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Studies on the Biology and Fishery of the Fishes of the genus *Chirocentrus* Cuvier I. Taxonomy*

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Abstract

The dorsal fin colouration is largely blackish in *C. dorab* (Forskal) and whitish in *C.* nudus Swainson ; depth at orbit is narrow being 8.4-9.5 as percent of standard length (%SL) in *C. dorab* and deeper (10.3–11.9 % SL) in *C. nudus* ; and the pectoral fin is shorter (11.6–13.1 % SL) in *C. dorab* and longer (14.8–17.8 % SL) in *C. nudus*. These characters help to distinguish the two species only in fish above 150mm SL. But they could be distinguished irrespective of the size of the fish from the general morphology of the pterotic (squamosal) namely, presence of two short spines in *C. dorab* and their absence in *C. nudus* Furthermore, the two species differ also in the extension of the maxilla beyond the border of preopercle, and in the morphology of the otolith (sagitta) and the air bladder. The two species are widely distributed in the Indo-Pacific region. *C. nudus* is generally more abundant than *C. dorab* in Palk Bay and Gulf of Mannar.

INTRODUCTION

The genus *Chirocentrus* comprises of two recognised species, namely *C. dorab* (Forskal) and *C. nudus* Swainson. Forskal (1775) described the former under the genus *Clupea* and Cuvier (1816) created the genus *Chirocentrus* to accommodate it. Swainson (1839) described the other species based on 'Wahlah' of Russell (1803). However, Bleeker (1852) created another new species namely, *C. hypselosoma* and treated *C. nudus* Swainson as its synonym. Subsequent authors (Gunther, 1868; Day 1878 and 1889; Weber and de Beaufort, 1913) recognised only a single species of *Chirocentrus*, namely *C. dorab* (Forsskal). Hardenberg (1930), however, re-examined the question of the existence of two species under the genus and resurrected *C. hypselosoma* Bleeker. Fowler (1941) followed by Deraniyagala (1952), Smith (1953) and Munro (1955) accepted Hardenberg's (1930) recognition of the two distinct species under the genus *Chirocentrus*, but gave priority to the specific names, *nudus*, over *hypselosoma*. Misra (1962), however, treated *Chirocentrus* as a monotypic genus, recognising only *C. dorab*.

On the basis of over eight thousand specimens of both sexes examined from the Palk Bay and the Gulf of Mannar, Luther (1968) had pointed out to the occurrence of

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two species of *Chirocentrus* in the Indian waters : *C. dorab* (Forskal) and *C. nudus* Swainson. Contrary to that observed by earlier workers, he had found that among the several meristic and morphometric characters examined, only two morphometric characters did not overlap. This distinction was reinforced by a difference noticed in dorsal fin colouration, which could serve as the most important character to separate the two species in the field. The conclusion was confirmed by Whitehead (1973) by measurement of 42 specimens in the British Museum and in Copenhagen collected from the entire distributional range of *Chirocentrus* from Natal to Japan. In this account it is shown that the two species of *Chirocentrus* could be distinguished not only by certain morphological character but also by certain anatomical characters.

Materials and Methods

Material for this study was collected mainly from the catches around the Rameswaram Islands. Additional material for comparison, comprising the two species of the genus, was examined from the catches at Port Blair, Andamans, at many fishing centres along the Palk Bay and the Gulf of Mannar, at Madras, Colachel, Vizhinjam, Trivandrum, Quilon and Bombay, the last five centres being situated along the Arabian sea. Terminology used for describing osteological characters is according to Whitehead (1962), Bardack (1965) and Fitch (1969). Measurements employed here were described earlier by Luther (1968).

Description

Brief descriptions of the genus *Chirocentrus* and of its two recognised species are given below. Fowler (1941) gives an extensive list of references under the synonymy for the respective species. But these descriptions of the two species by the previous authors are based on characters that overlap considerably between the two species (Luther, 1968). So only a few references which are considered to give nearly adequate description of the species concerned are listed in the synonymy.

