

FIRST DOCUMENTED MORPHOMETRIC AND MERISTIC STUDY OF THE MOTTLED EEL, *Anguilla bengalensis bengalensis*, Gray, 1831 (ACTINOPTERYGII, ANGUILLIDAE) FROM MAYURAKSHI RIVER, SIURI, WEST BENGAL, INDIA.

Somnath Bhakat*, Pradip De and Arup kumar Sinha
Associate professor. Department of Zoology, Rampurhat College,
Rampurhat – 731224, Dist. – Birbhum,
W. B. India

*Corresponding author

Abstract

Anguilla bengalensis bengalensis, an endangered catadromous mottled eel from Mayurakshi river, Siuri are collected in the rainy season. It is the first morphometric and meristic study from West Bengal. The study shows different morphometric characters in percentage of total length and head length along with anodorsal length, the main identifying character of *A. bengalensis bengalensis*.

Index Terms: Anodorsal length, maxillary band, rudimentary scale, slime encasement, Tilpara barrage, variegated skin

INTRODUCTION

One of the catadromous eel, genus *Anguilla* Schrank, 1798, distributed worldwide, covered 19 species of which 11 are in tropical regions (Ege, 1939; Watanabe et al., 2009). Of these two species, *A. bengalensis bengalensis* Gray, 1831 and *A. bicolor bicolor* McClelland, 1844 have been reported from India (Jayaram, 2010; Talwar and Jhingram, 1991) with a key (Jayaram, 2010). Day (1878) reported that the Indian freshwater eel, *A. bengalensis bengalensis* is widely distributed in the Indian subcontinent though it was much rarer on the hills than in the plains. Nath and Dey (2000) reported *A. bengalensis bengalensis* from River Dikrong, Arunachal Pradesh, while Rema Devi et al. (2004) mentioned the species in Anamalai hill ranges, Western Ghats. Moravec et al. (2012) collected a few specimens from the river of Kerala, India for endoparasitic study. Arunachalam and Sankaranarayanan (2000) mentioned its economic importance. Besides their normal distribution range, both the species have been recovered from Malaysia, a new distribution range (Arai, 2014; Arai and Siow, 2013). Extensive research works have been done on different aspects of different species of eels in different countries around the world (Watanabe, 2009; Arai et al., 2002; Shen and Tzeng, 2007; Lintas et al., 1998; Sang et al. 1994; Castle and Williamson, 1974), but studies on *A. bengalensis bengalensis* are scanty and there is no comprehensive studies on morphometric of *A. bengalensis bengalensis* from India. Rahimullah et al.

(1944) correctly pointed out the fact, “.....though extensive researches have been conducted on various aspects of the biology of the eel in the European countries, practically no work has been done on any of the Indian species (viz. *A. bengalensis* and *A. bicolor*) except for certain observations of a preliminary nature.....”. In this context, it is necessary to study the morphometry of *A. bengalensis bengalensis*.

Pantulu (1957) mentioned, “ the eels are generally acclaimed as very important food fish in many European and in certain Asian countries, they are seldom eaten in India except by poorer classes”. But *A. bengalensis bengalensis* has an endangered status in India (Molur and Walker, 1998; Jacoby et al., 2014). Hence detailed study of the species, *A. bengalensis bengalensis* is necessary to conserve the species quite efficiently. So the present worker badly feels a need to study the morphometrics of the eel, *A. bengalensis bengalensis*.

MATERIALS AND METHODS

Twenty six specimens of different size groups (168-338 mm in length) were collected from Tilpara Barrage on Mayurakshi river at Siuri (87° 32'00" E, 23° 55'00" N), (Fig. 1.marked collection site) district Birbhum, West Bengal, India during the rainy season, 2017.

During the days prior to the capture of the eel there was incessant rain in Siuri and in the upper reaches of river Mayurakshi. The gates of Tilpara Barrage were opened for three days and there was a massive influx of fresh water into the site from where the samples were collected by the local fishermen in live. The collected specimens were preserved in 8% formaldehyde solution. Measurements were taken within two days of preservation.

