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MISCELLANEOUS NOTE

14. THE DEEP SEA SPINED DOG FISH *CENTROPHORUS ARMATUS* (GILCHRIST) (SELACHII : SUALIDAE) FROM THE EAST COAST OF INDIA, WITH A NOTE ON ITS TAXONOMY

(*With a map and a text-figure*)

The spined dog fish *Centrophorus armatus* (Gilchrist) was first reported by Gilchrist (1922) from the east coast of Africa and later from Natal coast and Mozambique by others. Silas *et al.* (1969) recorded it from the west coast of India. The present report of it extends its distribution to east coast of India.

Gilchrist (1922) created the genus *Atractophorus* to accommodate the dog fish *armatus* Gilchrist based on an arrow head at the tip of its second dorsal spine. All other important generic characters such as dissimilar teeth in both jaws, and elongated inner margin of pectoral fin are common to *Centrophorus* Müller & Henle 1833 and *Atractophorus* Gilchrist, 1922. The specimens of *armatus* Gilchrist from Gulf of Mannar have a slight enlargement laterally at the tip of second dorsal fin which can be observed only when examined carefully. This character is not considered by us to be significant for generic separation. Many spined dog fishes like *Squalus acanthias* Linnaeus has such lateral enlargement in second dorsal spine during embryonic development (Ford 1921) which disappears later. Therefore, the species *armatus* should be placed in *Centrophorus* Müller & Henle, 1833, an earlier available name, as the important generic diagnostic characters of both the genera are the same. Barnard (1925) also found no reason for creating the genus *Atractophorus* for accommodating the species *armatus*, though he used the name *Atractophorus armatus*. Bigelow & Schroeder (1948) and Stead (1968) include the dog fishes with above characters in *Centrophorus* Müller & Henle, though Smith (1961) & Silas *et al.* (1969) recognise *Atractophorus* and place *armatus* in it.

From the Laccadive sea of Indian coast another spined dog fish *Scymnodon rossi* was described by Alcock (1898). Though many species of spined dog fishes are known to occur from Indian Ocean along the coast of Australia and Africa only two species are so far reported from the Indian coast, namely *Centrophorus armatus* (Gilchrist) and *Scymnodon rossi* (Alcock).

Key to the Indian species of spined dog fishes

1. Teeth noticeably dissimilar in both jaws ; inner corner of pectoral broadly rounded ; blades of dermal denticles with three to several ridges ; marginal teeth on posterior and anterior parts of trunk.
—*Scymnodon rossi* (Alcock)

[2]

TABLE

CHEMICAL COMPOSITION OF THE MUSCLE OF SOME COMMON FISHES AND DEEP SEA SHARK *C. armatus*

Species		Moisture	Protein %	Ash %	Phosphorus mg./100 gr.	Iron mg./100 gr.	Calcium mg./100 gr.
Common species*							
Carcharias limbatus	..	72·0	26·10	1·43	13·30	3·86	107·0
Sphyrna blochii	..	75·14	23·9	1·10	15·11	4·48	118·00
Dasyatis uaranak	..	77·5	20·04	1·15	18·92	6·15	152·00
Rhinoptera sewelli	..	75·25	20·9	1·24	270·5	5·30	178·60
Stromateus argenteus	..	71·00	16·69	1·48	21·24	3·76	250·00
Wak sina	..	77·41	17·25	1·38	21·46	4·73	97·54
Rastrelliger kanagurta	..	74·70	19·55	1·65	48·14	8·49	778·20
Hilsa toli	..	78·33	17·98	1·80	23·01	2·84	567·50
Lactarius lactarius	..	73·33	19·39	1·42	318·70	3·35	235·7
Harpodon nehereus	..	89·30	9·05	·74	18·6	1·29	334·2
Scomberomorus commerson	..	78·9	17·9	1·26	17·26	4·02	345·0
Muraenesox talabon	..	80·0	16·92	·91	26·52	4·24	280·0
Sardinella fimbriata	..	77·36	18·57	1·60	52·66	6·68	1136·00
Tachysurus dussumieri	..	78·10	12·72	·88	24·32	3·81	307·00
Polynemus indicus	..	77·38	15·50	1·29	14·77	4·50	125·30
Thunnus macropterus	..	71·94	23·84	1·80	358·00	6·78	435·70
*Centrophorus armatus***	..	75·3-77·6	21·73-21·82	1·20-0·96	170·0-190·0	2·18-6·61	not known

* After *Wealth of India* **4** : 99 (1962). **After Silas (1969).

