

First record of valid species of torpedo electric ray, *Torpedo polleni* (Bleeker, 1865) (Torpediniformes: Torpedinidae) from Indian waters

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A species of torpedo electric ray, *Torpedo polleni* (Bleeker, 1865) has been reported for the first time from Indian waters. Six specimens of *T. polleni* measuring 147-397 mm TL were collected from shrimp trawl by-catches at Visakhapatnam, central eastern coast of India. The present paper provides description and comparison of morphometric data of *T. polleni* with closely resembling species of genus *Torpedo* thus helping in clearing taxonomic ambiguities. The present study suggests that *T. polleni* (Bleeker, 1865) with 6-8 knob-like papillae on the posterior margin of spiracle, the central papilla being larger, distance between eye and spiracle less than eye diameter, nasal curtain short and wide, its length more than half the length of inter narial width, first dorsal fin originating entirely above the pelvic fin base and base ending little beyond the pelvic fin, dorsal surface showing ornate appearance with close set of brownish-black spots, few spots very closely set or joined together forming vermiculations and dark brown lines is a valid species.

[**Keywords:** *Torpedo polleni*; Valid species; First record from Indian waters]

Introduction

The life history traits such as growth rate, maturation, reproductive cycle, fecundity and life span of torpedo electric rays make them highly vulnerable to human-induced pressures¹. Four species of torpedo electric rays, namely, *Torpedo fuscomaculata* Peters, 1855, *T. marmorata* Risso, 1810, *T. panthera*, Olfers, 1831 and *T. sinuspersici*, Olfers, 1831 were recorded from Indian waters. These are regularly represented in the shrimp trawl by-catches of Visakhapatnam². In addition to these, during our routine field visits one more species, *Torpedo polleni* (Bleeker, 1865) was encountered in the trawl catches of this region. This is the first record of this species from Indian waters. Previous literature reveals that there is lot of confusion prevailing in the identity and validity of this species. The present paper provides full description of *T. polleni* and discusses the validity of this species.

Materials and Methods

Six specimens of *Torpedo polleni*, four males measuring 148-397 mm TL and two females measuring 147 and 237 mm TL were collected from trawl catches along with specimens of *T. fuscomaculata*, *T. panthera* and *T. sinuspersici* during April 2015 to March 2018 from Visakhapatnam (Fig. 1) (Lat 17°01'N to 19°22'N; Long 83°23'E to 85°14'E) fisheries harbor where catches from nearby fish landing centers are brought

for sale. The total length of specimens was taken from tip of snout to caudal fin end (TL) and measured to the nearest millimeter. Identification of specimens, descriptions, terminology for morphometric characters, external and morphometric measurements were taken following standard taxonomic works^{3,4,5}.

Results

In this study, *Torpedo polleni* is rediagnosed and redescribed on the basis of fresh material collected from Indian waters. Description of *T. polleni* collected during the present study is given below. Morphometric data is given in Table 2.

Bleeker, P. 1865. Description du *Narcacion polleni*, espèce inédite des mers de l'île de la Réunion.

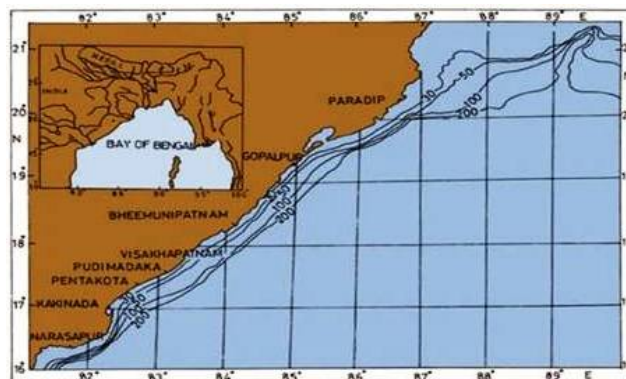


Fig. 1—Map showing sample collection centre

Nederlandsch Tijdschrift voor de Dierkunde v. 3: 171-173 (Type-locality: Reunion, western Mascarenes)

Diagnosis: Spiracle with 6-8 knob-like papillae on its posterior margin, the central papilla being larger. Distance between eye and spiracle less than eye diameter. Nasal curtain short and wide, its length more than half the length of internarial width. First dorsal fin originates entirely above the pelvic fin base and base ends little beyond the pelvic fin. Dorsal surface shows ornate appearance with close set of brownish-black spots, few spots are very closely set or joined together forming vermiculations and dark brown lines.