(a) Genus **Chirocentrus** Cuvier, 1816

Chirocentrus Cuvier, 1816, *Regne Animal* Ist ed., 2 : 178 (Type : *Clupea dorab* Foskal) (for dating, see Whitehead, 1967)
Neosudis Castelnau, 1873, *Proc. zool. Acclim. Soc.* Victoria, 2 : 119 (Type : *Neosudis vorax* Castelnau)

Diagnosis : Elongate, laterally compressed fishes attaining a standard length of about 1 m. Abdomen trenchant, lacking scutes. Dorsal fin origin over that of anal, and much nearer to caudal base than snout, Pelvic fin situated at start of last 3rd of distance between pectoral fin base and anal fin. Thin deciduous cycloid scales less than 5 mm in height. Intestinal Ringfalten in a spiral. Gape of mouth directed upward. Premaxillary with one or two enlarged ventro-anterio-

rly directed caniniform teeth followed by several smaller conical teeth. Conical maxillary teeth in shallow alveoli. Mandibles with 6-10 large teeth, largest attaining a little over 1 cm in crown height. Mandibular teeth in shallow alveoli and partly fused to alveolar border. Caudal fin deeply forked.

In percentages of standard length: body depth 13-20, depth at orbit 8-12, head length 16-20, snout length 5-6, eye diameter 3-4, pectoral fin length 12-18, predorsal length 66-72, caudal peduncle 20-25.

Supraoccipital crest low, exceeded in height by parieto-epiotic crest. Contact of supraoccipital and frontals separates small parietals. Supraoccipital forms lateral border of posterier frontal fontanelles, parietals not contributing. Temporal foramen and preepiotic fosa present. Basisphenoid without vertical arm. Parasphenoid projects posteriorly under first 2-3 anterior centra. Three distal pectoral radials present. Pelvic scutes small, crescentic, cutaneous sensory canals of head covering upper portion of operculum.

Vertebrae 69-75: Precaudal 42-45, caudal 27-31. Centra higher than long. Longitudinal lateral ridge between deep depressions. Dorsal fin with 4-5 unbranched rays and 12-14 branched rays. Anal fin with 3-4 unbranched rays and 26-32 branched rays. Pectoral fin with one spinose unbranched ray and 12-14 branched rays. Pelvic fin with one unbranched and 6-7 branched rays.

Geologic occurrence and distribution : Recent and Indo-pacific in distribution: East African coast from Natal to Red sea; eastward to India, Sri Lanka (Ceylon), Malaysia, Indonesia, Thailand, New Guinea and Queensland; north to Philippines, China, Taiwan and Japan.

(b) Chirocentrus dorab (Forskal, 1775)

(Plate 1, figs 1, 3, 5, and plate II, figs 1 & 2)

Clupea dorab Forskal 1775, *Descr. Anim.* xiii, 7 (Djedda and Red Sea, type now lost *fide* Klausewitz & Nielsen, 1965 : 13).

Dlupea dentex Schneider, 1801, *Syst. Ichth Bloch*, 428 (on *Clupea dorab* Forskal).

Esox chirocentrus Lacepede, 1803, *Hist. Nat. Poiss.*, 5 : 295, 317, pl. 8 (1) (*des Indes*, on Commerson drawing ; species indeterminate).

hirocen trus hypselosoma Bleeker, 1852s *Natuurk. Tijdschr. Ned. Indie* **3** : 71 (Holotype from Singapore or Samarang , some Bleeker specimens are *C. nudus* –, vide Whitehead, 1973, *J. Mar. biol. Ass. India* **14** (1) : 166.

Neosudis vorax Castelnau, 1873, *Proc. Zool. acclim. Soc. Victoria*, **2** : 118 (Noumea, New Caledonia)

Chirocentrus dorab Valenciennes, 1846. *Hist. Nat. Poiss.*, **19** : 150 Rofen. *et al.*, 1963, *Handbook food fishes Gulf of Thailand*, p. 212-213 ; Luther, 1968, *J. mar. biol. Ass. India* (1966) **8** (1) : 193, Plate I (1) ; Whitehead, 1973 *ibid* (1972) **14** (1) : 166, fig. 2.