2. Teeth noticeably dissimilar in both jaws ; inner corner of pectoral produced : dermal denticles regular without blades ; no marginal teeth on trunk.
—*Centrophorus armatus* (Gilchrist)

Centrophorus armatus (Gilchrist)

(Fig. 1 A)

Atractophorus armatus Gilchrist. *An. rept.* **2**, *Fish. mar. Biol. Surv. Uni. S. Afr. Spec. rep.* **3**, 1922 : 41-79 ; Barnard, *Ann. S. Afr. Mus.*, 1925, **21**, pt. 1 : 51-52 ; Fowler, *Proc. Acad. nat. Sci., Philad.*, **87**, 1935 : 361-408 ; *Bull. U.S. natn. Mus.*, no. **100** (13), 1940 : 1-879 ; Silas *et al. Curr. Sci.* **38**(5), 1969 : 105-106 ; Smith *Sea Fish S. Afr.* Capetn., 1961 : 57.

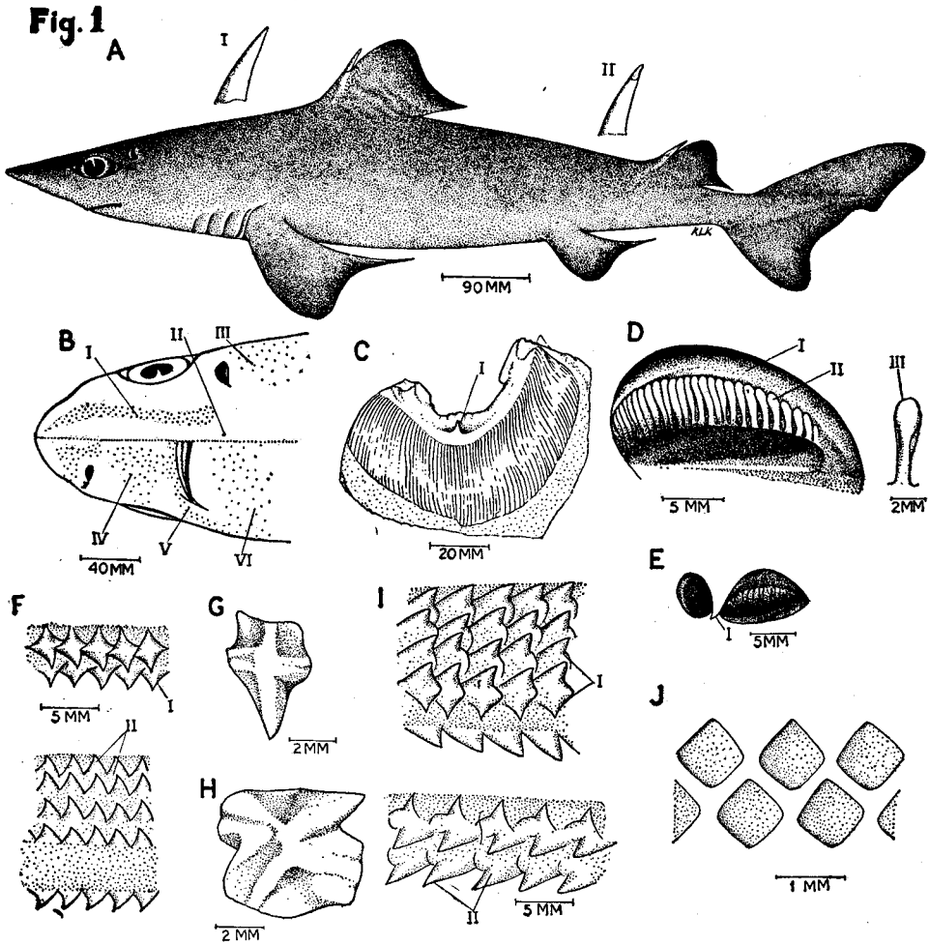


FIG. 1. A. *Centrophorus armatus* (Gilchrist) : Total length 935 mm. I. First dorsal spine (enlarged), II. Second dorsal spine (enlarged) ; B. Dorsal and ventral views of head. I. Supra-ophthalmic ampullae, II. Endolymphatic duct, III. Infra-spiracular ampullae, IV. Infra-ophthalmic ampullae, V. Mandibular ampullae, VI. Hyomandibular ampullae ; C. Fifth gill arch. I. Gill raker ; D. Median septum of the spiracle. I. Wall of the Septum, II. Spiracular filament, III. Spiracular filament (enlarged) ; E. Nostril. I. Nasal Flap ; F. Upper jaw teeth. I. Outer series (functional) ; II. Inner series (non-functional) ; G. Upper jaw tooth ; H. Lower jaw tooth ; I. Lower jaw teeth, I. Inner series (non-functional), II. Outer series (functional) ; J. Dermal denticles.

