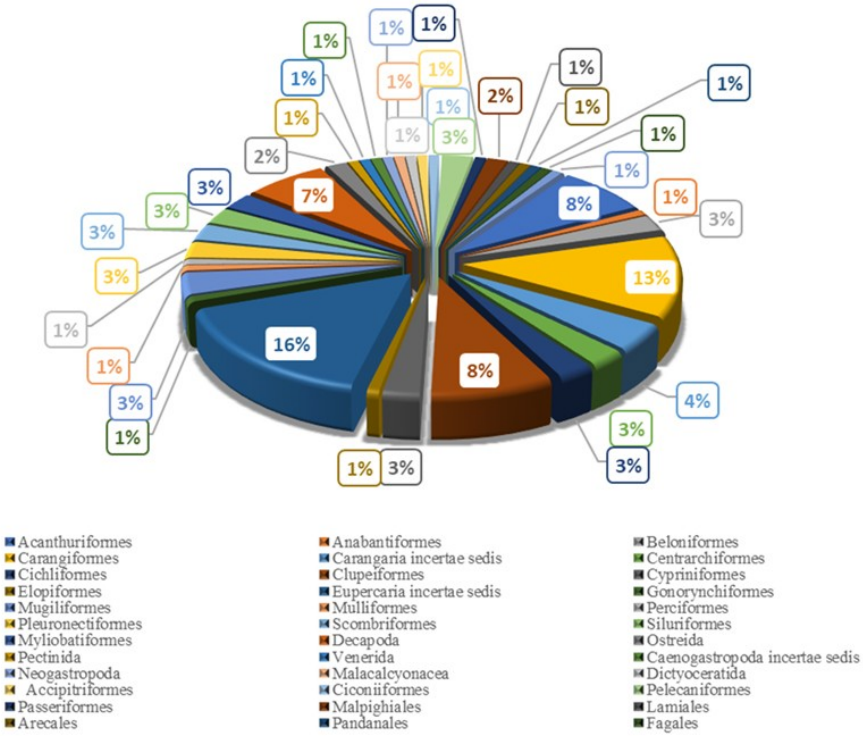

FIGURE 2 Order-wise percentage distribution of the recorded species in the Manakudy Estuary, showing the relative contribution of each taxonomic order to the total species richness.

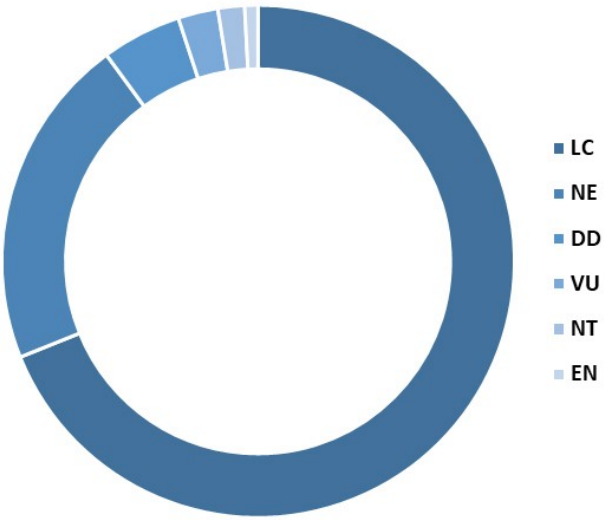

FIGURE 3 Percentage distribution of IUCN Red List categories for the recorded ichthyofaunal and floral species of the Manakudy Estuary, India. LC = Least Concern, NE = Not Evaluated, DD = Data Deficient, VU = Vulnerable, NT = Near Threatened, EN = Endangered.

