

NOTES ON THE INDIAN FLYING FISHES OF THE GENUS *CYPSELURUS* SWAINSON.

By MARY CHANDY, *Department of Zoology, University of Delhi, Delhi.*

INTRODUCTION.

While studying the collections of flying fishes during my routine work as Reference Collection Officer, Central Marine Fisheries Research Station, between 1948-49, several new points of systematic importance of this group were observed. These points are analysed and the results are set forth in this paper.

I am deeply grateful to the Chief Research Officer, Central Marine Fisheries Research Station for placing its entire collection of flying fishes at my disposal and also for helpful suggestions. My sincere thanks are also due to the Curator, Prince of Wales Museum, Bombay and to the Institute of Science, Bombay for facilities afforded to study their collections of flying fishes. It gives me great pleasure to record my thanks to Dr. S. L. Hora and to Dr. K. S. Misra of the Zoological Survey of India for various suggestions in the final preparation of the paper.

GENERAL ACCOUNT OF THE GENUS *CYPSELURUS* IN INDIAN WATERS.

The family Exocoetidae of the order Synentognathi Gill (Belontiiformes Berg 1948) comprises of several genera, of which *Cypselurus* is an important and large one. This genus is found to inhabit the tropical and sub-tropical parts of Indian, Pacific and Atlantic oceans. In Indo-Australian zone alone 17 species of *Cypselurus* are recorded (Weber and de Beaufort, 1922), of which 7 also occur around the coast of India.

The earliest reference to the Indian species of flying fishes is by Day (1877). He classified them under the family Scombresocidae, genus *Exocoetus* (Artemi) synonymous with *Cypsilurus* Swains, *Halocypselus* Weinland and *Parexocoetus* Bleeker. Six species, viz. *micropterus*, *poecilopterus*, *volans*, *furcatus*, *bahiensis* and *mento* were included by Day under the single genus *Exocoetus* which later on proved to be a composite one. Subsequently this was split up into several distinct genera, viz. *Cypselurus*, *Exocoetus*, *Evolantia* and *Parexocoetus*, the classification being based on the teeth and the length of pectoral and ventral fins. Thus the genus *Cypselurus* is differentiated from other genera mainly on the length of the ventrals and their origin or location on the body.

The species of *Cypselurus* recorded, to date, in India are *C. speculiger*, *exsiliens* (*nigricans*), *bahiensis*, *spilopterus*, *oligolepis*, *astriginis*, *nigripennis*, *bilobatus*, *furcatus* (*altipinnis*), *cyanopterus*? and *coromandelensis* (sp. nov.). Besides these, Smith (1949) mentions the occurrence of *C. hewetti* in Indian ocean around S. Africa.

Comparatively, *Cypselurus* is a large sized flying fish, some of the species attaining a length of 475 mm. They are mostly warm open-sea dwellers but appear along the coast during breeding seasons in large shoals, providing special fisheries along the Coromandel coast in India, as in Cebu in Philippine Islands and other places.

*Key to the Identification of Species.**

1. Pectoral fin <i>with</i> spots	<i>spilopterus</i> .
2. Pectoral fin <i>without</i> spots .	3
3. Palate <i>with</i> teeth .	4
Palate <i>without</i> teeth .	5
4. Palatine patch of teeth <i>long and club-shaped</i> ; L. L. 39-40	<i>oligolepis</i> .
Palatine patch of teeth <i>small and oblong</i> ; L. L. 45-46	<i>exsiliens</i> .
5. Eye-diameter 3 in head length ; pre-dorsal scales 28-32 .	<i>coromandelensis</i>
Eye-diameter more than 3 in head length ; pre-dorsal scales 34-36.	<i>C. sp.</i>

SYSTEMATIC ACCOUNT.

***Cypselurus spilopterus* Cuv. and Val.**

1846. *Exocoetus spilopterus*, Cuv. and Val., *Hist. nat. Poissons* XIX, p. 113.

1866. *Exocoetus spilopterus*, Bleeker, *Ned. Tijdschr Dierk.* III, p. 116 Atl. Icth. VI. 1866-1872, p. 74.