Description : Measurements in per cent of the total length. (After Bigelow & Schroeder 1948, modified). Female, 935 mm, 2 specimens, off Mandapam (Gulf of Mannar) CMFRI, F. 199/633a and b.

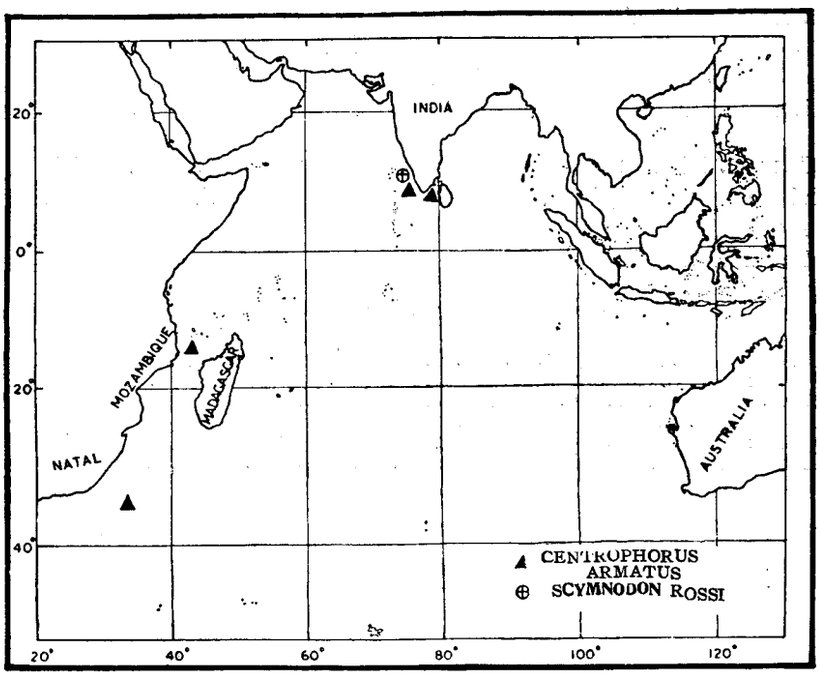
Trunk at pectoral origin : breadth 14·0-14·8, height 9·5-11·7. Snout length in front of : outer nostril 4·8, mouth 10·1-10·3. Eye : horizontal diameter 5·4. Mouth : breadth 8·6-9·9. Nostrils : distance between inner ends 1·8. Labial furrow from angle of mouth : upper 2·3-2·4, lower 3·8-4·0. Gill openings : first 2·6-3·2, second 3·4-3·7, third 4·2-4·3, fourth 5·0-5·8, fifth 6·7-7·6. First dorsal fin : vertical height 6·9-7·7, length of base 9·0-11·0. Second dorsal fin : vertical height 5·0-6·0, length of base 5·3-5·9. Length of dorsal spines : first dorsal spine 6·7, second dorsal spine 4·2. Concealed portion of dorsal spines from the base : first dorsal spine 3·5-3·9, second dorsal spine 2·1. Spiracle : width 2·1, length 1·3-1·7. Caudal fin : upper margin 18·4-19·0, lower anterior margin 9·0-10·1. Pectoral fin : outer margin 10·7, inner margin 14·1, distal margin 11·9-12·6. Distance from snout to : first dorsal origin 33·8-34·2, second dorsal origin 70·2, upper caudal 78·6-84·5, pectoral 25·4-27·2, pelvic 57·0-59·3. Inter space between : first and second dorsal 25·6-26·7, second dorsal and caudal 6·9-8·0, origin of pelvic and caudal 17·8-18·5. Distance from origin of : pectoral and pelvic 32·6-33·1, pectoral and caudal 54·5-57·7, pelvic and caudal 22·4-22·7. Pelvic fin : outer margin 7·4, inner margin 6·4-6·5, distal margin 8·5-9·0.

