Building evidence for conservation globally

Journal of Threatened Taxa

10.11609/jott.2023.15.10.23931-24150
www.threatenedtaxa.org

26 October 2023 (Online & Print)
15(10): 23931–24150
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

Open Access

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Ph: +91 9385339863 | www.threatenedtaxa.org
Email: sanjay@threatenedtaxa.org

For Focus, Scope, Aims, and Policies, visit https://threatenedtaxa.org/index.php/JoTT/aims_scope
For Article Submission Guidelines, visit https://threatenedtaxa.org/index.php/JoTT/about/submissions
For Policies against Scientific Misconduct, visit https://threatenedtaxa.org/index.php/JoTT/policies_various

continued on the back inside cover

Cover: Orange Oakleaf *Kallima inachus* with colour pencils and watercolor wash by Elakshi Mahika Molur adapted from a workshop by Lenin Raj.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 October 2023 | 15(10): 24032–24042
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.8595.15.10.24032-24042
#8595 | Received 16 June 2023 | Final received 07 September 2023 | Finally accepted 09 October 2023
COMMUNICATION

Taxonomy and conservation status of swamp eels (Synbranchiformes: Synbranchidae) of West Bengal, India

Ram Krishna Das

Department of Industrial Fish and Fisheries, Asutosh College, 92, S. P. Mukherjee Road, Kolkata, West Bengal 700026, India.
ramkrishnazoology@gmail.com

Abstract: In a comprehensive study spanning January 2019 to April 2023 within the state of West Bengal, the research focused on elucidating the taxonomy and conservation status of swamp eels in the state. Swamp eels were harvested using traditional fishing techniques, and sampling sites were randomly selected across nine districts: Cooch Behar, Alipurduar, Jalpaiguri, Uttar Dinajpur, Purba Bardhaman, Nadia, Purba Medinipore, North 24 Parganas, and South 24 Parganas, accounting for variations in climatic zones and topography. Through meticulous examination involving X-ray radiographs and morphometric measurements, two distinct swamp eel species, *Ophichthys cuchia* (Hamilton, 1822) and *Ophisternon bengalense* McClelland, 1844, were identified, both falling under the 'Least Concern' category according to the IUCN Red List of Threatened Species. Rapid population decline of swamp eels in West Bengal is primarily attributed to habitat degradation and the indiscriminate use of pesticides and chemical fertilisers.

Keywords: Bengal Mud Eel, diagnosis and description, Gangetic Mud Eel, *Ophichthys cuchia*, *Ophisternon bengalense*, Synbranchiform fishes.

Editor: R. Ravinesh, Centre for Marine Living Resources and Ecology, Kochi, India.

Date of publication: 26 October 2023 (online & print)

Citation: Das, R.K. (2023). Taxonomy and conservation status of swamp eels (Synbranchiformes: Synbranchidae) of West Bengal, India. *Journal of Threatened Taxa* 15(10): 24032–24042. https://doi.org/10.11609/jott.8595.15.10.24032-24042

Funding: West Bengal Biodiversity Board (Memo No. 1221/3K(Bio)- 5/2019

Competing interests: The author declares no competing interests.

Author details: Dr. Ram Krishna Das is an assistant professor in Industrial Fish and Fisheries at Asutosh College, Kolkata, West Bengal. His research interests include animal taxonomy, fish nutrition and toxicology.

Acknowledgements: The author extends his gratitude to the West Bengal Biodiversity Board for financial support(Memo No. 1221/3K (Bio)-5/2019). Special thanks are owned to Dr. Subhadip Gupta, assistant professor, Department of Geography, Asutosh College for creating the study area map. Furthermore, the author appreciates to the principal of Asutosh College for the permission granted to carry out the research. Lastly, sincere thanks are extended to all the fishermen for their invaluable field support.

INTRODUCTION

The swamp eel, a distinctive eel-like percomorph fish, belongs to the Synbranchidae family. These eels are found across tropical and sub-tropical regions globally, excluding Antarctica (Rosen & Greenwood 1976; Bera 2007; Britz et al. 2021a,b). According to Praveenraj et al. (2021), the Synbranchidae family comprises four genera and approximately 26 species, with 12 residing in India (Gopi et al. 2017; Praveenraj et al. 2021), including *Monopterus eapeni* Talwar, 1991, *M. albus* (Zuiew, 1793), *Ophichthys cuchia* (Hamilton, 1822), *O. fossorius* (Nayar, 1951), *O. hodgarti* (Chaudhuri, 1913), *O. ichthyophoides* (Britz, Lalremsanga, Lalrotluanga & Lalramliana, 2011), *Rakthamichthys digressus* (Gopi, 2002), *R. indicus* (Silas & Dawson, 1961), *R. roseni* (Bailey & Gans, 1998), *R. rongsaw* (Britz, Sykes, Gower & Kamei, 2018), *R. mumba* Jayasimhan, Thackeray, Mohapatra & Kumar, 2021, and *Ophisternon bengalense* McClelland, 1844 (Gopi et al. 2017; Britz et al. 2020, 2021a,b)

The state of West Bengal contains diverse habitats ranging from the eastern Himalaya in the north to the Bay of Bengal in the south (Das et al. 2020; Bera et al. 2018). This geographic diversity underscores the state's significance in terms of biodiversity. Surprisingly, no comprehensive study on the taxonomy and conservation status of swamp eels in West Bengal, India, has been conducted by any previous author. These fishes inhabit a variety of environments, including subterranean waters and mud holes in swamps and caves, making their harvesting challenging with conventional fishing methods. Additionally, their superficial anatomy lacks distinctive features, and the limited external characteristics are highly variable, posing identification challenges. Consequently, this study seeks to investigate the taxonomy and conservation status of swamp eels in West Bengal, India, including the identification of major threats to facilitate effective conservation strategies.

