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# DESCRIPTIONS OF THE ADULT AND EMBRYO OF THE BRAMBLE SHARK *ECHINORHINUS BRUCUS* (BONNATERRE) OBTAINED FROM THE CONTINENTAL SLOPE OF INDIA

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ABSTRACT

A description of the bramble shark *Echinorhinus brucus* (Bonnaterre 1788) is given here based on specimens collected during exploratory surveys from the continental slope from 200 to 400 metres along the west coast of India and the Gulf of Mannar. The description of a 300 mm embryo of this species is also included. A biochemical analysis of the meat and liver of this species showed that the moisture content of the meat is high (78.66%), and the percentage of oil in the liver is as high as 78.07%. The vitamin A content of the oil is negligible, being only 360 USP/gm of oil.

## INTRODUCTION

RECENTLY Silas *et al.* (1969) and Silas (1969) have reported the occurrence of the bramble shark *Echinorhinus brucus* (Bonnaterre) (Family : Dalatidae) from the upper continental slope of the west coast of India and Nair and Lal Mohan (1971) along the east coast. Bigelow and Schroeder (1948) have drawn attention to the desirability of having good descriptions of this species from the different geographical areas for a correct evaluation of the status of the intraspecific variations particularly in the context of determining the validity of the nominal species *E. obesus* Smith ; *E. cookei* Pietschmann and *E. mccoyi* Whitley, all at present considered synonyms of *E. brucus*. This paper embodies a detailed description of *E. brucus* from Indian seas.

We are thankful to late Dr. V. Krishna Pillai, Director, Central Institute of Fisheries Technology, for kindly arranging for the biochemical analysis of the meat and the liver of this species which was carried out by Shri Gopakumar of that Institute. We are also thankful to Shri M. Kumaran for the embryo of the bramble shark.

## **Echinorhinus brucus** (Bonnaterre)

(Figs. 1 a-j ; 2 a-k)

Synonyms :

Le' boucle Broussonet, 1780. *Mem. Math. Phys. Acad. Sci. Paris*, p. 672.

*Squalaus brucus* Bonnaterre 1788. *Tabl. Encyc. Meth. Ichthyol.*, p. 11 (N. Atlantic).

*Squalus spinosus* Gmelin *In* : Linnaeus, *Syst. Nat.*, 1 (3) : 1500 (1788) (by ref. to Broussonet, 1780).

*Echinorhinus obesus* Smith, A. 1949. *Ill. Zool. S. Afr.*, pl. 1 (South Africa).

*Echinorhinus cookei* Pietschmann, 1928. *Anz. Akad. Wiss. Wien*, **27**: 297 (Hawaiian Islands).

*Echinorhinus* (*Rubusqualus*) *mccoyi* Whitley, 1931. *Aust. Zool.*, **6**: 311 (Victoria, Australia).

For a detailed list of records and synonyms reference is invited to Bigelow and Schroeder (1948 : 530-532).

