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New record of *Moringua raitaborua* (Hamilton, 1822): First report of the genus from the Interu Mangrove Swamp, Krishna Estuary, Andhra Pradesh, India

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Abstract
An ell species, which has not been reported in the Interu mangrove swamp, has been reported by the researchers for the first time. The investigators gathered twelve individuals of eels, ranging from 215 to 682 millimetres in body length. Measurements and countable features matched those seen long ago in Ganges. Far from expected, this eel-like fish now appears farther south than ever recorded on India's eastern shore. Its presence hints at hidden richness within tangled root systems where tides rise and fall. Before this, no member of its genus had turned up in the Krishna estuary. Seeing it here shifts what was assumed about its range. The finding of the purple spaghetti-eel in the Krishna estuary shows that mangroves hold more life than it was thought. Each new record is reshaping the knowledge of these valuable habitats.

Keywords: New record, Purplespaghetti-eel, Mangrove swamp, Krishna Estuary, India

Introduction

Wetland forests near warm coasts do more than just trap carbon - they hold entire living worlds within tangled roots and salty air. On India's eastern shoreline, a wide network of rivers carries life through the Krishna delta, where thick stands of salt-tolerant trees stretch across twenty-five thousand hectares, nearly half the total mangrove cover in Andhra Pradesh. One patch, called Interu, spreads over a thousand football fields at the upper edge of this tidal maze. Factories dismantling old ships leak harmful elements into the water, tainting the mud and pushing native creatures out of balance. When poisons seep into these fragile zones, what grows there shifts slowly, sometimes beyond return. Knowing exactly who lives in these swamps - down to the smallest crab or sprout - helps shape quieter, smarter ways to protect them.