MATERIALS AND METHODS

The research spanned January 2019 to April 2023 in West Bengal (Figure 1), involving the collection of swamp eel specimens from nine districts of West Bengal (Cooch Behar, Alipurduar, Jalpaiguri, Uttar Dinajpur, Purba Bardhaman, Nadia, Purba Medinipore, North 24 Parganas and South 24 Parganas; Table 1). Sampling sites were systematically chosen to ensure representation across diverse climatic and topographical conditions. Traditional fishing techniques such as Shuli, kodal-assisted digging, and handpicking were used in rice fields and marginal water areas, while drag nets and mosquito nets were employed in weed-infested wetlands like oxbow lakes. Additionally, baited hooks on hand lines were used to capture species in ditches and fish ponds. Post-harvest, specimens were photographed and preserved in 10% formalin solution, each assigned a museum voucher/accession number for documentation. Detailed morphometric measurements were conducted using a digital caliper to measure various morphometric measurements like total length (TL), head length (HL), snout length (SL), pre-anal length, gape length, the distance between anterior-posterior naris, the width of the body at vent and depth of the body at the vent. The meristic character, like vertebral count, was also undertaken. The vertebrae counts were determined through X-ray radiography and examined various anatomical features, such as fins, scales, gill cleft, soft tissue around the upper jaw, branchiostegal membrane, holobranchs, suprapharyngeal pouches, and afferent and efferent blood vessels of 4th gill arch. Fishes were identified as per the standard taxonomic keys (Rosen & Greenwood 1976; Jayaram 2010).

The assessment of species threat status adhered to the criteria outlined by the IUCN Red List of threatened species (Dahanukar 2010; Dahanukar et al. 2019). Additionally, the frequency of each species' occurrence was determined by calculating the number of times it was collected during the sampling process. This determination was facilitated by employing a standard catch frequency chart, as presented by Tamang et al. (2007), where catch frequencies were categorized as follows: 91–100% (common), 81–90% (abundant), 61–80% (frequent), 31–60% (occasional), 15–30% (sporadic), 05–14% (rare), and less than 5% (extremely rare).

RESULTS

The study revealed the occurrence of two species of swamp eel, *Ophichthys cuchia* (Hamilton, 1822) and *Ophisternon bengalense* McClelland, 1844 in the study area (Table 2).

Taxonomic account

The recorded swamp eels belong to the family Synbranchidae, which is characterized by anterior and posterior nostrils widely separated; gill openings united to form a single pore or slit under the head or throat,