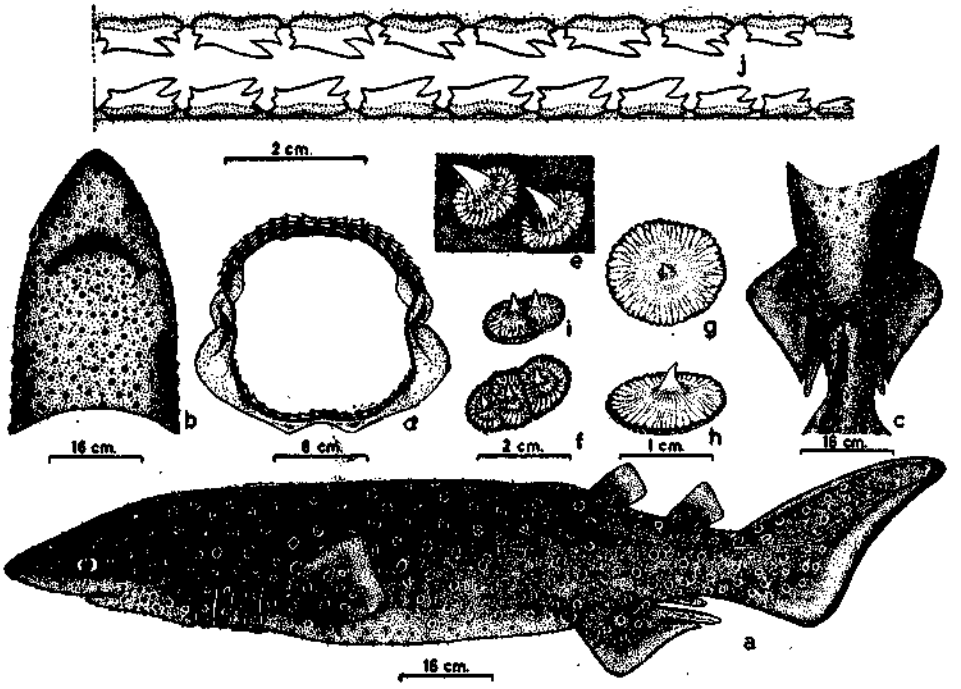


Fig. 1. *Echinorhinus brucus* (Bonnaterre) adult male 162 cm in total length. a. Lateral view ; b. Ventral view of head ; c. ventral view of pelvic fins and claspers ; d. Jaws showing the arrangement of teeth (upper jaw showing inner view and lower jaw showing outer view of teeth) ; e-i. Different types of dermal tuberculated scales ; and j. Teeth from upper and lower jaws.

## Material

1 Male 162 cm and 29 kg from 405 m at 12°06'N, 74°23'E on 25-7-1968 during cruise of R.V. *VARUNA* ; 1 Male 150 cm and 20 kg from 270-306 m off Quilon on 15/16-3-1969 during fishing cruise of M.V. *BLUE FIN* ; 1 Female 170 cm and 45 kg from 340-360 m off Quilon from 28/31-7-1969 during fishing cruise of M.V. *VELA-MEEN* (Not examined) ; and 1 Female embryo 30 cm weighing 110 gms from 216 m from N.E. Gulf of Mannar on 11-4-1970 during fishing cruise of M.V. *KLAUS SUNNANA*.

## Diagnosis

Shark without anal fin ; dorsal fins short and situated far backwards, origin of first dorsal not surpassing that of pelvics ; teeth almost similar in each jaw with generally three or four cusps with the cutting edge much inclined being nearly hori-