1866. *Exocoetus spilopterus*, Günther, *Cat. Brit. Mus.* VI, p. 292-*Fische der Sudsee, Heft. VIII*, 1909, p. 368.

1878. *Exocoetus poecilopterus*, Day, *Fish. India*, p. 518.

1913. *Exocoetus spilopterus*, Max Weber, *Siboga—Expeditie, Fische*, p. 126.

D. 12-13 ; A. 10 ; P. 1.13-14 ; V. 6 ; L. 1.50-55 ; L. tr. 7.

Height 5-5. 3, (6.5-7 in total length). Head 4.4.3 (5.5.5 in total length). Eye 2.6.3 in head. Teeth comparatively well-developed, simple, in a few rows on the jaws ; a few teeth on each side on the palatines. Origin of anal opposite to 6th ray of dorsal. Pre-dorsal scales 30-32. Pectorals reaching to posterior part of dorsal or farther. Ventrals longer than head or scarcely so, reaching to middle of anal or not so far. Pectorals blackish, with a narrow hyaline hind border and an indication of a hyaline transverse band and provided with more or less numerous black, round spots. Other fins hyaline, caudal dusky. Ventrals and dorsals sometimes with a black spot posteriorly. Gill-rakers 15/6.

Species question of the Indian Spotted Flying Fish,
Cypselurus spilopterus C. and V.

The large variety of flying fish with spotted pectoral fins, has erroneously been identified by Day as *Exocoetus poecilopterus*. While studying the collection of flying fishes from the Coromandel coast and comparing them with other species it became clear that our spotted variety is not *E. poecilopterus*. Weber and de Beaufort have noted this mistake by Day and remarked: "The fish described by Day (*Fish. India*, 1878-1888, p. 518) as *E. poecilopterus* seems to be *Cypselurus spilopterus* C. and V., a species with smaller scales".

*The key is only for the species mentioned in this paper.

The spotted flying fish of India conforms in every detail to *spilopterus*, whose characters are tabulated below in order to bring out clearly the distinguishing features in which this species differs from *C. poecilopterus*.

	<i>C. spilopterus.</i>	<i>C. poecilopterus.</i>
Anal rays	10	7-8.
Pectoral rays	1-13-14	1-14-15.
Number of scales along lateral line.	50-55	45.
Number of scales along transverse series.	7/1/3	8/1/2½.
Distance between origin of dorsal fin and base of caudal.	Equal or scarcely longer than head.	Much more than head.
Pre-dorsal scales	30-32	25-27.
Gill-rakers	15 : 6	?
Colour and pattern of pectorals	Scattered round black spots	Large oval, black, spots, arranged in transverse bands.
Distribution	Malay Archipelago Seas of India, Tahiti.	Malay Archipelago, Japan.

It is evident from the above that the spotted form seen along our coast is, undoubtedly, *Cypselurus spilopterus* C. and V while *C. poecilopterus* is confined to the seas of the Malay Archipelago and Japan.

***Cypselurus oligolepis* Bleeker.**

1866—72. *Exocoetus oligolepis*, Bleeker, *Ned. Tijdschr Dierk. III*, p. 109-*Atl. Ichth.*, p. 69.

1866. *Exocoetus oligolepis*, Günther, *Cat. Brit. Mus. VI*, p. 296-*Fische der Sudsee. Heft, VIII*, 1099, p. 370.

1907. *Cypsilurus brachysomus*, Jordan and Seale, *Bull. Bur. Fish. Wash. XXVI*, p. 9.

1913. *Exocoetus brachysoma*, M. Weber, *Siboga-Expeditie, Fische*, p. 125.

D. 11-13 ; A. 8-9 ; P. 1-13-14 ; V. 6 ; L. 1-39-40 ; L. tr. 7.

Head 4 in standard and 5 in total length. Height 5 in standard and 6 in total length. Eye-diameter 2 in length of head, $\frac{3}{4}$ in snout and 1 in inter-oribital space, which is concave. Band of teeth on jaw disposed in 2 or 3 rows. Each tooth small and with 3 cusps, a median, large one and 2 lateral small ones. Palatine teeth arranged on long spindle-shaped patch on each side, bordering the upper jaw. (Text fig. 1c). Eyes very large. Fins: Pectorals reach the end of dorsal. Anal originates behind the dorsal fin.