The external morphometric characters were measured followed by Ege (1939) and Watanabe et al. (2004). The fin difference index (I_{FD}), which is the distance between the verticals from the beginning of dorsal fin (Z) to the anus (anodorsal length) relative to the total length(LT) was calculated as follows:

$$I_{FD} = 100Z LT^{-1}$$

Seventeen morphometric characters were measured by using dial-calipers with 0.1mm accuracy. Measurements were taken in both sides of each individual. Body measurements were expressed as percentage of total length (%TL) and head measurements were expressed as percentage of head length (%HL). Four meristic counts were also done.

RESULTS

Of all the 26 specimens collected, following observations are recorded:

The fishes are encased in slime (nearly 1 mm. thick) making them very slippery. Body color olive green mottled with dark brown, lighter below. Upper surface of the body with darker spots and blotches. Elongated and cylindrical body; rounded abdomen; long and compressed head; pointed snout (Plate- 1,2,3,&4), terminal mouth, mouth gape extends up to orbit, with well developed thick lips, lower jaw slightly protruded (Plate-6), no barbells, presence of two external nares (Plate-8), small superior eyes, narrow maxillary bands of teeth (Plate- 7 & 8), vertebrae 106-112, dorsal fin inserted midway between the gill opening and the origin of anal fin; dorsal, caudal and anal fins are continuous (Plate-3), rudimentary cycloid scales embedded in the skin; variegated skin color, distinct lateral line (Plate-5), I_{FD} ranges from 8.89 to 13.69.

Of the specimens 17 morphometric characters were recorded and presented in Table 1. Four meristic counts are given in Table 2.

Dorsal fin is longer than the anal fin (Table 1., where the mean pre-dorsal length is 26.55 while the mean pre-anal length is 38.94. Again the mean pre-anal length without HL is 26.73, nearer to half of the mean pre-dorsal length 14.35).

DISCUSSIONS

Arai (2014) recommended pre-anal, HL, pre-anal length-HL, pre-dorsal length-HL in percentage of total length as 40.0, 15.0, 13.9 and 16.4 respectively. Kadir (2017) recorded HL, pre-dorsal and pre-anal length as 14.29, 29.13 and 37.68 respectively, while in the present study pre-anal length, HL, pre-anal-HL, pre-dorsal-HL, and pre-dorsal length are 38.94, 12.20, 26.73, 14.35 and 26.55 respectively. In the present study all the values are slightly lower except in pre-anal length, where, the value is slightly higher.

I_{FD} value of *A. bengalensis bengalensis* is 9.1 (Arai, 2014), ranges from 8 to 14 (Ege,1939; Watanabe et al., 2004) and 15 (Kadir et al.,2017) but in the present study it ranges from 8.87 to 13.69 (mean 11.02 ± 1.15). So I_{FD} value of *A. bengalensis bengalensis* is within the range as reported by other authors.

Talwar and Jhingran (1991), Shafi and Quddus (2001) and IUCN report of Bangladesh (2000) proposed fin formula as dorsal fin with 250-305 rays, anal fin with 220-250 rays, pectoral fin with 18 rays, while caudal fin with 10-12 rays mentioned by IUCN report of Bangladesh (2000) and Shafi and Quddus (2001). In the present study, all the meristic counts are within the range of the study of these workers, except Jayaram (2010) who mentioned dorsal fin with 220-305 rays and anal fin with 200-250 rays.

Recent molecular study also shows that all the eels that possess skin with variegated markings, are identified as *A. bengalensis bengalensis* (Arai et al. 2015; Arai and wong, 2016), which is reflected also in the present study.

REFERENCES

- Arai,T. (2014), First Record of a tropical mottled eel, *Anguilla bengalensis bengalensis* (Actinopterygii:Anguillidae) from the Langkawi Islands, Peninsular Malaysia, Malaysia, Marine Biodiversity Records 7 (38):1-3.
- Arai,T., Mani, M., Miller, M. J. and Tsukamoto,K. (2002) Growth history and inshore migration of the tropical eel, *Anguilla marmorata* in the Pacific. Mar. Biol., 140:309-316.
- Arai,T. and Siow, R. (2013) First Documented Occurrence of the Giant Mottled eel, *Anguilla marmorata* in Peninsular Malaysia, Malaysia. World Applied Sciences Journal 28(11): 1514-1517.
- Arunachalam, m. and Sankaranarayanan, A.(2000). Some economically important and cultivable fishes in Gadana river, Western Ghats. P 244-246. In A. G. Pooniah and A. Gopalakrishnan (eds.) Endemic fish diversity in Western Ghats. NBFGR-NATP Publications. National Bureau of Fish Genetic Resources, Lucknow, U.P., India. 1, 347 p.