Description: Disc broadly rounded in outline with straight anterior margin and a small median protuberance anteriorly. Snout length anterior to orbit less than the length of eye and spiracle combined. Preorbital snout length slightly greater than prenasal length. Interorbital distance greater than interspiracle distance. Eyes and spiracles relatively close together, space between them less than eye diameter. Spiracle with 6-8 knob-like papillae on its posterior margin, the central papilla being larger and placed close behind eyes (Fig. 2E). The anterior spiracular wall lined by pseudobranchial fold on the inner side. Few sensory pores present in the snout region both dorsally and ventrally. A pair of kidney shaped electric organs present on either side of the head, not clearly visible dorsally but can be easily observed ventrally. These originate very close to disc outline and end at a level of middle of last gill opening. Electric organs with concave inner margins and convex outer margins; widest in the region between mouth and first gill slits.

The nasal curtain short and wide, its length more than half the length of internarial width (Fig. 2F). Posterior margin of the nasal curtain with a small median lobe. Nasal curtain expands backwards to mouth opening. Nostrils with a prominent fold surrounding the outer margins, their outer margins situated just lateral to level of mouth corners. Posterior contour of nostrils confluent with conspicuous median lobes that contact nasal curtain at its corners and separate nostrils from mouth. Mouth curved, internarial width less than the width of mouth. Teeth morphologically similar on both the jaws, small, arranged in 18 rows with acute crowns, their bases wide and rectangular with the two ends projecting backwards and a single central cusp emerging at the anterior portion (Fig. 2G). The cusps more prominent towards the central rows. Gill slits crescent-shaped, placed lateral to level of outer corners of mouth and nostrils ending at a level of pelvic fin insertion. Distance between first gill slits

greater than the distance between fifth gill slits. The length of third gill slits larger than others and fifth gill slits smallest.

Pelvic fins originate posterior to disc margins. First dorsal fin situated entirely above the pelvic fin base and base ends little beyond the pelvic fin. Interdorsal distance is equal to the distance between the second dorsal and caudal fin. The posterior margin of caudal fin is straight and apex rounded.

Colouration: Dorsal surface shows ornate appearance with close set of brownish-black spots and white periphery on uniform dark brown background,



Fig. 2—*Torpedo pollenii* (Bleeker, 1865) (A) Dorsal view (151 mm-male) (B) Ventral view (151 mm-male) (C) Dorsal view (237 mm-female) (D) Ventral view (237 mm-female) (E) Eyes and Speracles (F) Mouth and nostrils (G) Upper tooth band (showing cusps)

few spots very closely set or joined together forming vermiculations and dark brown lines. The vermiculations also extend towards the tail. Few spots present towards the margins of the disc. In larger specimens, creamish-white spots present only towards the snout and vermiculations appear beyond the level of spiracles. The vermiculations towards the center of the disc and the region between the pelvic fins are thicker and those towards the disc margins, snout, interorbital, interspiracular regions and pelvic fin margins are narrower. These vermiculations vary in size, some forming larger, elongated and thick bars and some forming small bars. The outer margin of the eye with alternating dark and light brown bands. Small sized vermiculations also present surrounding the eyes and spiracles. Few alternating dark and light bands exist on the margins of the pelvic fins. Margins of the disc, posterior margins of pelvic fins, dorsal and caudal fins with a very narrow edging of light cream colour. Narrow vermiculations present on dorsal, pelvic and caudal fins. Light and dark brown coloured elongated spots present on the dorsal surface of the claspers also

in males. Ventrally uniform creamy-white in colour with a thick line of brown margins along with spots present on disc margins, pelvic fins and tail. Small clusters of isolated brownish spots also present ventrally towards the disc margins.