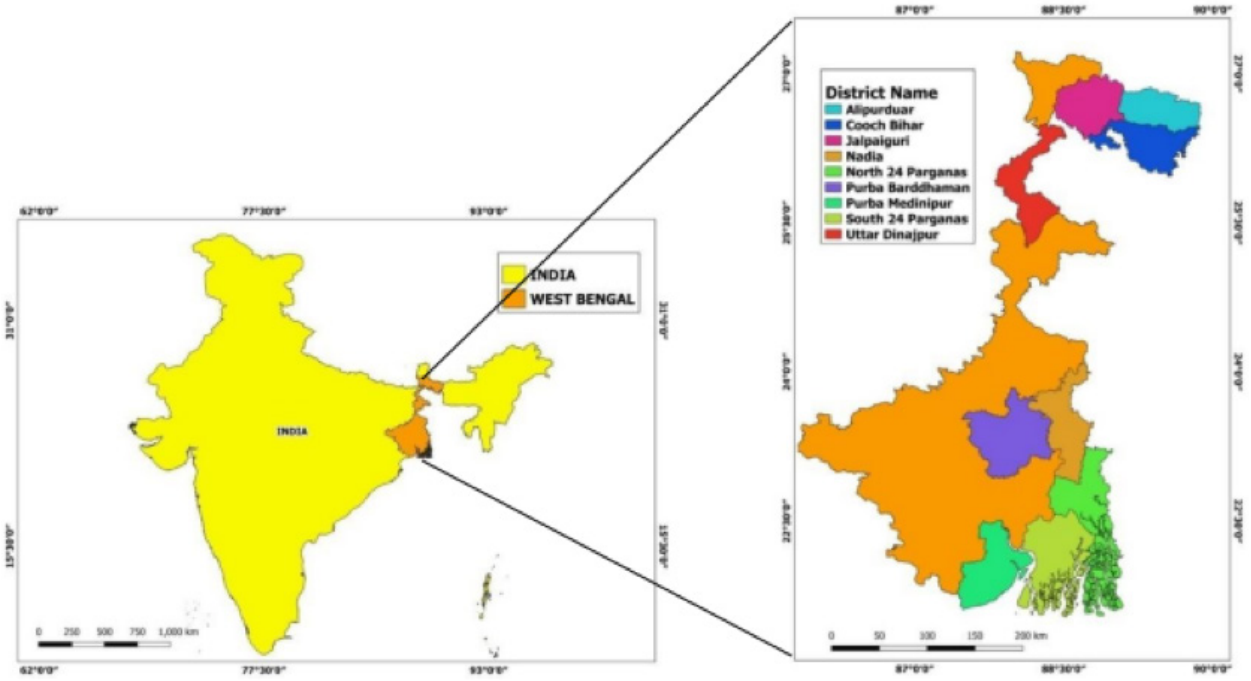

Figure 1. Map of West Bengal in the India map showing the study area.

Table 1. Details of the sampling sites.

District	Block	Village	GPS Readings	Type of water bodies
Cooch Behar	Tufanganj II	Bochamari	26.2500°N, 89.4400°E	Bochamari Beel (ox-bow lake)
	Cooch Behar II	Kharija Kakribari	26.2292°N, 89.2557°E	Beel (ox-bow lake)
		Baneswar	26.2400°N, 89.2993°E	Ditches
	Sitalkuchi	Gosaierhat	26.2048°N, 89.2876°E	Beel (ox-bow lake)
Alipurduar	Kumargram	Hindupara	17.4291°N, 83.1805°E	Rice Field
		Madhuvasa	26.2822°N, 89.4345°E	Beel (ox-bow lake)
Uttar Dinajpur	Hemtabad	Balliadighi	25.4410°N, 88.1260°E	Beel (ox-bow lake)
Purba Bardhaman	Jamalpur	Balarampur	23.5500°N, 87.5932°E	Beel (ox-bow lake)
Nadia	Chapra	Padmamala	23.3319°N, 88.3510°E	Fish Pond
North 24 Parganas	Habra II	Ashokenagar	22.5070°N, 88.3652°E	Fish Pond
South 24 Parganas	Canning II	Canning	22.3007°N, 88.6671°E	Tidal Creek, Matla River estuary
Purba Medinipore	Bhagbankhali	Chandipur	22.1406° N, 87.8715° E	Paddy field
Jalpaiguri	Ambari	Rajgunge	26.6388° N, 88.4971° E	Wetland

so they are named Synbranchidae, which means fused gills; the dorsal and anal fins are reduced to ray less skin folds, and the caudal fin is reduced, pectoral and pelvic fins absent; scales may be present or absent; eyes small or vestigial; 4th aortic arch is complete and swim bladder is absent.

Class: Actinopterygii
Order: Synbranchiformes
Family: Synbranchidae

***Ophichthys cuchia* (Hamilton, 1822) (Image 1)**

Unibranchapertura cuchia (Hamilton, 1822)

Amphipnous cuchia (Hamilton, 1822) Muller 1839

Monopterus cuchia (Hamilton, 1822) Rosen & Greenwood 1976

Monopterus (Amphipnous) cuchia (Hamilton, 1822) Talwar & Jhingran 1991

Ophichthys cuchia (Hamilton, 1822) Britz et al. 2020

Materials examined

2 exs., 03.iii.2019, 750–860 mm TL, Rice field (17.4291 N, 83.1805 E), Paschim Nararthali, Hindupara, Alipurduar, West Bengal, India, Coll. R.K.Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae/1-2; 1 ex., 20.vi.2019, 380 mm TL, an oxbow lake (Beel) (26.2822N, 89.4345E), Madhuvasa, Alipurduar, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae/3; 1 ex., 13.i.2019, 710 mm TL, small ditches (26.2400N, 89.2993E),Kaljani, Baneswar, Cooch Behar, West Bengal, India, Coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae/4; 1 ex., 04.xi.2020, 460 mm TL, Bochamari beel (26.2500N, 89.4400E), Tufangunge, Cooch Behar, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae/5; 2 exs., 25.xi.2020, 680–700 mm TL, ditches (26.2048N,89.2876E), Gosaierhat, Sitalkuchi, Cooch Behar, West Bengal, India, Coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /6–7; 1 ex., 06.xi.2020, 630 mm TL, Beel (ox-bow lake) (26.2292N, 89.2557E), Kharija Kakribari, Cooch Behar, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /8; 2 exs., 8.xii.2020, Beel (25.4410N, 88.1260E), Balliadighi, Hemtabad, Uttar Dinajpur, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /9–10; 2 exs., 22.ii.2021, 520–550 mm TL, Beel (23.5500N, 87.5932E), Jamalpur, Balarampur, Purba Bardhaman, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /11–12; 2 exs., 10.iii.2022, 715-770 mm TL, seasonal fish pond (23.3319N, 88.3510E), Chapra, Padmamala, Nadia, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /13–14; 2 exs., 25.xii.2022, 600-630 mm TL, fish pond (22.5070N, 88.3652E), Habra, Ashokenagar, North 24 Parganas, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /15-16; 2 exs., 20.iv.2023, 465–565 mm TL, fish pond (22.3007 N, 88.6671 E), Canning, South 24 Parganas, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /17–18.)