Similar diversity gradients have been reported in other estuarine ecosystems along the Indian coastline. For instance, Ramesh *et al*. (2023) recorded 49 species from the Thoothukudi mangroves, which is considerably lower than the species richness documented in the present study. Abinaya *et al*. (2024) documented 76 species in the Agniyar estuary, where Eupercaria and Sciaenidae emerged as dominant groups. Raju *et al*. (2017) recorded 866 fishes from the Arasalar estuary, which is higher than the present study. The estuaries of Mallipattinam and Gosthani supported 66 (Varadharajan *et al*. 2012) and 60 species (Jaya *et al*. 2024), respectively, reflecting moderate species richness comparable to Manakudy. In contrast, the Kavvayi estuary harboured 151 species (Ashwini *et al*. 2025), suggesting a much higher biodiversity potential possibly due to its larger size, diverse habitats, and relatively lower levels of disturbance. Other estuaries of Kerala also demonstrated notable faunal diversity, such as the Chettuva estuary (70 species: Benjamin *et al*. 2023), Poonthura estuary (71 species: Bella *et al*. 2022), and the rocky reef systems of Kerala, which supported an exceptionally high ichthyofaunal diversity of 232 species (Baiju *et al*. 2019).

In western coastal regions, the Zuari estuary exhibited remarkably high richness, yielding 286 species (Sreekanth *et al*. 2018), whereas Vembanad Lake, despite being the largest tropical wetland ecosystem in India,

supported a comparatively lower record of 96 species (Roshni *et al*. 2023), possibly reflecting habitat degradation. Likewise, Bharadwaj and Devi Prasad (2021) documented 63 species from the Sasihithlu estuary; Kunal *et al*. (2020) reported only 36 species from the Karanja-Dharamtar Creek and Chandran *et al*. (2022) reported 90 faunal species in the Gorai Creek, Mumbai, pointing towards the influence of local ecological settings and anthropogenic pressures. In the east coast, the Mahanadi and Devi estuaries collectively supported 119 species (Sajina *et al*. 2025). In the Sundarbans region, Bhutia *et al*. (2025) recorded 57 finfish species from the Matla estuary, reflecting the ecological uniqueness of mangrove-dominated estuaries.

TABLE 1 An Annotated Checklist of the Flora and Fauna of the Manakudy Estuary, India. L_{max} = Maximum Length observed; W_{max} = Maximum Weight observed.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Kingdom: Animalia												
Phylum: Chordata												
Class: Teleostei												
Order: Acanthuriformes												
Family: Drepaneidae												
Drepane longimana (Bloch & Schneider, 1801)	Concertina fish	-	+	+	B, M	15.4	280	-	3.7 ±0.34	MiC; Aq	H	NE
Drepane punctata (Linnaeus, 1758)	Spotted sicklefish	+	+	+	F, B, M	32	460	-	3.3 ±0.42	C	H	LC
Family: Leiognathidae												
Aurigequula fasciata (Lacepede, 1803)	Striped ponyfish	-	+	+	B, M	24.5	150	-	3.4 ±0.39	MiC	H	LC
Gazza minuta (Bloch, 1795)	Toothpony	-	+	+	B, M	16.8	40	-	4.2 ±0.01	C	H	LC
Karalla dussumieri (Valenciennes, 1835)	Dussumier's ponyfish	-	+	+	B, M	18.5	60	-	3.2 ±0.38	C	H	LC
Leiognathus equula (Forsskal, 1775)	Common ponyfish	+	+	+	F, B, M	19.5	82	10.7	3.0 ±0.40	MiC; AqC	H	LC
Family: Lobotidae												
Lobotes surinamensis (Bloch, 1790)	Tripletail	-	+	+	B, M	25	440	-	4.0 ± 0.5	C; Aq; G	H	LC
Family: Scatophagidae												
Scatophagus argus (Linnaeus, 1766)	Spotted scat	+	+	+	F, B, M	20	550	-	3.0 ±0.35	MiC; AqC; Aq	V	LC
Family: Siganidae												
Siganus javus (Linnaeus, 1766)	Streaked spinefoot	-	+	+	B, M	26	160	-	2.4 ±0.08	C; Aq	V	LC
Order: Channiformes												
Family: Channidae												
Channa punctata (Bloch, 1793)	Spotted snakehead	+	+	-	F, B	33	180	-	3.8 ±0.70	C; Aq; AqC	H	LC
Order: Beloniformes												
Family: Belonidae												
Ablennes hians (Valenciennes, 1846)	Flat needlefish	-	+	+	B, M	82.5	650	-	4.2 ±0.66	MiC; G	H	LC
Tylosurus melanotus (Bleeker, 1850)	Keeljaw needlefish	+	+	+	F, B, M	78.5	580	-	4.3 ±0.76	C	H	NE
Family: Laberamphidae												
Hemiramphus lutkei (Valenciennes, 1847)	Lutke's halfbeak	-	+	+	B, M	36	200	22.6	3.4 ±0.5	MiC	H	NE