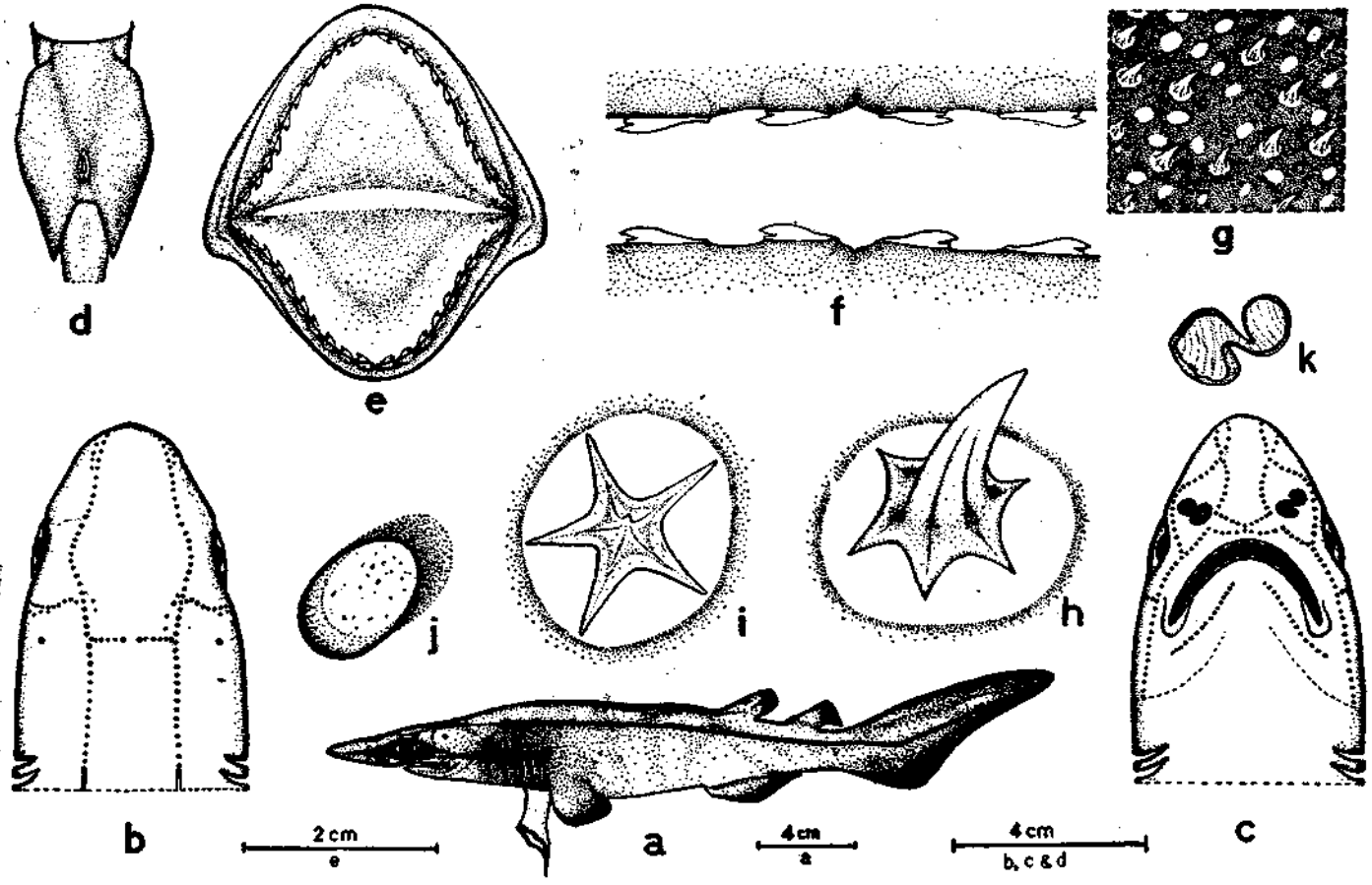


Fig. 2. *Echinorhinus brucus* (Bonnaterre) embryo 300 mm in total length. a. Lateral view; b. Dorsal view of head showing arrangement of sensory mucus pores; c. Ventral view of head showing arrangement of sensory mucus pores; d. Ventral view of pelvic fins; e. and f. Teeth from upper and lower jaws; g. Portion of skin showing open 'pits' and minute curved spines (schematic); h. and i. Lateral and dorsal views of dermal spine with radiating base (schematic and enlarged); j. Mucus pore (schematic and enlarged) and k. Nostril (schematic and enlarged).

zontal ; spiracles minute and behind eyes ; skin distinctly armed with tubercular scales with hard stellate basal shield and a spine at summit (shield-like dermal denticles of some authors), the number and disposition of which may differ from specimen to specimen and with age.

Description

The proportional dimensions in per cent of the total length in the three specimens (Mean for two adults followed by that for embryo) are given below along with the proportions (in parenthesis) of a 174 cm male recorded by Nair and Lal Mohan (1971).

*Trunk at origin of pectoral :* breadth 15.3, 14.3 ; height 14.3, 13.0 (10.2).

*Snout length in front of :* anterior nostril 6.7, 6.7 ; mouth 8.0, 8.7 (7.5) ; eye 7.5, 8.7, (7.9).

*Eye :* horizontal diameter 3.0, 4.7 (2.3) ; vertical diameter 1.9, 2.3 ; interorbital distance 9.1, 11.0 (12.3).

*Mouth :* breadth 10.9, 10.3 (10.4) ; height 3.5, 6.7.

*Nostrils* : distance between inner ends 5.6, 4.7.

*Labial furrow length from corner of mouth :* upper 1.5, 1.7 ; lower 1.7, 2.3.

*Gill opening lengths :* 1st—4.8, 5.0 (5.1) ; 2nd—6.0, 5.7 ; 3rd—6.6, 6.3 ; 4th—7.2, 6.0 ; 5th—7.3, 5.3 (4.1).

*First dorsal fin :* vertical height 4.7, 4.3 ; length of base 5.3, 5.0.

*Second dorsal fin :* vertical height 5.1, 4.0 ; length of base 4.9, 5.0.

*Caudal fin :* upper margin 22.0, 28.0 ; lower margin (anterior) 12.1, 11.7.