Common name Gangetic mud eel.

Local name Kuchia, Kuichha, Kuche.

Description

The body is elongated, eel-shaped with a rounded/oval abdomen but laterally compressed at the caudal peduncle; upper lip with a characteristic overhanging or jowl-like structure (Image 2); fins absent; very minute cycloid scales at the posterior part of the body; pre-maxilla with a single row of teeth with 2–3 rows of teeth at symphysis, the maxilla is equal to pre-maxilla in length, without any teeth, palatine/ectopterygoid with a row of teeth, each half of mandible is with more than

Image 1. *Ophichthys cuchia* (Hamilton, 1822). Scale bar: 3.2 cm. © R.K. Das.

Image 2. Dorsal view of the head of *Ophichthys cuchia* showing sense organs. Scale bar: 5.23 cm. © R.K. Das.

Image 3. Lateral view of the head of *Ophichthys cuchia* showing eyes, gape of mouth, and gill slit. Scale bar: 2.59 cm. © R.K. Das.

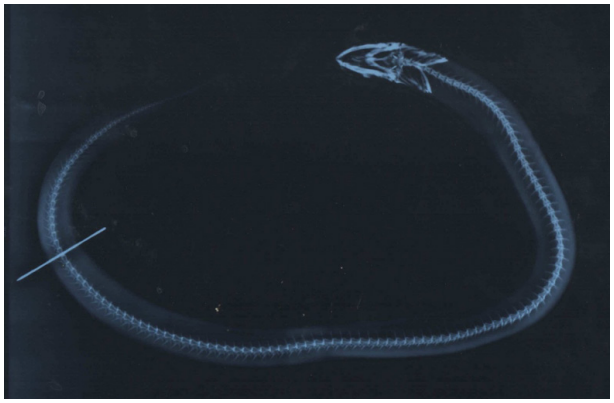

Image 4. X-ray radiograph of *Ophichthys cuchia* showing vertebrae.

Table 2. The list of swamp eels recorded from West Bengal.

Swamp eel species	English name / Common name	Local name	Catch frequency	IUCN category
O. cuchia (Hamilton, 1822)	Gangetic Mud Eel	Kuchia, Kuichha, Kunche	Abundant (85.71%)	LC
O. bengalense McClelland, 1844	Bengal Mud Eel	Nona Kuchia, Kuchia	Rare (14.28%)	LC

Image 5(a). Detection of swamp eels in a rice field in Alipurduar District. © R.K. Das.

Image 5(b). Harvesting of swamp eels from a rice field in Alipurduar District. © R.K. Das.

Image 5(c). Harvesting of swamp eel from a rice field in Alipurduar District. © R.K. Das.

one row of teeth anteriorly but a single row of teeth in posterior part; branchiostegal rays six in number; the triangular gill opening which is internally attached

Image 6(a). Mud holes in ditches in Cooch Behar District. © R.K. Das.

Image 6(b). Harvesting of swamp eel from ditches in Cooch Behar District. © R.K. Das.

Image 6(c). Harvesting of swamp eels in Cooch Behar District. © R.K. Das.

Image 6(d). Harvesting of a *Ophichthys cuchia* from Cooch Behar District. © R.K. Das.

Image 6(e). Detection of swamp eels in ditches in Cooch Behar District. © R.K. Das.

Image 6(f). Harvesting of swamp eels from ditches in Cooch Behar district. © R.K. Das.

with isthmus (Image 3); a single layer of gill filaments are present in 2nd and 3rd gill arches; 1st, 4th, and 5th gill arches are without any gill filaments, 5th ceratobranchial with several teeth-like structures. In the morphometric measurement, the head length 7.35–9.16 % of the total length, pre-anal length is 70.83–78.87 % of the total length, depth of the body at vent 2.08–4.65 % of the total length, the width of the body at vent 1.25–2.20 % of the total length, snout length 13–20 % of head length, the distance between anterior and posterior

naris 15.71–22.50 % of head length, snout length 40–50 % of the gape length. The total vertebral count was 165 to 167 in which abdominal vertebrae was 97–98 and caudal vertebrae was 68–69 (Image 4). Morphometric measurements of the species are presented in Table 3.

Colour

In living conditions, the dorsal side of the *O. cuchia* was yellowish/greenish/brownish with black spots. Whereas the ventral side was yellowish or whitish in colouration. However, the formalin preserved specimens were dark/blackish in colour.

Remarks

O. cuchia (Hamilton, 1822) differs from all the species of synbranchidae except *O. hodgarti* (Chaudhuri, 1913), *O. ichthyopthoides* (Britz, Lalremsanga, Lalrotluanga & Lalramliana, 2011), O. *fossorius* (Nayar 1951), *O. indicus* (Silas & Dawson, 1961) and *O. desilvai* (Bailey & Gans, 1998) by the presence of scales. *O. cuchia* differs from the latter five species having scales in the posterior part of the body. It also differs by having the highest vertebral count (165–167) compared to the remaining species of the genus *Ophichthys*.