Distribution: Western Indian Ocean: from South Africa to Zanzibar and possibly as far north as the Kenyan coast³. Possibly occurring off smaller islands in the Indian Ocean but identity of specimens uncertain and needs verification⁶.

Discussion

This is the first description of *T. polleni* after Bleeker's description of Type species from Reunion. *T. polleni* closely resembles and is often misidentified as *T. fuscomaculata*, *T. panthera*, and *T. sinuspersici*. Salient external characters to distinguish the four species of genus *Torpedo* represented in Indian waters are given in Table 1. Comparison of relevant morphometric data of these species is given in Table 2. Correct identification, limits and distribution of the species *T. fuscomaculata*, *T. panthera* and

Table 1 — Salient external characters to distinguish the four species of genus *Torpedo* represented in Indian waters

S.No.	Character	<i>T. polleni</i>	<i>T. fuscomaculata</i> *	<i>T. panthera</i> *	<i>T. sinuspersici</i> *
1	Space between eye and spiracle	less than eye diameter	less than eye diameter	equal to horizontal eye diameter	very less and not more than eye diameter
2	Nasal curtain	short and wide, its length more than half the length of internarial width	short and wide, its length about half the length of internarial width	short and wide, its length slightly larger than the internarial width	short and wide, its length smaller than the internarial width
3	Spiracle	6-8 knob-like papillae on its posterior margin, the central papilla being larger	5-9 small knob-like papillae around the posterior margin	5-8 knob-like papillae around the posterior margin	large, rounded with small knob-like 8-11 papillae on its edges
4	First dorsal fin origin	entirely above the pelvic fin base and its base ends little beyond the pelvic fin	entirely above the pelvic fin base and its base ends beyond the pelvic fin	above the pelvic fin base and its base ends in front of pelvic fin base	anterior to posterior axil of pelvic fin and its base ending entirely beyond the posterior apex of pelvic fin
5	Posterior margin of caudal fin	more or less straight and apex rounded	more or less straight and apex slightly blunt	more or less straight and apex rounded	more or less straight and apex slightly acute and not broadly rounded
6	Dorsal body colour	shows ornate appearance with close set of brownish-black spots and white periphery on uniform dark brown background with spots on the disc very closely set or joined together forming vermiculations and dark brown lines	has reddish-brown background with brownish-black spots having white periphery, spots towards margins smaller than those in the mid region of the body	amber coloured with small spots crowded at the anterior region of the snout. Small clusters of more or less isolated and blurred, whitish spots on the disc	uniform dark brown with close set of light brown or pale colour spots, spots on the disc fused and form rather thick vermiculations
7	Colour on ventral side	uniform creamy-white in colour with a thick line of brown margins along with spots on disc margins, pelvic fins and tail	uniform creamy-white in colour with a thick line of reddish-brown margins along with spots present on disc margins, pelvic fins and tail	uniform white in colour with a clear darker margin consisting of spots similar to dorsal colour on the disc margins, pelvic fins and tail	uniform creamy-white in colour with a clear darker margin consisting of spots on the disc margins, pelvic fins and tail

*source Sujatha *et al.* 2014

Table 2 — Morphometric measurements expressed as percentage of total length (TL) of four species of electric rays *Torpedo polleni*, *T. fuscomaculata**, *T. panthera** and *T. sinuspersici**