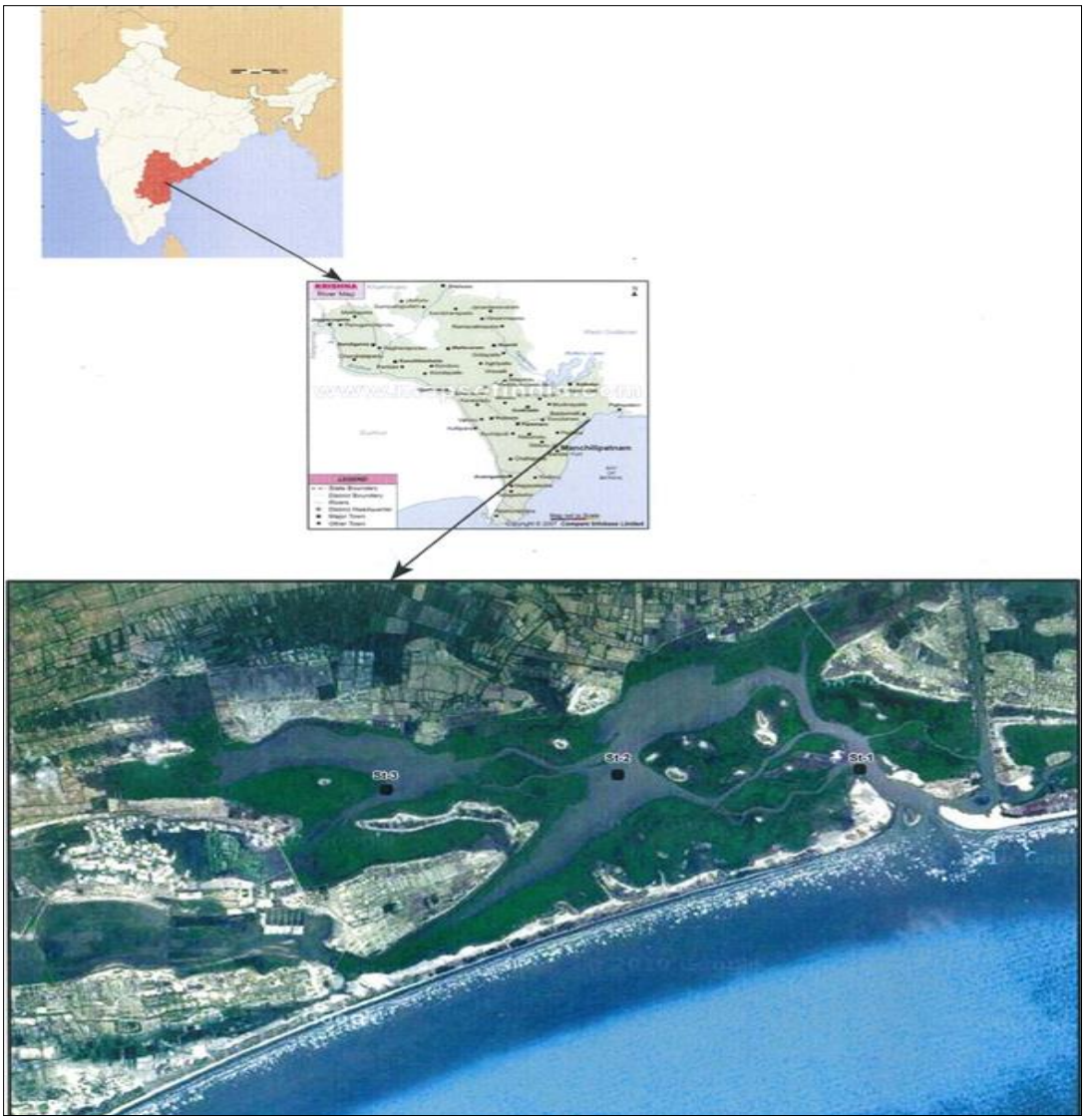
Spaghetti eels belong to the family Moringuidae, made up of around fifteen kinds found globally under two accepted genera (Nelson *et al*., 2016) [13]. One genus along with nearly half a dozen types shows up so far in Indian seas (Jayaram, 2010) [10]. These creatures lack scales entirely, their bodies smooth and bare, while missing strong fang-like teeth on the roof of the mouth, besides having tiny fin ridges tucked near the tail end instead of full dorsal and anal fins (Smith, 1989; Nelson *et al*., 2016) [13, 16]. Living buried in silt-rich estuaries means dealing with sudden swings in salt levels, acidity, plus oxygen drops - a setup Moringua raitaborua handles well thanks to its biology (Day, 1878; Froese & Pauly, 2024) [3, 6]. Skin-based breathing helps it survive low-oxygen habitats because layers beneath the outer skin grow dense with blood vessels, making gas transfer effective even when water quality shifts fast (Bhattacharya & Bhattacharya, 2006; Zaccone *et al*., 2012) [2, 20].

Along India's eastern shoreline, M. raitaborua appears in the reports from West Bengal, Odisha, and Tamil Nadu - sources confirm this since at least 2010. In more recent years, genetic analysis flagged its presence in fresh locations, including Chilika Lagoon, another spot within Odisha, marking it as newly observed there by 2021. Even though earlier work in the Krishna estuary found several Clupeioids and Gobioid species, one group stayed absent from records - the eel-like fish of the Moringuidae family. It remained unseen in the Interu mangroves until this new discovery happened. Past surveys from 1995 onward missed them completely, just like later ones in 2013.

It was for the first time that Moringua genus appears in the Interu mangrove swamp, which is part of the Krishna estuary. With this rediscovery, M. raitaborua marks a southward shift of the genus along India's eastern coast-line. Records like this one stretch what scientists thought they knew about where the purple spaghetti-eel lives. With each new discovery in newer areas, the knowledge regarding the life of tidal zones and how it holds together there grows. The discovery of each new organism, though seems trivial, but matters more when viewed through the perspective of managing these vulnerable ecosystems.