Habitat

The study revealed the occurrence of *O. cuchia* in diverse aquatic habitats in the study area. They were found to live in the mud holes of rice fields in the Alipurduar and Purba Medinipore districts (Image 5a–c). However, most of the specimens were found to inhabit the marginal areas of ditches in Cooch Behar and Uttar Dinajpur districts (Images 6a–f). Some individuals were also found to live in the weed-infested wetlands in Alipurduar and North 24 Parganas districts (Oxbow lake) (Image 7), and fish ponds in Nadia and South 24 Parganas district (Image 8). Higher density of the individual was observed in the clayey soils and weed-infested water bodies. During drying seasons, they move to a greater depth of soil, having a very small amount of water. Some specimens were also observed to live in subterranean water. They create a characteristic canal located in deep soils in the marginal areas of water bodies (Image 9). All of the *O. cuchia* were collected from the freshwater region of the study area.

Distribution

India (West Bengal, Assam); Bangladesh; Nepal; Myanmar; Pakistan; and USA.

Image 7. Harvesting of swamp eel from a weed-infested wetland (oxbow lake) in Alipurduar District. © R.K. Das.

Image 8. Harvesting of swamp eel from a fish pond in Nadia District. © R.K. Das.

Image 9. Canal of swamp eels below the soil in the marginal area. © R.K. Das.

Status

According to catch frequency, the species can be categorised as an abundant species (Table 2). On the other hand, the species is recognized as a 'Least Concern' (LC) category as per the IUCN Red List of Threatened Species (Dahanukar 2010).

***Ophisternon bengalense* McClelland, 1844 (Image 10)**

Materials examined

1 ex., 20.iv.2023, 330 mm TL, Tidal creek of Matla river estuary (22.3007 N, 88.6671 E), Canning, South 24 Parganas, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /19; 2 exs., 22.iv.2023, 381–487 mm TL, Tidal creek of Matla river estuary (22.3007 N, 88.6671 E), Canning, South 24 Parganas, West Bengal, India, coll. R.K. Das, Reg. No. AABM/IFF/AC/Fish/Synbranchidae /20–21.

Common name: Bengal Mud Eel.

Local name: Nona kuchia, Kuchia.

Description

Body elongated, eel-like, abdomen rounded; eyes visible through skin (Image 11), vent in the posterior part of the body; head short, compressed; mouth wide, terminal, the gap of mouth extending to some distance behind the posterior border of the eye (Image 11); both the jaws equal with villiform teeth; four branchial arches with well-developed gills; scales absent; pectoral and pelvic fins absent; dorsal, anal, and caudal, fins are rudimentary; dorsal originates ahead of anal; dorsal, caudal and anal fins are confluent with each other. The snout length (SL) is 40% of the gape length; the head length is 9.65–9.71 % of the total length; the pre-anal length is 74.01–75.75 % of the total length, the depth of the body at vent 2.87–3.67 % of total length, the width of the body at vent 1.43–2.36 % of total length, snout length 9.4–10.8 % of head length, the distance between anterior and posterior naris 12.50–16.21 % of head length, snout length 44.40–45.45 % of the gape length. The total vertebral count was 128–132 in which abdominal vertebrae was 73–75 and caudal vertebrae was 55–57 (Image 12). The morphometric measurements of the species are presented in Table 3.

Colour

In living conditions, the dorsal side of the fish was deep brownish, and the ventral side was light brownish with small spots. Whereas the formalin preserved specimens were reddish/brownish in colour.

Table 3. Selected morphometric data for *Ophichthys cuchia* and *Ophisternon bengalense*.

	***O. cuchia* (n = 18)**		***O. bengalense* (n = 3)**	
	Range	Mean±SD	Range	Mean±SD
Total Length (TL) in mm	340–860	600.27±141.60	330–487	399.33±80.08
In percent of total length				
Head length (HL)	7.35–9.16	8.49±0.48	9.65–9.71	9.68±0.03
Pre-anal length	70.83–78.87	74.82±2.26	74.01–75.75	75.03±0.91
Body depth at the vent	2.08–4.65	3.39±0.57	2.87–3.67	3.19±0.42
Body width at the vent	1.25–2.20	1.60±0.25	1.43–2.36	1.76±0.51
In percent head length				
Snout length	13.33–20.00	16.77±1.52	9.37–10.81	10.27±0.78
Distance anterior-posterior naris	15.71–22.50	19.20±1.82	12.50–16.21	13.82±2.07
In percent gape length				
Snout length(SL)	40–50	44.17±4.61	44.40–45.45	44.93±0.50
Ratio				
Depth/Width of body	1–1.66	1.23±0.22	1.00–1.06	1.02±0.03
Total length/Head length	10.90–13.60	11.80±0.71	10.29–10.36	10.32±0.03
Total length/Body depth	20–28.88	23.19±2.41	30.43–33.00	31.72±1.28
Vertebrae				
Abdominal	97–98	97.5±0.70	73–75	74±1.41
Caudal	68–69	68.5±0.70	55–57	56±1.41