Trunk stout, posterior end tapering ; snout pointed, head flat. Length of snout much shorter than that of distance between mouth and pectoral origin. Head with well developed sensory pores : dorsally supra-ophthalmic ampullae originates anterior to endolymphatic duct and communicates ventrally with the infra-ophthalmic ampullae which extends posteriorly as hyomandibular ampullae ; mandibular ampullae and infra-spiracular ampullae are represented by a few pores on ventral side (Fig. 1 B). Endolymphatic ducts in the middle of interspiracle space. Labial folds at the corners of mouth, anterior labial fold short, posterior one long and deep.

Teeth distinctly asymmetrical in both jaws, $\frac{19+1+19}{19+1+19}$, upper jaw teeth erect, pointed with one cusp, uniform in size along the jaw ; lower jaw teeth quadrate, each overlapping the next at outer edge, one broad sharp cusp so strongly oblique that its inner margin forms a continuous cutting edge parallel to the jaws ; two series of functional teeth in upper and lower jaws and 4-5 series of non-functional teeth in both jaws (Fig. 1 F, G, H, I). Nostrils more or less horizontal, near to snout end than to mouth, inner margin drawn into pointed flaps (Fig. 1 E). Dermal denticles not closely spaced, exposing skin, rectangular without any spine or flap (Fig. 1 J). Spiracles large close behind orbit, divided into posterior

and anterior chambers by a median septum; about twenty-four well developed spiracular filaments on inner side of median septum, each filament with an upper and lower lobular ends (Fig. 1D). Eyes large, oval. Gill slits gradually increase in length from first to fifth, first to third slits evenly spaced, fourth and fifth close together, upper end of fifth gill slit extends over the middle of pectoral peduncle ; gill arch with one short, pointed gill raker medially on the posterior side (Fig. 1C).

First dorsal fin behind the pectoral origin, apex round, posterior margin elongated ; first dorsal spine pointed, partly concealed, grooved on its inner side medially. Second dorsal behind pelvic fins, apex round, posterior margin produced ; spine pointed, partly concealed with a groove on inner side, and its tip with slight enlargement laterally. Smith (1961)



Map. Distribution of *Centrophorus armatus* (Gilchrist) and *Scymnodon rossi* (Alcock).

reports an arrow-head-like enlargement on the tip of second dorsal spine. Anterior margins of pectoral and pelvic fins round, inner margins elongated ; inner margins of pectoral reach end of first dorsal base. Anal fins absent. Caudal with a sub-terminal notch, upper and lower margins round.

Colour : Dark brown dorsally, light brown ventrally, posterior margins of gill flaps tinted black.

Distribution: South Africa, Mozambique, west and east coasts of India. Though Smith (1961) states that ' only few specimens ever found from fairly deep waters'. In spite of being a bathypelagic species its distribution is restricted to the western and central Indian Ocean (15°N-35°S, 20°E-80°E) probably due to the 20° mean annual isotherm as indicated by Misra & Menon (1955).

Material: Two specimens, 935 mm, Female; Gulf of Mannar (08° 50'N, 79° 05'E), 220 fathoms, Trawl net; 22-iii-70 CMFRI. F. 199/633a and b.

Economic importance: Though the deep sea sharks are not favourably considered in the market, they are bound to become popular, as in other countries, when people become familiar with it. Silas (1969) found that vitamin A potency of liver of the species is very low compared to other commercially important sharks. According to Silas (op. cit.) percentage oil in liver varies from 69·4-72·5, and vitamin A potency of liver oil from 90·0-103·0 (usp./gm of oil).

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REFERENCES

BIGELOW, H. B. & SCHROEDER, W. C. (1948): Fishes of western north Atlantic. *Mem. Sears fdn. mar. Res.*, **1** (1): 1-576.

MISRA, K. S. & MENON, M. A. S. (1955): On the distribution of the Elasmobranchs and chimaeras of the Indian region in relation to the mean annual isotherms. *Rec. Indian Mus.* **53**: 73-86.

SILAS, E. G. (1969): Exploratory fishing by 'R.V. Varuna'. *Bull. cent. mar. Fish. Res. Inst.* **12**: 25.