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Order: Carangiformes												
Family: Carangidae												
Atropus armatus (Forsskal, 1775)	Longfin trevally	-	+	+	B, M	22	420	-	4.1 ±0.57	C; G	H	LC
Atule mate (Cuvier, 1833)	Yellowtail scad	-	+	+	B, M	20	300	-	4.2 ±0.5	MiC; G	H	LC
Caranx heberi (Bennett, 1830)	Blacktip trevally	-	+	+	B, M	30	450	50	4.0 ±0.57	MiC; G	H	LC
Caranx hippos (Linnaeus, 1766)	Crevalle jack	-	+	+	B, M	24	175	66	3.6 ±0.4	C; G	CP	LC
Caranx ignobilis (Forsskal, 1775)	Giant trevally	-	+	+	B, M	52	220	60	4.2 ±0.4	C; AqC; G; Aq	CP	LC
Caranx sexfasciatus (Quoy & Gaimard, 1825)	Bigeye trevally	+	+	+	F, B, M	28	400	42	4.5 ±0.6	C; G	CP	LC
Ferdauia ferdau (Fabricius, 1775)	Blue trevally	-	+	+	B, M	18	280	-	4.3 ±0.5	C; G	CP	LC
Megalaspis cordyla (Linnaeus, 1758)	Torpedo scad	-	+	+	B, M	36.5	640	22	3.9±0.57	HC	H	LC
Scomberoides commersonnianus (Lacepede, 1801)	Talang queenfish	-	+	+	B, M	42	12000	63.5	4.4 ±0.45	MiC; G	H	LC
Scomberoides lysan (Forsskal, 1775)	Double-spotted queenfish	-	+	+	B, M	65	4000	-	4.0 ±0.67	MiC; G	-	LC
Scomberoides tol (Cuvier, 1832)	Needlescaled queenfish	-	+	+	B, M	40	1500	26	4.1 ±0.6	MiC; G	V	LC
Selaroides leptolepis (Cuvier, 1833)	Yellowstripe scad	-	+	+	B, M	15	150	11.9	3.8 ±0.2	C	H	LC
Seriolina nigrofasciata (Ruppell, 1829)	Blackbanded trevally	-	+	+	B, M	58	550	-	4.2 ±0.57	MiC; G	H	LC
Family: Coryphaenidae												
Coryphaena hippurus (Linnaeus, 1758)	Common dolphinfish	-	+	+	B, M	45	3000	55.8	4.4 ±0.02	HC; AqC; G	CP	LC
Family: Rachycentridae												
Rachycentron canadum (Linnaeus, 1766)	Cobia	-	+	+	B, M	48	5000	-	4.0 ±0.02	MiC; AqC; G	H	LC
Order: Carangaria *incertae sedis*												
Family: Lactariidae												
Lactarius lactarius (Bloch & Schneider, 1801)	False trevally	-	+	+	B, M	30	480	15	4.2 ±0.7	C	H	NE
Family: Latidae												
Lates calcarifer (Bloch, 1790)	Barramundi	+	+	+	F, B, M	62.5	2000	44.5	3.8 ±0.60	HC; AqC; G;	H	LC
Family: Polynemidae												
Eleutheronema tetradactylum (Shaw, 1804)	Fourfinger threadfin	+	+	+	F, B, M	35	300	-	4.1 ±0.5	HC; AqC	H	NE
Family: Sphyraenidae												
Sphyraena jello (Cuvier, 1829)	Pickhandle barracuda	-	+	+	B, M	75	4000	-	4.5 ±0.6	C; G	CP	LC
Sphyraena obtusata (Cuvier, 1829)	Obtuse barracuda	-	+	+	B, M	52.5	500	-	4.5 ±0.4	C; G	H	LC