S.No.	Measurements	<i>T. polleni</i> 147-397, n=6		<i>T. fuscomaculata</i> 163-561, n=17		<i>T. panther</i> 258-444, n=14		<i>T. sinuspersici</i> 118-508, n=73	
		Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD
1	Disc width*	24.5-153.7	76.6±47.2	60.1-69.2	64.8±2.8	59.5-68	63.8±2.8	58.5-70	64.2±2.9
2	Disc length *	22.5-125.8	65.9±39	56.2-62.9	59.4±1.8	57.8-60.2	59.1±0.9	50.3-61.3	56.2±2.3
3	Snout length	3.1-17.6	9.5±5.3	6-10.1	9.3±2.1	5.4-11.2	8.8±2.1	7.2-13.1	9.8±1.5
4	Snout, preorbital	3.1-16.3	9.1±5.1	7.3-10.4	8.6±0.9	6.6-9.6	7.9±0.8	6.9-10.8	8.5±0.9
5	Snout, preoral	3.7-22.4	11.2±6.5	7.8-11	9.3±0.9	6.6-10.1	8.9±1	7.3-11.9	9.6±0.9
6	Snout, prenasal	2.5-14.9	8.2±4.5	6.2-8.7	7.2±7.2	5.8-9.8	7.7±1	5.8-9.7	7.6±0.9
7	Eye diameter	1.4-6.1	3.5±1.9	1.9-3.6	2.6±0.5	1.9-3.7	2.6±0.4	1-3.9	2.5±0.6
8	Interorbital distance	2.2-14.2	6.8±4.2	4.8-7.5	5.8±0.7	5-8.1	3±1	4.1-11.1	6.3±1.1
9	Spiracle cavity length	1.7-7.4	3.7±2.2	2.5-5.2	4.2±0.8	2.6-5	4±0.8	2.5-5.8	4.1±0.7
10	Spiracle width	1.4-7.4	3.8±2.4	2.1-4.8	3.8±0.7	3.4-3.8	3.6±0.2	1.7-5.2	3.8±0.6
11	Interspiracular distance	1.7-8.8	5.2±2.7	2.9-3.7	3.4±0.4	3.3-5	4.2±0.5	2.4-5.9	4.2±0.6
12	Orbit+spiracle length	3.9-18.3	10±5.8	5.5-10.1	8±1.1	7.8-8.8	8.5±0.4	6.5-9.5	8±0.8
13	Distance between eye and spiracle	0.8-3.4	1.8±0.8	-	-	-	-	-	-
14	P base*	21.9-130.6	64.6±40	48.3-56.2	52.4±2.2	44.4-53.9	50.1±3.2	46.4-59.9	51.5±2.3
15	D1 height*	4.2-20.4	11.9±6.3	9.3-12	10.4±0.7	10.1-11.2	10.7±0.4	7.3-13.9	11.2±1.2
16	D1 base length	3.1-18.3	9.1±5.6	7-9.1	7.8±0.6	7.7-1.1	6.1±9.5	5-11.9	7.9±1
17	D2 height	2.8-17	8.6±5.3	6.6-9.5	7.9±0.8	6.2-10	7.9±1	5.4-11.6	8.3±1
18	D2 base length	1.9-9.5	5.5±3	4.2-5.6	5±0.5	4.1-5.6	4.9±0.6	3.3-6.8	5±0.6
19	Space D2 to upper caudal*	0.8-7.4	3.5±2.2	22.7-26.8	25.1±1.5	24.4-25.7	25±0.7	22.8-28	25.4±1.5
20	Caudal height upper lobe	8.2-41.5	21.2±12	14-17.5	15.9±1.1	14.2-18.2	15.7±1.1	11.1-18.7	16.3±1.3
21	Caudal height lower lobe	7.6-35.3	18.2±10.3	11.3-16.2	13.9±1.2	11.7-16.1	13.4±1.3	10.2-19.5	14.1±1.5
22	Caudal margin length*	5.4-31.9	17.3±10.1	14-18.5	15.9±1.2	14.3-17	15.5±0.9	12.1-20.1	16.3±1.8
23	Tail, height at caudal origin	1.4-8.1	3.9±2.4	2.1-4.2	3.4±0.5	3-3.6	3.3±0.3	2.8-4.9	3.6±1.5