D. iv-x 12-14; A. iii-iv 26-32; P. i 12-14; pelv. i 6-7; G.R. 1-4+10-16.

In percentages of standard length: body depth 13.1 - 16.2, depth at orbit 8. 4-9.5, head length 16. 0-18.4.

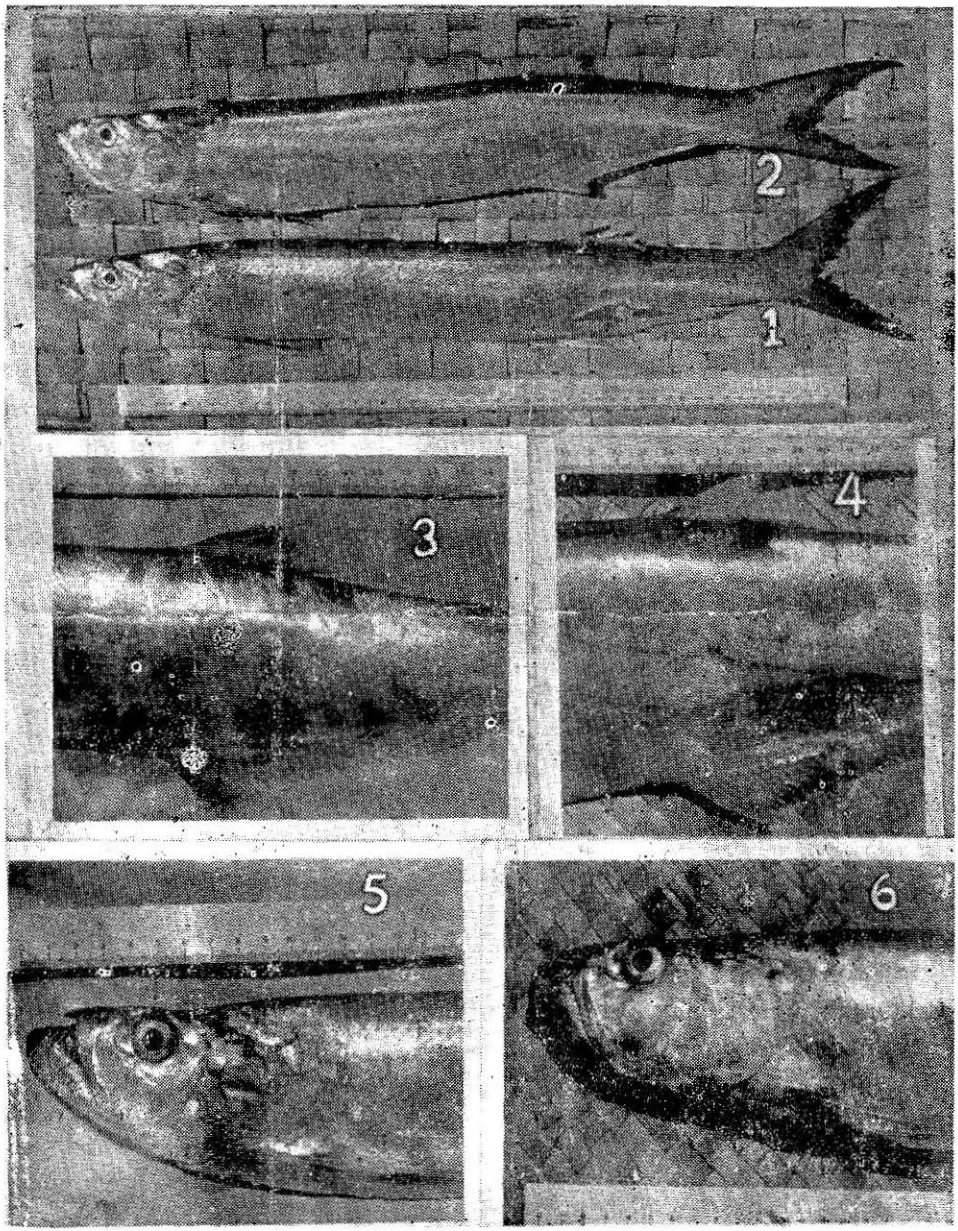

Plate I (1) *Chirocentrus dorab*. (2) *Chirocentrus nudus* (3) A portion of *C. dorab* enlarged to show the colouration of the dorsal fin, the major portion of which is blackish. (4) A portion of *C. nudus* enlarged to show the colouration of the dorsal fin, the major portion of which is whitish. (5) Head of *C. dorab* to show that the maxilla does not reach beyond pre-opercular margin. (6) Head of *C. nudus* to show that the maxilla reaches beyond pre-opercular margin – in fish over 210 mm SL.