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Order: Centrarchiformes												
Family: Terapontidae												
Terapon jarbua (Forsskal, 1775)	Jarbua terapon	+	+	+	F, B, M	25	160	13	3.9 ±0.5	MiC; AqC	H	LC
Terapon puta (Cuvier, 1829)	Small-scaled terapon	+	+	+	F, B, M	20	100	-	3.4 ±0.47	MiC	H	NE
Terapon theraps (Cuvier, 1829)	Largescaled terapon	+	+	+	F, B, M	18.5	120	-	3.7 ±0.46	MiC	H	LC
Order: Cichliformes												
Family: Cichlidae												
Etroplus suratensis (Bloch, 1790)	Pearlspot	-	+	-	B	25	500	15	2.9 ±0.26	C; AqC; Aq	H	LC
Oreochromis mossambicus (Peters, 1852)	Mozambique tilapia	+	+	-	B, M	34.5	450	14.4	2.2 ±0.03	HC; AqC; G; Aq	PP	VU
Oreochromis niloticus (Linnaeus, 1758)	Nile tilapia	+	+	-	B, M	38.5	640	18.6	2.0 ±0.02	HC; AqC	PP	LC
Order: Clupeiformes												
Family: Chirocentridae												
Chirocentrus dorab (Forsskal, 1775)	Dorab wolf-herring	-	+	+	B, M	45	540	-	4.4 ±0.89	C; G	H	LC
Family: Dorosomatidae												
Herklotsichthys castelnaui (Ogilby, 1897)	Castelnau's herring	+	+	+	F, B, M	18	80	-	3.1 ±0.3	MiC	H	LC
Hilsa kelee (Cuvier, 1829)	Kelee shad	+	+	+	F, B, M	17	150	15	2.9 ±0.33	HC	H	LC
Nematalosa nasus (Bloch, 1795)	Bloch's gizzard shad	+	+	+	F, B, M	22	180	16.2	2.2 ±0.09	MiC	H	LC
Family: Engraulidae												
Thryssa dussumieri (Valenciennes, 1848)	Dussumier's thryssa	-	+	+	B, M	15.5	50	-	2.8 ±0.21	C	H	LC
Thryssa malabarica (Bloch, 1795)	Malabar thryssa	-	+	+	B, M	17	46	-	3.4 ±0.5	C	H	DD
Thryssa mystax (Bloch & Schneider, 1801)	Moustached thryssa	-	+	+	B, M	13.5	42	13	3.6 ±0.6	C	H	LC
Thryssa setirostris (Broussonet, 1782)	Longjaw thryssa	-	+	+	B, M	14	45	16	3.3 ±0.48	MiC	H	LC
Stolephorus indicus (van Hasselt, 1823)	Indian anchovy	-	+	+	B, M	14.5	30	9	3.6 ±0.03	C	H	LC
Family: Pristigasteridae												
Opisthopterus tardoore (Cuvier, 1829)	Tardoore	-	+	+	B, M	16.5	60	-	3.4 ±0.46	MiC	H	LC
Order: Cypriniformes												
Family: Cyprinidae												
Labeo calbasu (Hamilton, 1822)	Orangefin labeo	+	+	-	F, B	30	1200	32.8	2.0 ±0.05	C; AqC	H	LC
Labeo rohita (Hamilton, 1822)	Rohu labeo	+	+	-	F, B	96.8	8000	58	2.2 ±0.12	HC; AqC; G	H	LC
Systomus sarana (Hamilton, 1822)	Olive barb	+	+	-	F, B	28.5	150	-	2.9 ±0.2	MiC; Aq, G	H	LC