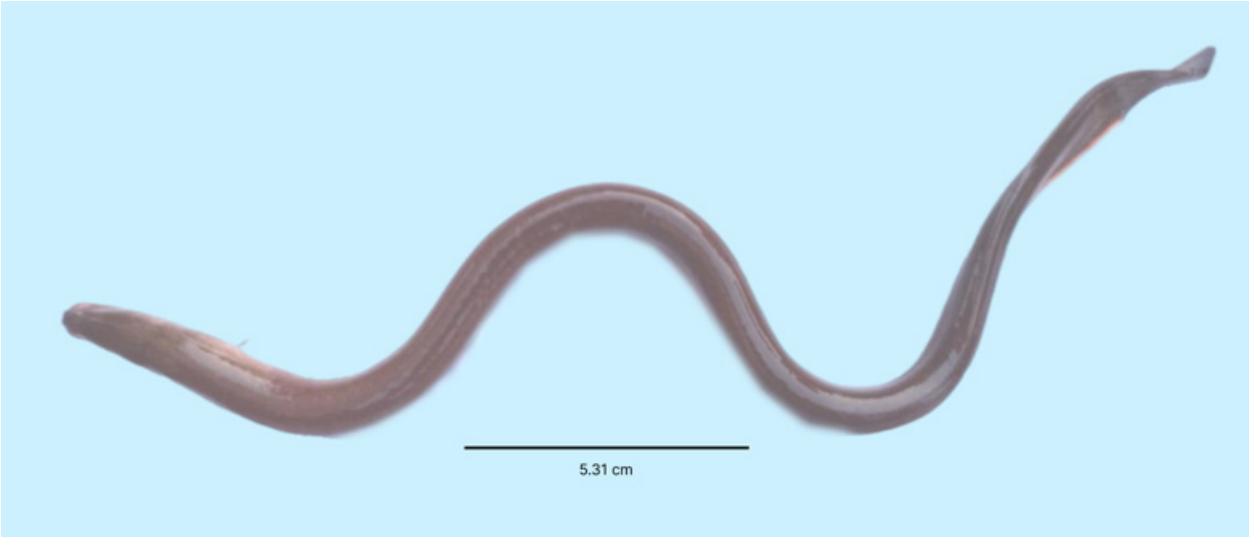

Image 10. *Ophisteron bengalense* McClelland, 1844. Scale bar: 5.31 cm. © R.K. Das.

Image 11. Ventral view of the head of *Ophisteron bengalese*. Scale bar: 2.46 cm. © R.K. Das.

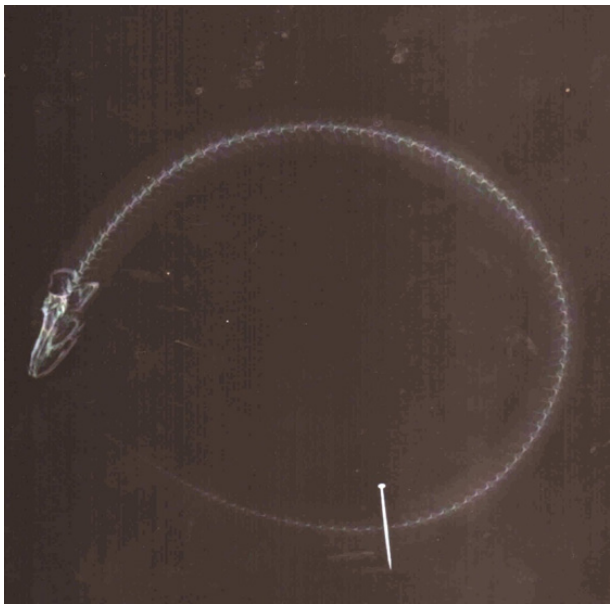

Image 12. X-ray radiograph of *Ophisteron bengalense* showing vertebrae.

Remarks

O. bengalense McClelland differs from all the species of the genus *Ophisternon*, having caudal vertebrae of 55–57, and a snout length of 40% of the gape length. In *O. bengalense*, pectoral and pelvic fins are absent; dorsal, anal, and caudal fins are rudimentary; dorsal originates ahead of anal; dorsal, caudal and anal fins are confluent with each other.

Habitat

The specimens of *O. bengalense* were collected from the mud holes located in the marginal areas of the tidal creek of the Matla River estuary (Image 13), Canning, South 24 Parganas, West Bengal, India. Thus, the results of the present study reveal that *O. bengalense* is a brackish water swamp eel.

Distribution

India (West Bengal); Sri Lanka; Bangladesh; Indo-Malayan region; Philippines.

Status

According to catch frequency, the species can be categorized as a rare species (Table 2). On the other hand, the species is recognized as a 'Least Concern' (LC) category as per the IUCN Red List of Threatened Species (Dahanukar et al. 2019).

Image 13. Harvesting of swamp eel, *Ophisteron bengalense*, from the Tidal Creek of Matla River estuary, South 24 Parganas. © R.K. Das.