Remarks.—Two specimens of a flying fish 160 and 180 mm. respectively in length obtained from the Institute of Science, Bombay and specimen 192 mm. in length collected from Ratnagiri were identified as *Cypselurus oligolepis*. So far this species is known from Zanzibar, Singapore, through Malay Archipelago on to Philippines, China and Tahiti. Its present

record from Bombay Coast extends its range of distribution to Indian waters.

Cypselurus exsiliens Linnéaus.

1771. *Exocoetus exsiliens*, Linne, *Manitssa plantarum*, p. 529.
 1846. *Exocoetus bicolor*, Cuvier and Valenciennes, *Hist. Nat. Poissons*, XIX, p. 111.
 1866. *Exocoetus nigricans*, Günther, *Cat. Brit. Mus.* VI, p. 290.
 1872. *Exocoetus nigricans*, Bleeker, *Atl. Ichth.* VI, p. 73.
 1896. *Exocoetus nigricans*, Jordan and Evermann, *Fishes N. America* 1, p. 737.
 1922. *Cypselurus nigricans*, Weber and de Beaufort, *Fish. Ind. Austr. Archip.* IV, p. 183.
 1934. *Cypselurus exsiliens*, Brünn, *Journ. Linn. Soc.* XXXIX, p. 34.
 D. 14; P. 1-14; A. 8-11; L. I. 45-46; L. tr. 6-8.

Cypselurus exsiliens Linné is recorded here for the first time from the Bay of Bengal and Arabian Sea. It has so far been known only from the Malay Straits, Java seas, Bay of Batam, Pacific, Atlantic and Indic. (Weber and de Beaufort, IV, p. 183). A brief description of the species is given below.

Head 4.5-5, height 6 in standard length. Eye-diameter 3 in length of head, $\frac{3}{4}$ in snout, $1\frac{1}{4}$ apart. Teeth on jaws conical, pointed, in 3-4 rows in both jaws. Palatine teeth¹ disposed in an oblong patch on each side. These patches are very small and about the size of the nostril.

Pectoral fins large, reaching to posterior part of dorsal or base of caudal. Dorsal fin anterior to anal fin, which starts at about the 6th dorsal ray. Ventrals as long as head, their origin is about midway between the operculum and base of caudal. Caudal deeply forked.

Pre-dorsal scales 26-29 in number. Vertebrae 44-45, Gill-rakers 4-6/16-17.

Colouration of the preserved specimen brownish above, silvery yellowish below. The pectorals are black, especially their dorsal surface. Posterior half of dorsal and inner distal end of ventrals black; anal is white, caudal rather deep brown.

The description of the species is based on four specimens, measuring 194 mm. to 240 mm. in standard length, three of which were obtained from the Southern section of Coromandel coast and one from the Bombay coast.

Redescription of **Cypselurus coromandelensis** Hornell.

The material for this section of the paper came from a large collection of flying fishes made at Nagapatanam, Tranquebar, Cuddalore, Madras.

¹Bleeker states that there are no teeth on the palate. Weber and de Beaufort describe the teeth as two small oblong patches. Brünn (1935) comments: "teeth are present on the jaws and palatine but it may be noted that the palatine teeth are often but few in number, 6-10 on each side and in a few cases they seem to be quite wanting, though it is not possible to distinguish such specimens from others with teeth. The few individuals without teeth belong however, among the largest so that this is perhaps a character that varies with age". The three specimens, from Rameswaram Road in the Central Marine Fisheries collection, have been observed to have no teeth on the palate. These specimens are comparatively smaller in size to the specimen from Ratnagiri, which possesses these teeth. It is, therefore, doubtful whether the variation in teeth can be ascribed to age.

and Mandapam by the Fishery Survey division of the Central Marine Fisheries Research Station during 1949-51. The size of the individuals ranged from 170-225 mm., including the upper caudal fin-lobe.

Along the Coromandel coast, there is an annual season from middle of May to middle of June, when this species of flying fish appears in large shoals, for the purpose of breeding in the Sargassum beds off the sea-shore.