- Castle, P. H. J. and Williamson, G. R. (1974). On the validity of the freshwater eel species *Anguilla ancestrales* Ege from Celebes. *Copeia* 2, 569-570.
- Day, F (1875-1878). The fishes of India : being a natural history of the fishes known to inhabit the seas and freshwater of India, Burma and Ceylon. Text and atlas 4 parts. London xx + 748, 195 pls.
- Ege, V (1939). A revision of the genus *Anguilla* Shaw. Dana report 16, 8-256.
- Gray, J. E. (1831). Illustrations of Indian Zoology; chiefly selected from the collection of Major-General Hardwicke, F. R. S. 20 parts in 2 vols. pls. 1-202.
- IUCN Bangladesh (2000). Red book of threatened fishes of Bangladesh. IUCN- The World Conservation Union, xii + 116 pp.
- Jacoby, D., Harrison, I. J. and Gollock, M. (2014). *Anguilla bengalensis*. The IUCN Red List Of Threatened Species. Version 2015.2. Available at: www.iucnredlist.org. (Accessed on 21/08/2015).
- Jayaram, K. C (2010). The Freshwater Fishes of the Indian Region (2nd Edn) Narendra Publishing House, India. Pp. 29-30.
- Kadir, S. R. A., Rased, M. H. F. A., Kwong, K. O., Wong, L. L. and Arai, T. (2017). Occurrence and the ecological implication of a tropical anguillid eel *Anguilla marmorata* from peninsular Malaysia. *Zoo Keys* 695 : 103-110 (2016).
- Lintas, C., Hirano, J. and Archar, S. (1998). Genetic variation of the European eel (*Anguilla anguilla*). *Mol. Mar. Biol. Biotech.*, 7 : 263-269.
- Molur, S. and Walker, S. (eds.) (1998). Freshwater fishes of India. Zoo Outreach Organisation, Tamil Nadu, India.
- Moravec, F., Sheeba, S. and Biju Kumar, A. (2012). *Rhabdochona (Rhabdochona) Keralensis* sp. nov. (Rhabdochonidae) and some other nematodes in the Indian mottled eel *Anguilla bengalensis bengalensis* from India. *Acta Parasitologica*. 57 (1): 74-82.
- Nath, P. and Dey, S. C. (2000). Fish and fisheries of Northeastern India (Arunachal Pradesh). Narendra Publishing House, Delhi. xviii+217.
- Pantulu, V. R. (1957). Studies on the biology of the Indian fresh-water eel, *Anguilla bengalensis* Gray. *Proc. Nat. Inst. Sci. India*, 22 (5): 259-278.
- Rahimullah, M., Syed Mahamood and Kabir, S. A. (1944). A note on the breeding habits of the common eel, *Anguilla bengalensis* Gray and Hardwicke. *Proc. Indian Acad. Sci.* 19B (1): 16-18.
- Rema Devi, K., Indra, T. J., Raghunathan, M. B. and Rabichandran, M. S. (2005). Fish fauna of Anamalai hill ranges, Western Ghats, India. *Zoos' Print J.* 20 (2):1809-1811.
- Sang, T. K., Chang, H. Y., Chen, C. T. and Hui, C. F. (1994). Population structure of Japanese eel, *Anguilla japonica*. *Mol. Biol. Evol.* 11: 250-260.

Shafi, M. and Quddus, M. M. A. (2001). Bangladesher Mosto Shampad (Fisheries of Bangladesh) (in Bengali). Kabir publication, Dhaka, Bangladesh.pp. 17-20.

Shen, K.N. and Tzeng, W. N. (2007). Population genetic structure of the year-round spawning tropical eel, *Anguilla reinhardtii* in Australia. Zool.Stud., 46: 441-453.

Talwar , P. K and Jhingran , A . (1991) Inland fishes of India and adjacent countries , Delhi , Oxford and IBH Publishing Co . Pvt. Ltd . 2 vols xix + 1158

Watanabe, S., Aoyama, J . and Tsukamoto, K . (2004) Reexamination of Ege (1939) use of taxonomic characters of the genus *Anguilla* . Bulletin of Marine Science . 74 , 337-351 .