24	Tail, width at caudal origin	1.7-8.8	4.4±2.6	2.1-3.5	3±0.4	2.7-3.3	2.9±0.3	2.4-4.4	3.1±0.5
25	Lateral tail fold length	5.9-35.3	16.3±11.1	7.3-14.4	11.6±2	10.1-17.2	13.3±2.9	10-17.5	13.3±2
26	Head length; ventral*	10.2-80.9	40.8±24.9	33.5-39.3	35.8±1.7	22.9-37.2	35.1±1.3	31.6-38.3	35.4±1.6
27	Head length; dorsal*	7.1-36	19.8±11.2	13.4-18	15.8±1.2	15-16.6	16±0.7	13.9-18.5	16.1±1.2
28	Mouth width	3.7-19.7	9.4±5.7	4.6-9	7±1.5	5.8-9.3	7.5±1.3	5.4-9.2	7.4±1
29	Upper tooth band width	2.8-15.6	7.3±4.5	-	-	-	-	-	-
30	Lower tooth band width	2.8-15.6	7.3±4.5	-	-	-	-	-	-
31	Internarial width	3.1-12.2	6.4±3.6	3.3-7.3	4.7±1	3.5-5.3	4.4±0.5	3.6-6.1	4.7±0.5
32	Nasal curtain length	1.1-8.8	4.2±2.8	1.3-2.6	1.8±0.4	1.2-1.8	1.5±0.2	1.6-2.6	2.6±0.3
33	Nasal curtain width	2.2-12.2	6±3.6	-	-	-	-	-	-
34	Length of first gill slit	1.1-6.8	3.4±2	2.5-4.6	3.4±0.5	3-4.2	3.8±0.5	2.4-5	3.7±0.5
35	Length of third gill slit	1.1-8.1	4.2±2.5	2.7-4.9	4±0.5	3.3-4.9	4.2±0.6	3.1-5.3	4.2±0.5
36	Length of fifth gill slit	0.8-4	2.2±1.4	1.7-3	2.3±0.4	2.7-3.6	2.9±0.4	1.6-3.8	2.5±0.5
37	Space between first gill slits	7.1-39.4	20.8±12.1	15.8-19	17.5±1.1	15.5-18.4	16.7±0.9	14.3-19.2	17.1±1
38	Space between third gill slits	6.2-37.4	19.1±11.5	-	-	-	-	-	-
39	Space between fifth gill slits	5.9-38.1	18.1±11.9	11.6-17	15±1.4	12.2-17.5	14.7±1.4	10.3-16.9	14.8±1.4
40	Pelvic fin length	5.9-27.8	13.5±8.3	9.1-15.2	12.1±1.7	0.7-1.2	0.9±0.2	9.4-17.2	11.9±1.6
41	Pelvic fin width	7.5-25.6	17.2±7.7	3.9-20.2	17.2±1.9	15.4-20.9	19±1.5	13.8-23.1	18.2±2.5
42	PDO [#]	2.5-16.3	10.5±5.1	14.9-23	17.1±2.3	15.7-23.4	17.7±2.9	14.1-19.8	17.1±1.3
43	Anterior margin of pelvic fin	6.5-32.6	15.6±9.7	-	-	-	-	-	-
44	Posterior margin of pelvic fin	5.1-23.8	14±7.8	-	-	-	-	-	-
45	Snout to pelvic origin*	22.7-127.2	66±39.9	51-60.6	56.6±2.1	49.3-59.1	55.4±2.9	50.1-59.7	55.1±2.3
46	Snout to mid-cloaca	27.6-144.9	74.3±43.6	58.7-64.1	61.4±1.8	60.5-64.2	61.8±1.1	53.7-65.3	60.5±2.3
47	Snout to D1 origin	27.6-156.4	78.6±48	60.6-67.4	63.5±1.8	61.1-65.3	63.5±1.4	60.2-70	64.2±2.2
48	Snout to D2 origin*	33.6-180.2	90.7±54.6	71.2-78	74.4±1.9	72.3-77.6	74.3±1.5	71.2-79.2	74.6±1.8
49	Interdorsal space	1.9-6.8	3.5±1.7	2.5-4.5	3.5±0.6	2.3-4.2	3.2±0.6	1.6-5.1	3.3±0.7