In my attempt at identification the fish in question proved problematic, as I found that it did not conform to any of the species so far known. However, Hornell¹ had noticed this species as early as 1922 and had given a brief description of the same. He stated (p. 100): "Two species of flying fishes are recognized by the fishermen, a larger called distinctively Thai-Kola ("Mother Kola") and a smaller one, usually called simply Kola. The former has spotted pectorals and is *Cypselurus poecilopterus* (C. and V.). .. The smaller species, which runs generally 8-9 inches in extreme length is also a *Cypselurus*; the species remains to be identified" Later (Hornell, *loc. cit.* p. 107) he added: "The smaller species, where the pectorals in life are dark purple in tint with a narrow hyaline margin above and a wider one below, has not yet been identified. It does not appear to belong to any of the species of Exocoetidae described by Day or by Weber and de Beaufort..... Should the species prove to be a new one, I propose that it be called *Cypselurus coromandelensis*" My study of a large number of this flying-fish has proved that this is a distinct species and I shall redescribe it here under the name *Cypselurus coromandelensis*, proposed for it by Hornell.

***Cypselurus coromandelensis* Hornell.**

1922. *Cypselurus coromandelensis*, Hornell, *Madras Fish Bull.* Vol. XV, (4), p. 100.

D. 9-11; P. 1-15; V. 6; A. 10-12; C. 17-19; L. 1. 42-49; L. tr. 7.

The body is fairly slender and compressed laterally. Unlike most fishes, the flying fish is broad and flat dorsally as well as ventrally, rendering the shape of the body not elliptical, but somewhat quadrangular in cross-section. The height of body is $6\frac{1}{2}$ -7 in total, $5-5\frac{1}{2}$ in standard length. Head is 5 in total length, $4\frac{1}{2}$ in standard length. Eye-diameter is 3 in the length of head, 1 from snout and 1 apart. Inter-orbital space is somewhat depressed with a pair of grooves on each side, starting from the level of the posterior nostrils to the region of the occiput. The lower jaw is slightly more prominent than the upper jaw. Teeth are present on both jaws but they are absent on the palatines. Teeth are arranged in two or three rows and are just visible as minute specks of vitreous matter to the naked eye. Each tooth has a flat base which is the point of attachment to the jaw-bone, and has a somewhat conical body, which tapers to a point at the free end (Text. fig. 1a and b).

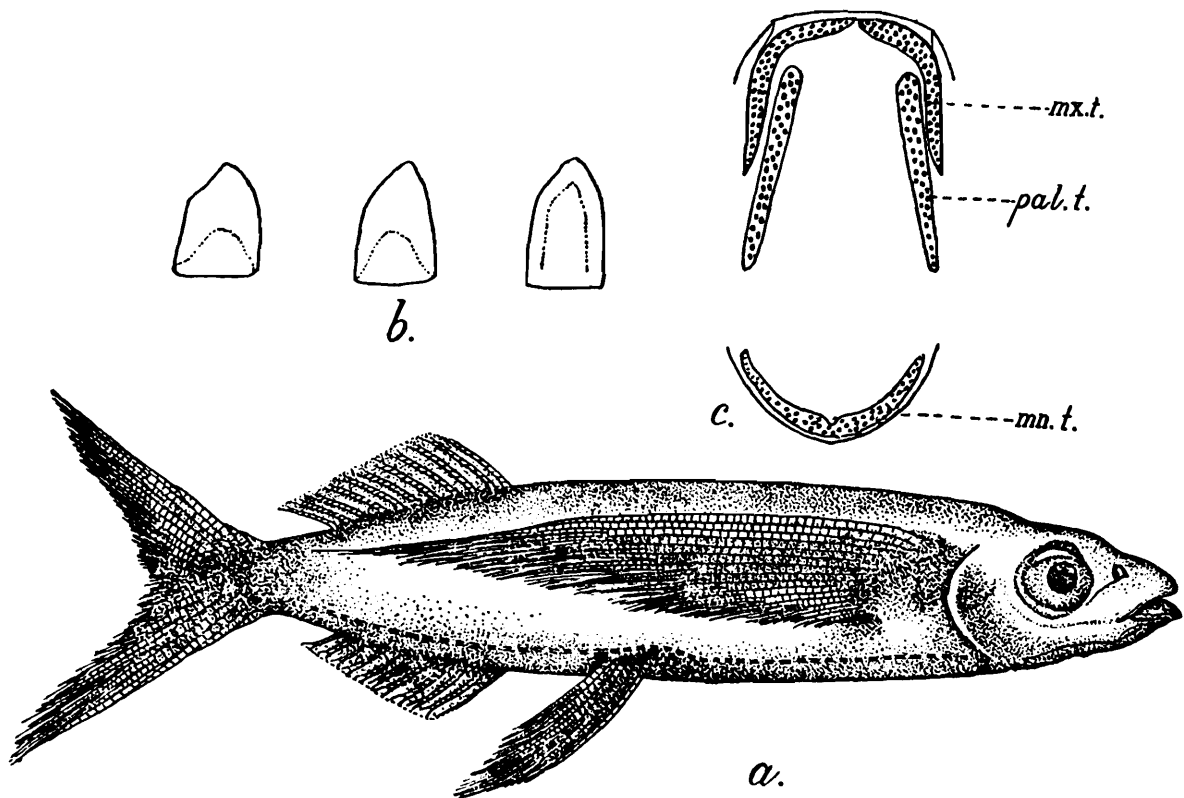
The dorsal fin originates at the same level as the anal; it is separated from the occiput by 28-32 scales. The distance from the origin of the dorsal fin to the origin of the caudal fin is approximately equal to length