Watanabe , S. , Aoyama , J . and Tsukamoto , K . (2009). A new species of freshwater eel *Anguilla luzonensis* (teleostei : Anguillidae) from Luzon Island of Philippines , Fisheries Science 75 , 387-392 .

ACKNOWLEDGEMENT

We thank Teacher- in Charge, Rampurhat College(Govt. Sponsored), Rampurhat, District – Birbhum for providing necessary facilities. We are grateful to Mr. Alokesh Das, Assistant Professor, Dept. of Botany and Mr Gour Pramanik, Assistant Professor, Dept. of Physics, Rampurhat College for their cooperation. We are specially thankful to Mr. Sukdeb for collection of fishes and also to Mr. Dilip Chakraborty for his assistance.

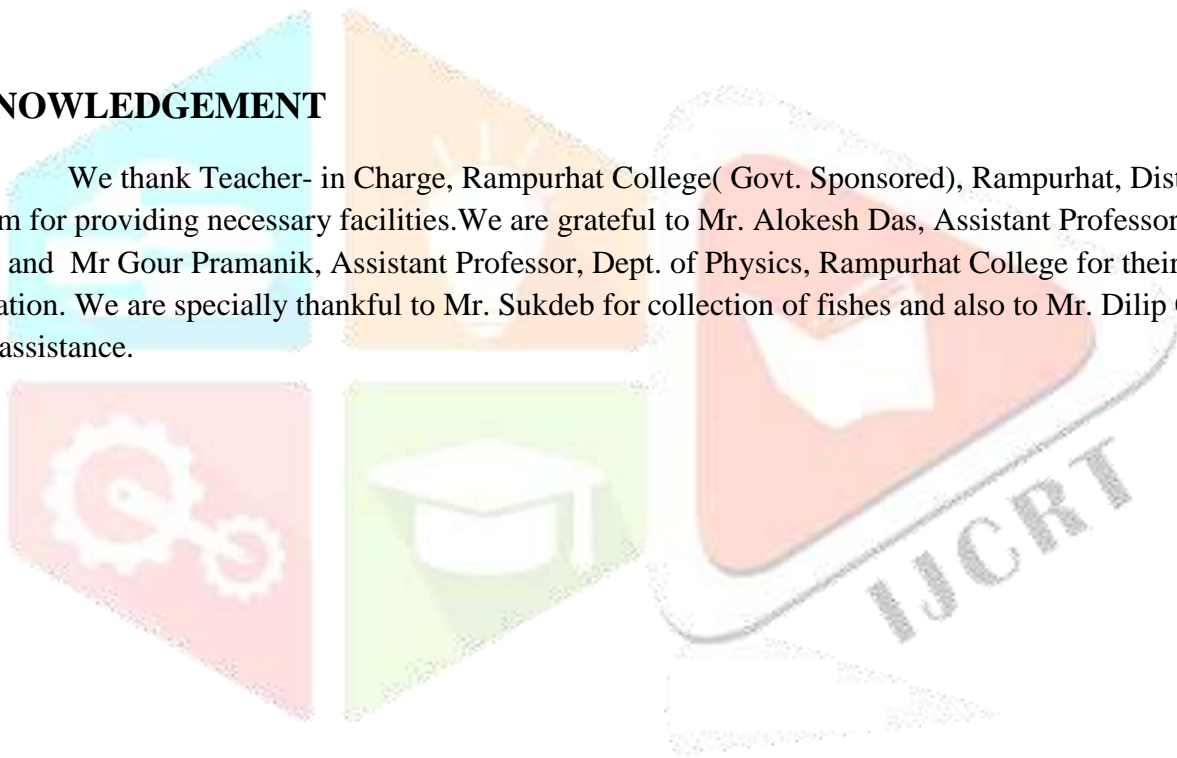


Table-1. Morphometric characters of *A. bengalensis bengalensis*

Characters	Mean \pm S. D.	Minimum range	Maximum range
Total length	248.54 \pm 42.96	168	338
%TL			
Head length	12.20 \pm 0.75	10.26	14.33
Dorsal fin length	73.36 \pm 1.47	70.42	76.09
Anal fin length	61.41 \pm 1.40	58.31	65.43