Material and Methods

The fish collections were done fortnightly in the Interu mangrove swamp from December 2007 to November 2009 which bordered (in the downstream direction with GPS reference coordination) 16°20'58.0624" N, 81°21'49.3781" E (Figure 1). All the fish species are captured by using stake net measuring 150 cm vertical length×1500 cm total length with stretch mesh size 7.5 cm, 6.5 cm, 5 cm, 3.5 cm and 2 cm and gillnet measuring 5.7–2.3 cm was operated randomly and stake nets were soaked overnight. Then, fish were preserved in 10% formalin for proper species identification and further investigations. All the necessary data of captured fish like morphometric meristic characters were recorded in fresh condition. Based on the standard taxonomic keys (Day, 1875-78; 1889; Koumans, 1953; Talwar and Kacker, 1984; Talwar and Jhingran, 1991) [3].



Result

Taxonomic descriptions of the species

Order: Anguilliformes

Family: Moringuidae

Genus: Moringua Gray 1831

Species: *Moringua raitaborua* (Hamilton, 1822) [7] (Fig.1)

Material examined: 12 specimens, 215 – 682 mm SL, Date of collection: 30-03-2008.

Locality for both the specimens: Interu mangrove swamp of river Krishna estuarine region Andhra Pradesh.

Fig 1: Moringua raitaborua (Hamilton)

Fin formula: D 28 – 30; P 9 -11; A 33 – 35.

Description

Body elongate, slippery, rounded and flattened towards the tail. Head length 8.9–11.6 (x̄: 10.17) in SL. Body depth 2.5–3.5 (x̄: 3.01) in SL. Origin of dorsal nearer to caudal fin, pre dorsal distance 67.5–74.1 (x̄: 70.76) in SL and base of dorsal 23.1–30.5 (x̄: 27.90) in SL. Pectorals small in size, pre pectoral distance 8.7–11.1 (x̄: 9.8) in SL and length of pectoral 1.0–1.9 (x̄: 1.50) in SL. Origin of anal slightly anterior to vertical through the origin of the dorsal. Pre-anal distance 64.8–71.8 (x̄: 68.10) and base of anal 27.0–35.1 (x̄: 31.30) in SL. The posterior portion of the dorsal fin after 28–30 rays and anal fin after 33–35 rays is embedded in the skin; caudal fin truncates. Eyes small and not easily visible, diameter 3.2–6.6 (x̄: 5.12) in HL, and interorbital distance 9.8–12.9 (x̄: 11.28). Snout blunt, length 6.0–9.0 (x̄: 7.58) HL. Anterior nostril tubular, mouth small, terminal, cleft of mouth reaches to posterior margin of the orbit; lower jaw slightly longer, pointed; upper and lower jaws with single row of backwardly directed small conical teeth, vomer with a single row of teeth; gill openings narrow, rounded, inferior and covered by a flap of skin.

Colour: Body colour coppery-olive dorsally, becoming dusky white below. After preservation the colour of the specimen slightly faded up.

Distribution: The species *M. raitaborua* is distributed in West Bengal (Barman 2007; Basu et. al. 2012; Yennawar *et al*. 2017), Odisha (Barman *et al*. 2007; Pati *et al*.2018; Rajesh Kumar Behera et. al.,2021), Andhra Pradesh (Madhusudhananrao, 2011; Rao *et al*. 2013; Devarapalli, 2017) and Tamil Nadu (Mogalekar *et al*. 2018) along the Indian coasts. Present study reports the new distribution record of the species *M. raitaborua* in Interu mangrove swamp

Discussion

The discovery of *Moringua raitaborua* in the Interu mangrove swamp marks a significant milestone in documenting the ichthyofaunal diversity of the Krishna estuarine system. While previous systematic surveys of the region have identified various Clupeioids and Gobioids (Rao, 1995; Srikanth *et al*., 2013) [15, 18], the family Moringuidae had not been previously recorded in this specific habitat. With the inclusion of this species, the known Anguilliformes diversity of the Interu swamp now comprises eight species across seven genera and five families (Jayaram, 2010; Nelson *et al*., 2016) [10, 13].