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Order: Elopiformes												
Family: Megalopidae												
Megalops cyprinoides (Broussonet, 1782)	Indo-Pacific tarpon	+	+	+	F, B, M	44.5	400	-	3.5 ±0.1	MiC; AqC; G	H	DD
Order: Eupercaria *incertae sedis*												
Family: Gerreidae												
Gerres erythrourus (Bloch, 1791)	Deepbody mojarra	-	+	+	B, M	22.5	80	-	3.3 ±0.43	MiC	H	LC
Gerres filamentosus (Cuvier, 1829)	Whipfin silverbiddy	+	+	+	F, B, M	24	120	19	3.3 ±0.2	MiC	H	LC
Gerres longirostris (Lacepede, 1801)	Strong-spine silver-biddy	+	+	+	F, B, M	18	92	20.6	3.5 ±0.34	C	H	LC
Family: Haemulidae												
Plectorhinchus albovittatus (Ruppell, 1838)	Two-striped sweetlips	-	+	+	B, M	38.5	1800	-	4.0 ±0.66	C, Aq	H	LC
Pomadasys maculatus (Bloch, 1793)	Saddle grunt	-	+	+	B, M	25	160	-	4.0 ±0.67	C	H	LC
Family: Lethrinidae												
Lethrinus lentjan (Lacepede, 1802)	Pink ear emperor	-	+	+	B, M	35	550	24.1	3.9 ±0.2	HC	H	LC
Lethrinus nebulosus (Forsskal, 1775)	Spangled emperor	-	+	+	B, M	30	600	38.8	3.8 ±0.2	HC; AqC; G	CP	LC
Family: Lutjanidae												
Lutjanus argentimaculatus (Forsskal, 1775)	Mangrove red snapper	+	+	+	F, B, M	32.5	180	57	3.6 ±0.5	C; AqC; G	CP	LC
Lutjanus cyanopterus (Cuvier, 1828)	Cubera snapper	-	+	+	B, M	46.8	1800	-	4.4 ±0.5	C; G	CP	VU
Lutjanus fulviflamma (Forsskal, 1775)	Dory snapper	-	+	+	B, M	25	385	19.1	3.8 ±0.3	C; G	CP	LC
Lutjanus fulvus (Forster, 1801)	Blacktail snapper	+	+	+	F, B, M	23.5	350	20.6	3.6 ±0.5	C; G; Aq	CP	LC
Lutjanus russellii (Bleeker, 1849)	Russell's snapper	-	+	+	B, M	20	260	-	4.1 ±0.4	C; AqC; G	H	LC
Lutjanus vitta (Quoy & Gaimard, 1824)	Brown-stripe red snapper	-	+	+	B, M	32.5	420	15.4	4.0 ±0.3	C	H	LC
Family: Sciaenidae												
Johnius borneensis (Bleeker, 1851)	Sharpnose hammer croaker	+	+	+	F, B, M	18	120	15.9	3.7 ±0.4	MiC	H	LC
Johnius carouna (Cuvier, 1830)	Caroun croaker	+	+	+	F, B, M	17.5	140	-	3.5 ±0.4	MiC	H	LC
Otolithes ruber (Bloch & Schneider, 1801)	Tigertooth croaker	-	+	+	B, M	34.5	500	19.7	3.6 ±0.6	C; G	H	LC
Panna microdon (Bleeker, 1849)	Panna croaker	-	+	+	B, M	24.8	265	-	3.6 ±0.4	MiC	H	LC
Family: Sillaginidae												
Sillago sihama (Forsskal, 1775)	Silver sillago	-	+	+	B, M	32.5	188	16.7	3.3 ±0.1	C; AqC	H	LC