Pectoral fin length	3.37 \pm 0.43	2.85	4.06
Girth at vent	13.91 \pm 1.16	12.50	15.91
Head width	4.67 \pm 0.37	4.09	5.54
Pre dorsal length	26.55 \pm 1.29	23.73	29.59
Pre anal length	38.94 \pm 1.16	36.61	41.69
Ano-dorsal length	11.02 \pm 1.15	8.87	13.69
Pre-dorsal without HL	14.35 \pm 1.13	12.97	16.57
Pre-anal without HL	26.73 \pm 0.96	25.33	28.73
%HL			
Head width	38.70 \pm 2.25	35.14	43.48
Snout	19.35 \pm 2.22	14.24	25.00
Inter-orbital width	18.66 \pm 1.65	15.21	24.89
Eye diameter	8.54 \pm 1.98	5.26	13.72
Mouth gape	32.08 \pm 2.20	27.27	38.00

Table -2. Meristic counts of *A. bengalensis bengalensis*.

	Present study	Talwar and Jhingram (1991)	IUCN Bang. (2000)	Shafi and Quddus (2001)	Jayaram (2010)
Dorsal fin	250 – 305	250 – 305	250 – 305	250 – 305	220 – 305
Pectoral fin	18	18	18	18	-
Caudal fin	10 – 12	-	10 – 12	10 – 12	-
Anal fin	220 – 250	220 – 250	220 – 250	220 – 250	200 – 250

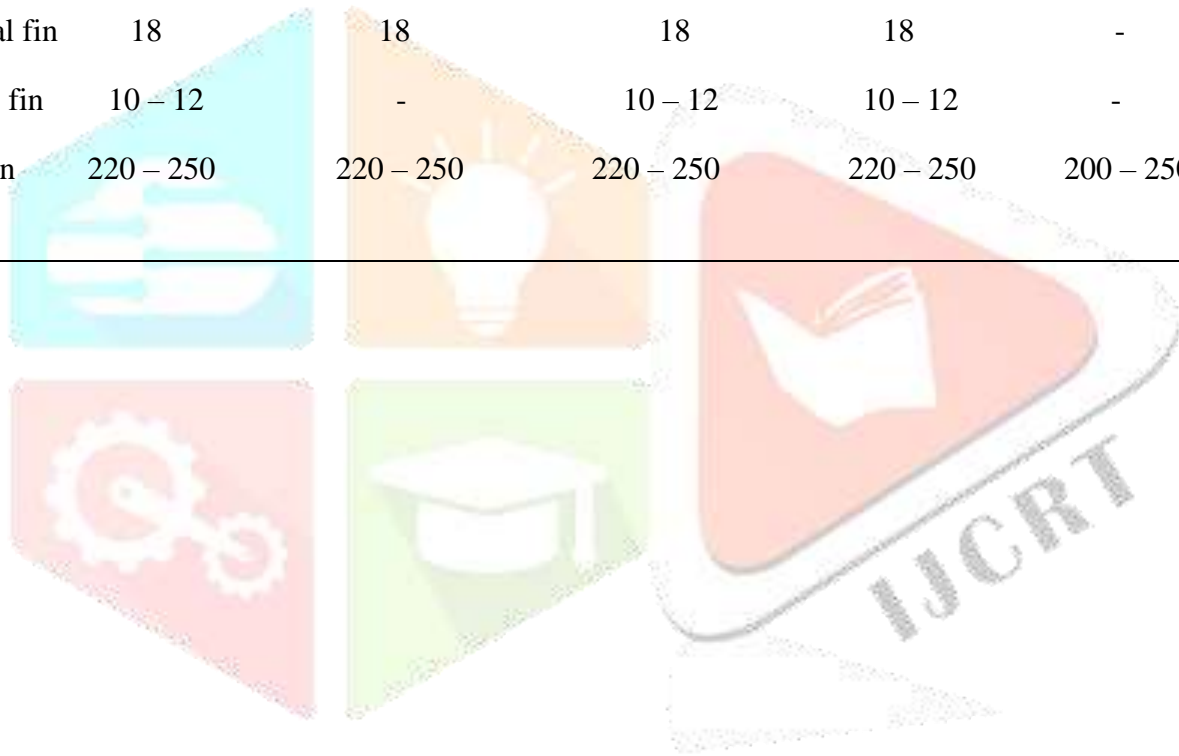




Plate – 1. Anterior portion showing pectoral fin.