The twelve specimens collected during this study (ranging from 215 to 682 mm SL) align closely with the original taxonomic descriptions provided by Hamilton-Buchanan in 1822 [7] for the Ganges estuary (Hamilton, 1822) [7]. A critical diagnostic feature distinguishing *M. raitaborua* from its congeners is its jaw structure: the jaws are nearly equal in front, or the lower jaw is only slightly longer (Smith, 1989; Jayaram, 2010) [10, 16]. This contrasts with other known species in the genus that typically exhibit a much more pronounced lower jaw. Furthermore, the specimens displayed the characteristic family trait of dorsal and anal fins being reduced to low folds that are embedded in the skin posteriorly and become confluent with the caudal fin (Nelson *et al*., 2016) [13].

Geographically, this report represents the first occurrence of the genus *Moringua* in the Krishna estuary, effectively extending the known distribution of the purple spaghetti-eel southward along the east coast of India (Jayaram, 2010) [10]. Historically, the species has been documented in West Bengal, Odisha, and Tamil Nadu (Day, 1878; Jayaram, 2010) [3, 10]. Recent research utilizing DNA barcoding has also confirmed its presence in other major brackish water systems, such as the Chilika Lagoon in Odisha (Mishra *et al*., 2021) [12]. The repeated discovery of this species in new localities suggests it may be more widespread than historical records indicate (Ward *et al*., 2009) [19], though its elusive, burrowing nature often makes it difficult to detect during standard surveys (Froese & Pauly, 2024) [6].

The ability of *M. raitaborua* to thrive in the muddy bottoms of the Interu swamp is supported by specialized biological adaptations. Estuarine environments are dynamic and often subject to hypoxia caused by organic runoff, stagnant water, or high nutrient loads (Diaz & Rosenberg, 2008) [4]. Histological investigations into this species reveal that it has adapted to these challenging conditions through cutaneous respiration (Bhattacharya & Bhattacharya, 2006) [2]. The eel possesses a thick epidermis characterized by abundant blood capillaries and specialized mucous cells — specifically goblet cells (MCI) and oval cells (MCII) (Zaccone *et al*., 2012; Bhattacharya & Bhattacharya, 2006) [2, 20]. These cells not only facilitate gas exchange by allowing oxygen to penetrate deeper toward the dermal matrix but also protect the skin from physical abrasion and pathogens while the eel digs into the substrate using its head (Zaccone *et al*., 2012) [20].

The presence of *M. raitaborua* serves as a vital indicator of the ecological complexity of the Krishna Estuary. However, like many coastal wetlands in the region, this habitat faces increasing anthropogenic pressures (Kathiresan & Bingham, 2001; Spalding *et al*., 2010) [11, 17]. Lessons from similar estuarine systems, such as the Fauzderhat coast, show that proximity to ship-breaking areas can lead to significant habitat degradation through the release of heavy metals and toxic chemicals (Hossain *et al*., 2016; Islam & Tanaka, 2004) [8, 9]. Such pollution can disrupt local food chains and threaten the stability of macrobenthic communities (Diaz & Rosenberg, 2008) [4]. Documenting the current status and taxonomic profile of the Interu swamp's fish fauna is therefore essential for establishing a baseline to monitor community resilience and inform future conservation and management strategies for India's east coast estuarine ecosystems (Primack, 2014; FSI, 2021) [14].

Summary and Conclusion

This study documents the first record of Moringua raitaborua (purple spaghetti-eel) from the Interu mangrove swamp of the Krishna estuary, Andhra Pradesh. Twelve specimens were identified by key morphological traits consistent with type descriptions. The finding extends the species' known east-coast distribution southward and raises the total Anguilliformes diversity of the swamp to eight species. Given ongoing anthropogenic stressors such as heavy-metal and organic pollution, this record provides a timely biodiversity baseline for monitoring and conservation.

The occurrence of *M. raitaborua* in the Krishna estuary confirms the genus' presence in this system and expands knowledge of its distribution along India's east coast. Its

specialised cutaneous respiration enables survival in hypoxic mangrove sediments, but habitat degradation poses risks. Conserving the structural integrity of the Interu mangroves is essential for sustaining this species and the broader estuarine fish community. Future surveys with molecular barcoding are recommended to clarify distribution and ecological roles.

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