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Family: Sparidae												
Acanthopagrus latus (Houttuyn, 1782)	Yellowfin seabream	+	+	+	F, B, M	25	350	24.4	3.8 ±0.43	C; AqC; G	H	DD
Order: Gonorynchiformes												
Family: Chanidae												
Chanos chanos (Fabricius, 1775)	Milkfish	+	+	+	F, B, M	65	640	86.1	2.6 ±0.18	HC; AqC; G	H	LC
Order: Mugiliformes												
Family: Mugilidae												
Ellochelon vaigiensis (Quoy & Gaimard, 1825)	Squaretail mullet	+	+	+	F, B, M	30	380	-	2.2 ±0.1	C; AqC; Aq	CP	LC
Mugil cephalus (Linnaeus, 1758)	Flathead grey mullet	+	+	+	F, B, M	53.8	520	35.4	2.5 ±0.17	HC; AqC; G	H	LC
Planiliza macrolepis (Smith, 1846)	Largescale mullet	+	+	+	F, B, M	27.5	240	23	2.8 ±0.17	C; AqC; G	H	LC
Planiliza parsia (Hamilton, 1822)	Goldspot mullet	+	+	+	F, B, M	30	360	9.5	2.0 ±0.01	C; AqC	H	NE
Family: Mullidae												
Parupeneus indicus (Shaw 1803)	Indian goatfish	-	+	+	B, M	35	530	-	3.5 ±0.37	C; G	H	LC
Order: Perciformes												
Family: Serranidae												
Epinephelus coioides (Hamilton, 1822)	Orange-spotted grouper	-	+	+	B, M	24.5	480	41.3	4.0 ±0.02	C; AqC; G	H	LC
Order: Pleuronectiformes												
Family: Cynoglossidae												
Cynoglossus lingua (Hamilton, 1822)	Long tongue sole	+	+	+	F, B, M	37.5	65	10.8	3.5 ±0.37	C	H	LC
Family: Soleidae												
Brachirus orientalis (Bloch & Schneider, 1801)	Oriental sole	+	+	+	F, B, M	42.5	84	-	3.5 ±0.37	C	H	LC
Synaptura albomaculata (Kaup, 1858)	Kaup's sole	-	+	+	B, M	24	60	-	3.9 ±0.6	NI	H	LC
Order: Scombriformes												
Family: Scombridae												
Scomberomorus Guttatus (Bloch & Schneider, 1801)	Indo-Pacific king mackerel	-	+	+	B, M	38.5	800	39.8	4.3 ±0.67	HC; G	H	DD
Family: Trichiuridae												
Lepturacanthus savala (Cuvier, 1829)	Savalai hairtail	-	+	+	B, M	75	460	38	4.3 ±0.76	C	H	NE
Trichiurus lepturus (Linnaeus, 1758)	Largehead hairtail	-	+	+	B, M	80	572	50.6	4.4 ±0.4	HC; G	H	LC
Siluriformes												
Family: Ariidae												
Arius jella (Day, 1877)	Blackfin sea catfish	-	+	+	B, M	28.5	250	-	3.5 ±0.37	C	T	NE
Arius maculatus (Thunberg, 1792)	Spotted catfish	+	+	+	F, B, M	31.5	340	-	3.4 ±0.46	C	T	NE
Family: Plotosidae												
Plotosus canius (Hamilton, 1822)	Gray eel-catfish	+	+	+	F, B, M	38	430	-	3.8 ±0.4	C	V	LC