*Distance from snout to :* 1st dorsal 61.0, 54.7 ; 2nd dorsal 69.2, 62.7 ; base of upper caudal 78.1, 71.3 ; pectoral 27.3, 30.0 ; pelvics 58.0, 52.0 (56.3) ; upper angle of first gill opening 20.8, 14.3 (18.9) ; 5th gill opening 27.0, 30.0.

*Interspace between :* 1st and 2nd dorsal 4.8, 3.7 ; 2nd dorsal and caudal 4.2, 3.7.

*Distance from origin to origin of :* pectoral and pelvic fins 31.6, 23.3 ; pelvic fin and caudal base (upper) 22.6, 20.7.

*Height of :* head at middle of eye 7.9, 4.0 ; head at 1st gill opening 14.1, 9.7 ; body midway between pectoral and pelvic fin origins 17.4, 13.0 ; at origin of pelvic fin 15.6, 10.0.

*Clasper* (only in adults) : length from vent to tip 7.7 ; from origin of pelvics to tip 17.2.

Body elongate, stout, head slightly depressed and dorsal profile more or less straight from behind head to just ahead of first dorsal where there is a slight hump (Fig. 1a) ; snout short and bluntly pointed ; mouth cresentic, its width greater than snout length in front of it ; labial grooves at angles of mouth not well developed (Fig. 1b) ; eyes moderately large, horizontal diameter being slightly longer ; nares closer to eye than to tip of snout and with a median pointed lobule on either margin, that of anterior margin being more conspicuous (Fig. 2k) ; gill opening moderately large with thickened gill flaps ; both dorsal fins are short with more or less truncated free margins ; dorsal spine absent ; origin of first dorsal slightly behind origin of pelvics and that of second dorsal behind posterior end of base of pelvics ; pectorals conspicuously short and oar-like ; pelvics relatively larger ; subcaudal deep but without distinct lobe and caudal margin slightly concave.

Lateral line running along upper half of body commencing opposite first gill opening and posteriorly passing through upper third of caudal peduncle curves upwards and runs to tip of upper caudal lobe ; lateral line groove is deeper and very prominent in embryo ; sensory mucus pores on head are more clearly seen in embryo and their disposition is shown in Fig. 2b, c & j. Commencement of lateral line is almost opposite second gill opening in embryo (Fig. 2a).

*Dentition :* Teeth uniserial, alike in both jaws, their total number in upper jaw being 18 or 20 and lower jaw 20 ; narrow inter-space between teeth present ; each tooth with a median cusp which is obliquely directed outwards, followed by a small cusp below it ; one or two cusps are generally present along inner margin of tooth except in the outermost teeth at the angles of the mouth where they may be poorly developed or absent ; oblique median cusp is much inclined and give a more or less horizontal cutting edge ; replacement teeth in three or four rows except the outermost two sets at the angles of the mouth which have two replacement teeth (Fig. 1d & j).

In embryo, full complement of teeth present in outer series, though teeth are not prominent and are separated by broad interspaces ; median cusp of each tooth is inclined obliquely pointing outwards and lateral cusps are absent or poorly developed (Fig. 2e & f).

*Dermal armature :* Body covered with mucus, skin smooth except for numerous tuberculated scales, the number, size and disposition of which vary considerably from specimen to specimen and with age ; each tuberculated scale with a basal shield of varying size; but generally oval to round in shape at centre of which is present a sharp pointed spine which may be slightly curved ; from base of spine to margin are present numerous radiating furrows. Occasionally two or three scales are fused and consequently two or three spines as the case may be, may occur on the shields close together ; thus each basal shield with only a single spine (Fig. 1f & i).

Diameter of basal shields vary much, larger shields occurring midlaterally above and below lateral line ; length of spine on each shield does not correspond to size of basal shield, for basal shields of lesser diameter may have longer spines (Fig. 1e, g & h). Tuberculated scales are more numerous above lateral line and numerous smaller sized tubercular scales are present in jugular region and on ventral side of belly. Dorsal and ventral sides of paired fins, specially towards their bases and basal halves of median fins are studded with tuberculated scales of varying sizes.

The skin of the embryo contains numerous open ' pits ', in some of which are present a minute, median, slightly curved spine which has a radiating base (Fig. 2g, h & i). It would appear that each basal shield of the tuberculated scale which eventually develops occupies such a ' pit '.