(Contd.)

Table 2 — Morphometric measurements expressed as percentage of total length (TL) of four species of electric rays *Torpedo polleni*, *T. fuscomaculata**, *T. panthera** and *T. sinuspersici**—(Contd.)

S.No.	Measurements	<i>T. polleni</i> 147-397, n=6		<i>T. fuscomaculata</i> 163-561, n=17		<i>T. panthera</i> 258-444, n=14		<i>T. sinuspersici</i> 118-508, n=73	
		Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD
50	Snout to maximum DW*	19.3-100	52.8±29.9	38.3-47.4	43.8±2.6	44-50.5	47±2.1	40.1-48.8	44.5±2.5
51	Snout to first gill slit	10.5-55.7	28±16	17.3-25.7	22.8±2.9	20.5-25.6	23.3±1.9	20.9-27.9	24.4±1.5
52	Mid-cloaca to tail end	17.6-95.9	46.5±28.2	35.1-41.8	38.5±1.9	37.3-40.2	39.1±0.9	34.2-43.6	39.4±2
53	Electric organ length*	14.5-73.4	38.8±22.2	31-39	33±2.3	16.2-32.7	28.4±8.1	28.8-39.9	32.4±2.1
54	Electric organ greatest width	7.1-30.6	17.8±9.1	12.3-19.8	16.1±2.2	13.3-19.8	15.9±3	12-19.8	16.1±1.7
55	Electric organ width at first gill slit	4.8-25.1	13.1±7.6	8.4-14.6	10.9±1.8	10-13.1	11.4±1.3	8.5-12.3	10.2±0.9
56	Maximum tail width at pelvic fin	9.1-44.2	25.6±13.5	-	-	-	-	-	-
57	Cloaca length For males	1.9-8.1	4.3±2.1	-	-	-	-	-	-
58	Clasper length	1.7-16.3	6.7±6.6	-	-	-	-	-	-
59	Clasper outer length	4.5-36	15.3±14.4	-	-	-	-	-	-
60	Clasper-cloaca length	4.2-38.1	16.9±15.2	1.3-18.8	16.7±1.6	15.8-17.8	16.7±0.8	10.7-20.1	17.8±2.1

(*published data taken from Sujatha et al. 2014)

Pelvic fin end to D1 origin

T. sinuspersici were problematical as these species have not been correctly reported to co-occur in western Indian Ocean, Arabian sea, Red sea, or Persian Gulf³. However, all the five species of genus *Torpedo* – *T. fuscomaculata*, *T. marmorata*, *T. panthera*, *T. polleni*, and *T. sinuspersici* are sympatric (co-occur) in this region (Lat 17°01'N to 19°22'N; Long 83°23'E to 85°14'E) and also represented in good numbers.

Described originally from Reunion, *T. polleni* was distinguished by Bleeker from both *T. panthera* and *T. fuscomaculata* on the basis of its teeth, shape of disc and fins, and dorsal colour. *T. polleni* is not a valid species and given as synonym of *T. fuscomaculata*^{7,8}. This species is questionably valid^{9,10,11} but the reasons are not mentioned. According to previous authors³, there are only three possible interpretations concerning *T. polleni*; it is a junior synonym of *T. panthera*, a junior synonym of *T. sinuspersici*, or it is a valid species (it is not a junior synonym of *T. fuscomaculata*). Further they stated that the first of these is the most improbable outcome, as *T. panthera* does not occur off islands in the south-western Indian Ocean or along the eastern African coast, and the dorsal vermiculate pattern of *T. polleni* is more similar to the colouration of *T. sinuspersici* than to that of *T. panthera*. They also tentatively regarded *T. polleni* as a synonym of *T. sinuspersici* on the basis of the similarity in colouration, fully realizing that it may eventually prove to be a valid species.

However, based on the specimens collected during the present study, *T. polleni* can be readily distinguished from *T. fuscomaculata* on the basis of

dorsal colouration as the former is unique in having brownish-black spots which join together forming vermiculations and dark brown lines and the latter possesses few isolated creamish coloured and brownish black spots. These vermiculations are totally absent in *T. fuscomaculata*. It differs from *T. panthera* in several characters, viz., distance between eye and spiracle, nasal curtain length, origin of first dorsal fin, and dorsal colouration. It differs from *T. sinuspersici* in terms of number of spiracular papillae, nasal curtain length, origin of first dorsal fin and in dorsal colouration (Table 1). Based on the above distinguishing characters, *T. polleni* is being considered as a valid species.

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