DISCUSSION

The swamp eel species, *O. cuchia,* was originally described as *Unibranchapertura cuchia* by Hamilton in 1822 using the type locality of the Ganges river in southeastern Bengal. Later, Muller (1839) transferred the species *U. cuchia* to the genus *Amphipnous*. Rosen & Greenwood (1976), in their well-known revisionary work on the taxonomy of swamp eels, placed the species in the genus *Monopterus.* Recently, Britz et al. (2020) again revised the taxonomy of this fish, placing the species in the genus *Ophichthys.* On the other hand, *O. bengalense* was described by McClelland in 1844 with the type locality of Hooghly River, West Bengal, India. The swamp eels identified in the present study are in accordance with the holotype of the species. In an earlier study, Mishra et al. (2003) recorded the *O. cuchia* in the rivers Kansai, Subarnarekha, and Shilabati of West Bengal. Recently, Mishra & Gopi (2017) recorded both species in the Sundarban Biosphere region of West Bengal, India.

The results of the present study showed that *O. cuchia* is widely distributed in the state of West Bengal. The adaptive features like air breathing organs, the ability to tolerate a wide range of salinity, the capacity to withstand extreme draught and cold by living in burrows, the ability to survive without feeding for considerable periods, and the crawling type of movement are evident in the swamp eel species *O. cuchia*, which possibly caused the wide distribution of the species in the state of West Bengal (Nico et al. 2019). However, *O. bengalense* has been recorded only in the tidal creek of the Matla River estuary, demonstrating brackish water of living habit, thus showing a very restrictive distribution of the species in the state compared to the *O. cuchia*.

Swamp eels occur in a variety of habitats, both freshwater and brackish water. Although some species live in clear flowing streams, most inhabit sluggish or standing waters, often with low oxygen content, like swamps or marshy areas, ponds, and lakes, where borrowing and amphibious habits are commonly displayed. They are admirably adapted for cave life, and some species from both the New World and Old World are cavernicolous (Rosen & Greenwood 1976; Bailey & Gans 1998). In addition, some species, like *M. eapeni* Talwar and *R. roseni* (Bailey & Gans 1998), are blind cavernicoles living in subterranean waters (Gopi 2002).

Overall, swamp eels are not usually considered to be heavily threatened or endangered. So, that is the reason IUCN is listed as the 'Least Concern' category. However, the populations of both species are declining rapidly in the state. Habitat loss due to urbanisation, agricultural expansion, and pollution of freshwater systems is probably responsible for the reduction of the population of swamp eels in West Bengal. Barman (2007) also considered habitat loss to be the chief threat to the fish in West Bengal. Overexploitation for food and trade can also impact local populations of these fish. As agricultural land or rice fields are considered one of the habitats for swamp eel, the indiscriminate use of pesticides and chemical fertilisers also causes the decline of the swamp eel population in West Bengal. Thus, localised threats such as habitat loss, water pollution, and overexploitation can affect the populations of swamp eels, especially in areas where human activities significantly impact their habitats.

CONCLUSION

The present study documented two species of swamp eels, *O. cuchia* (Hamilton, 1822) and *O. bengalense* McClellands, 1844 within the region of West Bengal, India. These swamp eels inhabit diverse environments, including mud holes of the rice field, ditches, fish ponds, wetland or oxbow lakes, and tidal creeks. Based on the

catch statistics, *O. cuchia* is notably abundant, whereas *O. bengalense* is relatively rare species. Nevertheless, it is noteworthy that both species are categorized as 'Least Concern' category as classified by the IUCN Red List of Threatened Species. The decline in swamp eel populations in West Bengal can be attributed to habitat loss due to urbanisation, and indiscriminate use of pesticides and other agro-chemicals. Further studies endeavors are warranted to delve into the biology of the swamp eels for the development of commercial swamp eel fisheries in West Bengal.

REFERENCES

Bailey, R.M. & C. Gans (1998). Two synbranchid fishes, *Monopterus roseni* from peninsular India and *M. desilvai* from Srilanka. *Occasional Papers of the Museum of Zoology, The University of Michigan* 726: 1–18.

Barman, R.P. (2007). A review of the freshwater fish fauna of West Bengal, India with suggestions for conservation of threatened and endemic species. *Records of the Zoological Survey of India, Occasional Paper* 263: 1–48.

Bera, M., S. Paloi, A.K. Dutta, P. Pradhan, A. Roy & K. Acharya (2018). Contribution to the Macromycetes of West Bengal, India: 23–27. *Journal of Threatened Taxa* 10(9): 12270–12276. https://doi.org/10.11609/jott.3875.10.9.12270-12276

Berra, T.M. (2007). *Freshwater Fish Distribution*. The University of Chicago Press, Chicago and London, 615 pp.