The shape of the pelvic fin differs in the embryo from that of the adult (Fig. 1c & 2d).

In the adult males, only the tip of the clasper is free from the pelvic fin (Fig. 1c). The outer gill arches generally carry 1-3+1+2-3 fleshy knob-like structures in the place of gill rakers. In the embryo it is 1+1+2 and 1+1+3 on the right and left sides respectively.

Digested remains of the lizard fish *Synodus indicus* Day and one specimen of *Clupisoma* sp. were seen in the stomach of one of the adult males, while the stomach

of the second adult male was empty. The inner wall of the stomach was brick red in colour and the spiral valve is present in the alimentary canal.

The liver is large weighing 5 kg and 3.5 kg in the two adult males respectively. The lobes are grooved internally and they are of about equal length. The biochemical analyses of the meat and liver showed the following (after Silas, 1969) :

| *Analysis of muscles* (% gm/100 gm wet muscle) | | *Analysis of liver* | |
|---|---|---|---|
| Moisture | 78.66 | Weight of liver | 5000 gms |
| Ash | 1.19 | Percentage of oil (66.67 g/100g wet liver) | 78.07 |
| Protein | 18.68 | Vitamin A in USP/gm of oil (Average of 3 batches of extraction) | 360 |
| Fat | 0.425 | Colour of oil | Glassy white |
| Vitamin A | Nil | | |
| Phosphorous | 0.2674 | | |
| Iron | 0.0022 | | |

Nair and Lal Mohan (1971) reported that the liver oil from the specimen they had examined had high iodine value and non-saponifiable matter, the values being : Saponification value 99.63 ; Iodine value 196.00 ; Iodine value of fatty acid 172.00 ; Iodine value of non-saponifiable matter 30 per cent ; and Vitamin A 376 USP.

*Colour :* In adults, the tuberculated scales of the dorsum and sides of the body are conspicuous on the dusky background colour of the body. The ventral side, especially belly and jugular region are dirty white with a tinge of yellow in the fresh specimens. A broad saddle-shaped black patch each is present ahead of the first and second dorsal fins and a similar coloured patch in front of the pelvics along the lateral side of the body. These patches are clear in fresh specimens. When fresh, the pupils are emerald green and iris black.

In the preserved embryo the sides of the body and dorsum of head are dirty white while the jugular region and the area around the gill openings are dusky. The margins of the paired and median fins are dusky to black.

*Distribution :* From the continental slope and deeper neritic waters of the Atlantic, Mediterranean and Indo-Pacific. In the Indian Ocean, *E. brucus* has been recorded from South African waters (Agulhas Bank), Arabian coast (Muscat, Boulenger, 1889), and from the continental slope along the south west coast of India and the Gulf of Mannar. Reference is invited to Bigelow and Schroeder (1948) for a detailed distribution of this species.

## Remarks

As may be expected, the tuberculated scales are ill-developed in the embryo and with growth considerable transformation takes place. From the available descriptions it would appear that the number and disposition of the tuberculated scales also differ from specimen to specimen. With our present knowledge it is rather difficult to say whether any regional differences exist in specimens from different geographical areas. In this connection an interesting difference we have noted is the presence of two or more spines on a single basal shield of tuerbulated scale shown by

Bigelow and Schroeder (1948 ; Fig. 102) for a specimen from Eastern Atlantic. As mentioned earlier, in our specimens it is seen that when two or more spines occur close together each one is borne on a separate shield which is more or less fused with the adjacent ones.

The dental formula given by Bigelow and Schroeder (1948) for specimens from Northern Atlantic, namely 20 to 26 for upper jaw and 22 or 26 for lower jaw is also interesting. In our specimens it is 18 to 20 in the upper and 20 in the lower jaw.

According to Smith (1961) the oil from the liver of *E. brucus* is considered to be of high medicinal value by the South Africans and fetches a high price. Smith also reports this species to grow to a length of 10 feet and weigh about 500 lb.

Bigelow and Schroeder (1948) remark that nothing is known about the breeding habits of this species. Little information is available about the embryo described by Barnard (1925). Our specimen (embryo) was collected in April and a large female obtained in July was also said to contain a well developed embryo. From this it would appear that *E. brucus* may breed during these months and the mode of reproduction is ovo-viviparous. However, more information about the breeding season and habits of this species is desirable.

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