¹Hornell, J.—Flying fish Fishery of the Coromandel Coast, Madras, Fish. Bull. Vol. XV, (4), 1922.

of head. Dorsal and anal fins are alike in height and disposition. The pectorals are very long, 1.6 times in standard length. The ventrals are moderately long, 4 times in standard length, the middle fin rays being the longest and reaching to the middle or even two-thirds of anal. The ventrals originate roughly mid-way between the operculum and the base of caudal fin. The caudal fin is forked, the lower lobe being longer.

Gill-rakers 8/20-23. Vertebrae 43.

Hornell noted : " The colouring of the body in life is deep blue above silvery below. Pectoral purplish, with a hyaline margin, that along the posterior edge the wider. Dorsal dusky owing to the presence of innumerable minute dark dots. Ventrals similarly dusky in the outer portion (half to three-fourths of the fin). Anal colourless. Caudal dusky "



TEXT-FIG. 1.—a.

- a. Lateral view of *Cypselurus coromandelensis* Hornell ;
 b. Isolated teeth from the upper jaw of the same ;
 c. Dentition of *Cypselurus oligolepsis* Bleeker.
 mx. t., maxillary teeth ; pal. t., palatine teeth ; mn. t. mandibular teeth.

The preserved specimens are blue-black above and silvery below. Pectorals are deeply pigmented in the posterior half, but hyaline in the upper and lower margins. Dorsal, ventral and caudal are dusky.

Remarks.—Hornell (*op. cit*) gave a brief description of the single specimen he obtained from Nagapatanam and five specimens from Madras and suggested that it might prove to be a new species if further study were done. It has now been possible to establish it as a distinct species and designate it as *Cypselurus coromandelensis*, the name suggested by Hornell. This species approaches to *Cypselurus oxycephalus* Bleeker and *Cypselurus speculiger* (C. and V.) in that the second pectoral fin ray is divided, the first remaining undivided and the anal originating opposite

to that of dorsal. *Cypselurus coromandelensis* can, however, be easily distinguished from all other species in having 42 to 49 scales along the lateral line and 7 (above lateral line) along the transverse series; also that the teeth on the maxilla being arranged in 2-3 rows and the palatal bones being edentulous. The colouration is also very characteristic of the species.

TABLE I.—*Measurements in millimetres and scale counts in 6 specimens of Cypselurus coromandelensis.*

	1	2	3	4	5	6
Total length .	170	178	190	200	180	180
Standard length	151	157	166	168	152	160
Length of head	37	37.5	40	42	37	39
Width of head	21	21	22.5	22	21	22
Height of head .	21	21	23	26	21	24
Diameter of eye	14	13	15	14	13	14
Length of snout .	9.5	8.5	12	11	10	10
Inter-orbital width	14	14.5	16	15	14	13
Depth of body .	27	26	33	31	28	29
Breadth of mouth	8	8.5	11	11	7	10
Length of pectoral fin .	96	99	105	110	100	103
Length of ventral fin	39	40	41	41	37	40
Length of caudal peduncle .	12	15	15	14	13	12
Least height of caudal peduncle.	11	10	12	11	10	11
Number of scales along lateral line.	42	42	47	43	42	43
Pre-dorsal scales	28	29	30	29	28	30

Cypselurus sp.