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Class: Elasmobranchii												
Order: Myliobatiformes												
Family: Dasyatidae												
Brevitrygon imbricata (Bloch & Schneider, 1801)	Coromandel whipray	+	+	+	F, B, M	25 cm WD	1050	19	3.5 ±0.37	MiC	V	VU
Brevitrygon walga (Muller & Henle, 1841)	Bengal whipray	-	+	+	B, M	26 cm WD	850	16.7	3.5 ±0.5	C	H	NT
Himantura uarnak (Gmelin, 1789)	Honeycomb stingray	-	+	+	B, M	37.5 cm WD	12500	83	3.6 ±0.6	MiC; Aq; G	T	EN
Class: Aves												
Order: Accipitriformes												
Family: Accipitridae												
Haliastur indus (Boddaert, 1783)	Brahminy kite	+	+	+	F, B, M	-	-	-	3.3±0.6	-	-	LC
Order: Ciconiiformes												
Family: Ciconiidae												
Mycteria leucocephala (Pennant, 1769)	Painted stork	+	+	+	F, B	-	-	-	3.0±0.5	-	-	NT
Order: Passeriformes												
Family: Corvidae												
Corvus splendens (Vieillot,1817)	House crow	+	+	+	F, B, M	-	-	-	3.3±0.4	-	-	LC
Order: Pelecaniformes												
Family: Ardeidae												
Ardea alba (Linnaeus, 1758)	Great white egret	+	+	+	F, B, M	-	-	-	3.0±0.3	-	-	LC
Ardeola grayii (Sykes, 1832)	Indian pond heron	+	+	+	F, B, M	-	-	-	3.2±0.8	-	-	LC
Egretta garzetta (Linnaeus, 1766)	Little egret	+	+	+	F, B, M	-	-	-	3.1±0.3	-	-	LC
Phylum: Arthropoda												
Class: Malacostraca												
Order: Decapoda												
Family: Gecarcinidae												
Cardisoma carnifex (Herbst, 1796)	Brown land crab	-	+	+	B, M	9 cm CW	135	-	-	-	H	NE
Family: Penaeidae												
Metapenaeus dobsoni (Miers, 1878)	Kadal shrimp	-	+	+	B, M	13	40	6.4	-	C	-	NE
Penaeus (Fenneropenaeus) indicus (H. Milne Edwards, 1837)	Indian white prawn	-	+	+	B, M	17.5	60	12.2	-	C	-	NE
Penaeus monodon (Fabricius, 1798)	Giant tiger prawn	-	+	+	B, M	20	120	-	-	C	-	NE
Penaeus semisulcatus (De Haan, 1844)	Green tiger prawn	-	+	+	B, M	18	80	10.4	-	C	-	NE
Penaeus vannamei (Boone, 1931)	Whiteleg shrimp	-	+	+	B, M	16.5	50	-	-	C	-	NE
Family: Portunidae												
Scylla serrata (Forskal, 1775)	Indo-Pacific swamp crab	+	+	+	F, B, M	17.5 CW	800	6.9	-	C	-	NE
Scylla tranquebarica (Fabricius, 1798)	Purple mud crab	+	+	+	F, B, M	15 CW	680	-	-	-	H	NE

TABLE 1 Continued.

Taxa	Common name	Occurrence			Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
		S1	S2	S3								
Phylum: Mollusca **Class: Bivalvia** **Order: Ostreida** **Family: Malleidae**												
Malleus species	Hammer oyster	-	-	+	MW	7.5	35	-	-	-	H	NE
Family: Ostreidae												
Crassostrea species	True oyster	-	-	+	M	6.8	18	-	-	-	H	LC
Order: Pectinida **Family: Placunidae**												
Placuna placenta (Linnaeus, 1758)	Window-pane oyster	-	-	+	M	10	40	-	-	C	H	NE
Order: Venerida **Family: Veneridae**												
Paphia species	Carpet clam	-	-	+	M	5	15	-	-	C	H	NE
Order: Caenogastropoda *incertae sedis* **Family: Cerithiidae**												
Cerithium species	Horn shell	-	-	+	M	2.5	3	-	-	-	H	NE
Order: Neogastropoda **Family: Melongenidae**												
Volegalea cochlidium (Linnaeus, 1758)	Spiral melongena	-	-	+	M	10	120	-	-	-	H	NE
Phylum: Cnidaria **Class: Octocorallia** **Order: Malacalcyonacea** **Family: Eunicellidae**												
Eunicella species	Gorgonians / sea whips	-	-	+	M	-	-		-	-	H	-
Phylum: Porifera **Class: Demospongiae** **Order: Dictyoceratida** **Family: Spongiidae**												
Spongia species	Bath sponge	-	+	+	B, M	-	-	-	-	C	H	NE
Kingdom: Plantae **Phylum: Tracheophyta** **Class: Magnoliopsida** **Order: Malpighiales** **Family: Rhizophoraceae**												
Rhizophora apiculata Blume	Tilt-root Mangrove	-	+	+	B, M	-	-	-	-	-	-	LC
Rhizophora mucronata Poir.	Loop-root mangrove	-	+	+	B, M	-	-	-	-	-	-	LC
Order: Lamiales **Family: Acanthaceae**												
Avicennia marina (Forssk.) Vierh.	Grey mangrove	+	+	+	F, B, M	-	-	-	-	-	-	LC
Order: Fagales **Family: Casuarinaceae**												
Casuarina equisetifolia L.	Horsetail she-oak	+	+	+	F, B, M	-	-	-	-	-	-	LC

TABLE 1 Continued.