Plate – 2. Middle part of body with dorsal fin.



Plate – 3. Continuation of dorsal, caudal and anal fin in posterior portion.



Plate – 4. Total view of an adult.



Plate – 5. Variegated skin with prominent lateral line.



Plate – 6. Anterior portion showing mouth gape and protruded lower jaw.



Plate – 7. Inner view of lower jaw.





Plate – 8. Inner view of upper jaw with external nares.



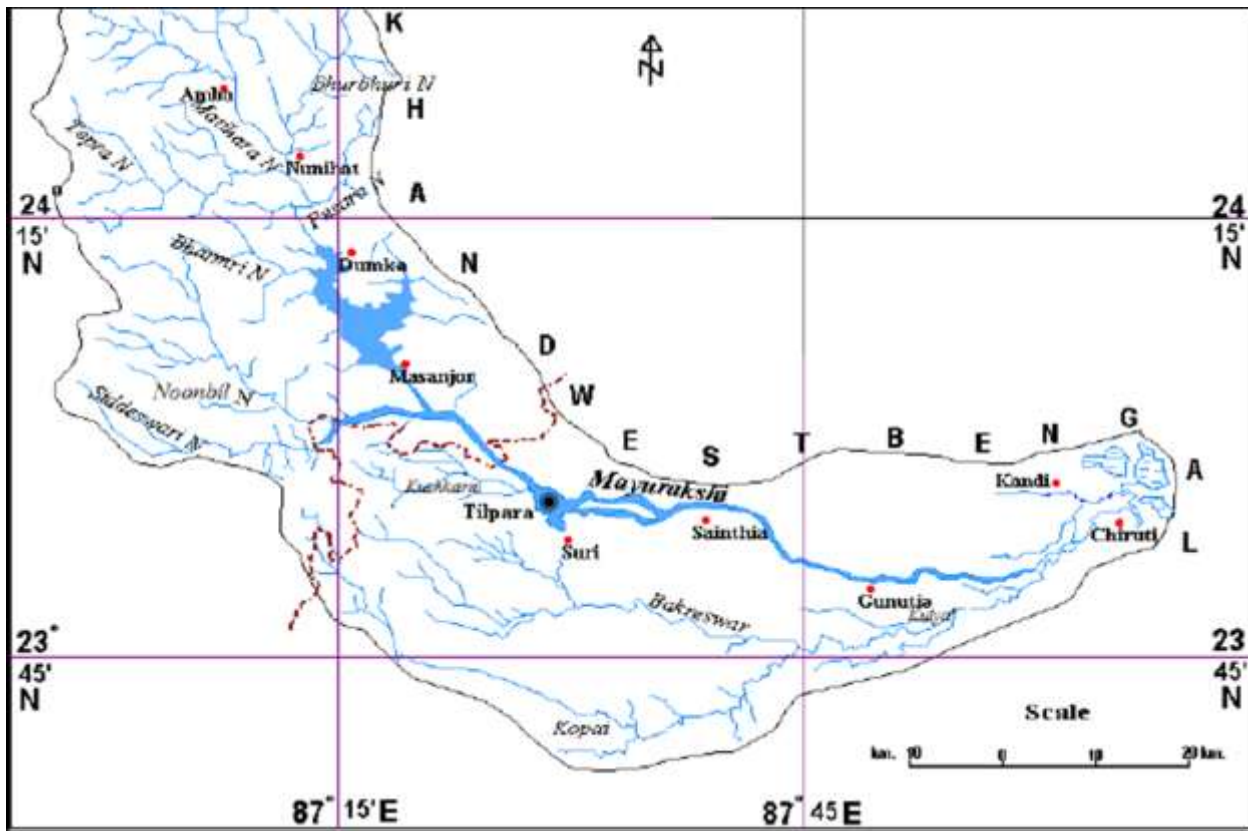


Fig. 1. Collection site at Tilpara Barrage on Mayurakshi River.