Britz, R., A. Standing, B. Kumar, M. Kripakaran, U. Katwate, R.L. Sundar & R. Raghavan (2021b). *Ophichthys fossorius*, a poorly known South Indian swamp eel (Teleostei: Synbranchidae). *Ichthyological Exploration of Freshwaters* 1173: 1–14. https://doi.org/10.23788/ief-1173

Britz, R., H. Sudasinghe, D. Sykes & R.R.H. Tharindu (2020). *Ophichthys desilvai*, a poorly known synbranchid eel from Sri Lanka (Teleostei: Synbranchidae). *Ichthyological Exploration of Freshwaters* 30: 1–16. https://doi.org/10.23788/IEF-1139

Britz, R., N. Dahanukar, A. Standing, S. Philip, B. Kumar & R. Raghavan (2021a). Osteology of '*Monopterus*' *roseni* with the description of *Rakthamichthys*, new genus, and comments on the generic assignment of the Amphipnous Group species (Teleostei: Synbranchiformes). *Ichthyological Exploration of Freshwaters* 30: 221–236. https://doi.org/10.23788/ief-1163

Dahanukar, N. (2010). *Monopterus cuchia*. The IUCN Red List of Threatened Species 2010: e. T166554A6235213. Accessed on 05 May 2023. https://doi.org/10.2305/IUCN.UK.20104.RLTS.T166554A6235213.n

Dahanukar, N., S. de A. Goonatilake, M. Fernado & O. Kotagama (2019). *Ophisternon bengalense*. The IUCN Red List of Threatened Species 2019: e.T166410A1131667. Accessed on 05 May 2023. https://doi.org/10.2305/IUCN.UK.20193.RLTS.T166410A1131667.en

Das, D., E. Tarafder, M. Bera, A. Roy & K. Acharya (2020). Contribution to the Macromycetes of West Bengal, India: 51–56. *Journal of Threatened Taxa* 12(9): 16110–16122. https://doi.org/10.11609/jott.5115.12.9.16110-16122

Gopi, K.C. (2002). A new synbranchid fish, *Monopterus digressus* from Kerala, peninsular India. *Records of the Zoological Survey of India* 100(Part 1–2): 137–143.

Gopi, K.C., S.S. Mishra & L. Kosygin (2017). Pisces, pp. 527–570. In: Chandra, K., K.C. Gopi, D.V. Rao, K. Valarmathi & J.R.B. Alfred (eds.). *Current Status of Freshwater Faunal Diversity in India*. Zoological Survey of India, Kolkata, 624 pp.

Hamilton, F. (1822). *An Account of the Fishes Found in the River Ganges and its Branches*. Archibald Constable and Company, Edinburgh, UK, 405 pp.

Jayaram, K.C. (2010). *The Fresh Water Fishes of the Indian Region*. Narendra Publishing House, New Delhi, 616 pp + XXIV pl.

McClelland, J. (1844). Apodal fishes of Bengal. *Calcutta Journal of Natural History* 5: 150–226.

Mishra, S.S. & K.C. Gopi (2017). Fish diversity of Indian Sundarban and its resource and research prospects**.** In: Chandra, K., J.R.B. Alfred, B. Mitra & B.R. Chowdhury (eds.). *Fauna of Sundarban Biosphere Reserve*. Zoological Survey of India, 229 pp.

Mishra, S.S., P. Pradhan, S. Kar & S.K. Chakrabory (2003). Ichthyofaunal diversity of Midnapore, Bankura and Hooghly Districts, South West Bengal. *Records of the Zoological Survey of India* 220: 1–65

Muller, J. (1839). Vergleichende anatomie der Myxinoiden,der Cyclostomen mit durchbohrtem Gaumen. Ueber das gefasssystem. *Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin* 175–304.

Nico, L.G., A.J. Ropicki, J.V. Kilian & M. Harper (2019). Asian swamp eels in North America linked to the live-food trade and prayer-release rituals. *Aquatic Invasions* 14: 775–814. https://doi.org/10.3391/ai.2019.14.4.14

Praveenraj, J., T. Thackeray, A. Mohapatra & A.P. Kumar (2021). *Rakthamichthys mumba*, a new species of Hypogean Eel (Teleostei: Synbranchidae) from Mumbai, Maharashtra, India. *Aqua, International Journal of Ichthyology* 27(3): 93–102.

Rosen, D.E. & P.H. Greenwood (1976). A fourth Neotropical species of synbranchid eel and the phylogeny and systematics of synbranchiform fishes. *Bulletin of the American Museum of Natural History* 157: 1–69.

Talwar, P.K. & A.G. Jhingran (1991). *Inland fishes of India and adjacent countries. Volume 2*. Oxford & IBH Publishing Co., New Delhi, Bombay, Calcutta, India, 615 pp.

Tamang, L., S. Chaudhury & D. Chaudhury(2007). Ichthyofaunal contribution to the state and comparison of habitat contiguity on taxonomic diversity in Senkhi stream, Arunachal Pradesh, India. *Journal of the Bombay Natural History Society* 104(2): 170–177.

Journal of Threatened Taxa is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64

Print copies of the Journal are available at cost. Write to:
The Managing Editor, JoTT,
c/o Wildlife Information Liaison Development Society,
43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore,
Tamil Nadu 641006, India
ravi@threatenedtaxa.org

Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

October 2023 | Vol. 15 | No. 10 | Pages: 23931–24150
Date of Publication: 26 October 2023 (Online & Print)
DOI: 10.11609/jott.2023.15.10.23931-24150

Publisher & Host

WILD ZOOREACH
Threatened Taxa