During the course of examination and identification of the collection of flying fishes from the Prince of Wales Museum, Bombay, I have come across a specimen, which differs from all the so far known species of *Cypselurus* recorded in Indian or Indo-Australian waters. As there is only one specimen, which is unfortunately in a bad state of preservation I desist from creating a new species to accommodate the specimen. I have given below a brief description of the species.

D. 13 ; P. 1.12 ; A. 11 ; L. 1.43 ; L. tr. 7.

Head 4, height 5 times in standard length. Eye-diameter $3\frac{1}{2}$ in length of head, 1 in snout and $1\frac{1}{4}$ apart. Teeth villiform on both jaws. Palate edentulous. Anal fin commences opposite the 7th dorsal ray. Pre-dorsal scales 34-36 ? Fins with no patterns, uniformly coloured like straw in preserved specimen.

Standard length :—285 mm.

The specimen varies from all other known species of *Cypselurus* in having a different proportion of eye in relation to length of head and in the number of pre-dorsal scales being 34 to 36.

Locality :—Not known,

CONCLUSION.

Our knowledge of the flying fishes of the extensive coast of India is based on the brief account of Day. Since then, with the growth of navigation and oceanographic expeditions, collections of flying fishes of the world and their systematic data have increased. Weber and de Beaufort (1922) have listed a good number of species from Malaya and East Indian Archipelago. Brünn (1935-37) has added substantially to the knowledge of the flying fishes of the Atlantic. Mention should also be made to the work of Herre (1945) on Pacific species in the Philippine seas, Hubb (1946) on Californian species and Smith (1949) on Indian species around South Africa. In the light of these it is obvious that a revision of the taxonomy of Indian species is desirable. In this paper, I have been able to observe some points in taxonomy and distribution of few of the flying fishes of India of the genus *Cypselurus* which are advancement to the existing knowledge. They are :—

1. Re-discovery of a new species from the Coromandel coast.

Hornell (1922) described a species which he pointed out as possibly new. I have confirmed it as a distinct species and named it *Cypselurus coromandelensis* Hornell.

2. The erroneous identification by Day (1877) of the common spotted variety of the Indian seas has been corrected and it has been assigned to *C. spilopterus* C. and V

3. *C. exsiliens* Linne and *C. oligolepis* Bleeker have been recorded by the author for the first time in India, thus extending their range of distribution.

4. A brief description of a specimen of flying fish from Bombay is given. This may prove to be a distinct species.

REFERENCES.

- BRÜNN, ANTON, F. (1935-37).—Flying Fishes of the Atlantic, 'Dana' Report 6.
- DAY, FRANCIS (1877).—Fishes of India.
- (1889).—Fauna of British India, Vol. 2.
- HERRE, A. W. T. (1945).—Additions to the Fish Fauna of the Philippine Islands, Copeia, p 147
- HORNELL, JAMES (1922).—Flying-fish fishery of the Coromandal Coast, Madras Fish. Bull. Vol. 15, 4, p. 100.
- HUBBS, C. L. (1946).—Classification of the Californian Flying Fishes, Copeia, pp. 188-218.
- JORDAN AND SEALE (1905-1906).—Bull. U.S. Bur. Fish. 25, p. 209, fig. 1.
- MCCULLOCH, ALLEN (1911-1914).—"Report on the Fishes obtained by the R. I. S. 'Endeavour' on the coasts of New South Wales, Victoria, South Australia and Tasmania" Vol. 1, Sydney.
- SMITH, J. L. B. (1949).—The Sea Fishes of S. Africa.
- WEBER AND DE BEAUFORT (1922).—The Fishes of the Indo-Australian Archipelago, Vol. 4, p. 173.