Taxa	Common name	Occurrence S1	S2	S3	Habitat	L_{max} (cm)	W_{max} (g)	Lm (cm)	Trophic status	Fishery status	Threat status	IUCN status
Order: Sapindales												
Family: Anacardiaceae												
Mangifera indica L.	Mango	+	+	+	F, B, M	-	-	-	-	-	-	DD
Class: Liliopsida												
Order: Arecales												
Family: Arecaceae												
Cocos nucifera L.	Coconut palm	+	+	+	F, B, M	-	-	-	-	-	-	NE
Order: Pandanales												
Family: Pandanaceae												
Pandanus tectorius Parkinson	Thatch screwpine	+	+	+	F, B, M	-	-	-	-	-	-	DD

Threat status: CP, Ciguatera poisoning; H, Harmless; PP, Potential pest; T, Traumatogenic; V, Venomous
S1, Site 1 (Towards freshwater influx); S2, Site 2 (Mid-Mangrove area); S3 (Towards the mouth of the estuary);
Habitat: F, Fresh water; B, Brackish Water; M, Marine Water;
MiC, Minor Commercial; Aq, Aquarium; AqC, Aquaculture; G, Gamefish; HC, Highly Commercial; NI, No Interest; LC, Least Concern; VU, Vulnerable; DD, Data Deficient; EN, Endangered; NT, Near Threatened; NE, Not Evaluated

In addition to ichthyofauna, the recorded malacofauna, avifauna, and floral components provide supporting baseline information on associated biotic groups within the estuary. The Manakudy Estuary recorded six molluscan species, dominated by Bivalvia (four species). A similar trend was observed along the Thoothukudi Coast, Tamil Nadu, where 84 molluscan species (45 gastropods and 39 bivalves) were documented by Keerthana *et al*. 2023. The predominance of bivalves indicates favourable estuarine conditions for filter feeders and ecological similarity with nearby coastal systems of southern Tamil Nadu. Avian and mangrove diversity in the Manakudy Estuary highlights the ecological role of mangroves as crucial foraging and nesting habitats. Six avian species were recorded, with *Corvus splendens*, *Egretta garzetta*, and *Ardea alba* being the most abundant. The mangrove assemblage comprised three true mangrove species and four associates, dominated by Avicennia marina, along with *Casuarina equisetifolia* and *Cocos nucifera*. Similar bird–vegetation associations have been reported from other southern Indian mangrove wetlands (Bharathi and Viji 2023), underscoring the importance of conserving mangrove stands in Manakudy to sustain avifaunal diversity and estuarine ecosystem health.

5 | CONCLUSIONS

This investigation establishes the Manakudy Estuary as a highly productive and biodiverse coastal system, recording a notable increase of 120 species relative to historical baselines. The dominance of marine-associated families such as Carangidae and Lutjanidae highlights the estuary's critical role as a nursery and feeding ground for commercially important fishes. However, the occurrence of IUCN-listed species, including the endangered *Himantura uarnak* and vulnerable *Brevitrygon imbricata*, indicates emerging ecological stress. In light of increasing anthropogenic pressures, continuous monitoring, community-based conservation, regulation of non-selective fishing gears, seasonal closures during monsoon recruitment, and protection of mangrove nursery habitats are recommended. Integrating these measures into local fisheries management frameworks will support the long-term conservation and sustainable use of the Manakudy Estuary.

CONFLICT OF INTEREST

The author declares no conflict of interest.

AUTHORS' CONTRIBUTION

Adyasha Sahu: Conceptualization, data curation, methodology, writing original draft; N. Jayakumar: conceptualization, investigation, supervision, validation; C. Sudhan: Software, visualization, formal analysis; R. Durairaja: Supervision, formal analysis, validation; P. Padmavathy and P. Velmurugan: Investigation and formal analysis; D. Dhruve: critical review; Kamei Ringjonmeilu: Conceptualization, data curation, investigation; Narsingh Kashyap: supervision; formal analysis.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on a reasonable request from the corresponding author.

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