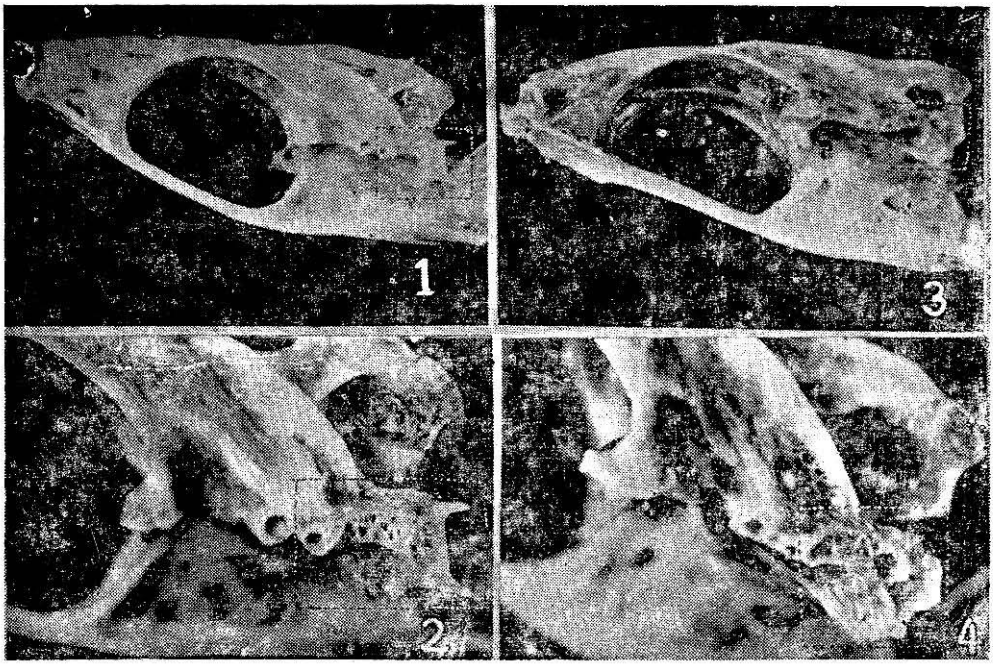

Plate II (1) Neurocranium, lateral view of *C. dorab*.
(2) Posterior portion of the neurocranium of *C. dorab*, enlarged to show the pterotic bone (enclosed within dotted lines) with the two short spines projecting posterolaterally.
(3) Neurocranium, lateral view of *C. nudus*.
(4) Posterior portion of the neurocranium of *C. nudus*, enlarged to show the ptero tic bone (enclosed within dotted lines). Spines similar to those in *C. dorab* are absent.

snout length 4. 9-5. 9, eye diameter 3. 0-3. 9, pectoral fin length 11. 6-13. 1, predorsal distance 66. 11.6 8-72.0, depth of caudal peduncle 6. 5-7. 9 and caudal fin length 19. 1-23. 7.

Maxilla fails to reach or in rare cases just reaches pre-opercular margin. Pterotic (=squamosal) with two short spines extending rearward from its postero-lateral corner.

Colour in fresh specimens : on the upper surface deep bluish green with a tinge of violet (dark grey in formalin-preserved specimens) descending in a diffused manner to the mid-lateral region; lower surface silvery. Dorsal fin black except for white crescentic area at base of fin rays, it being distinct in fish above 150 mm standard length. Anal fin hyaline, but in larger specimens (above 400 mm standard length) dark patches present anteriorly. Pectoral and caudal dark grey, acquiring an yellow tinge on preservation.

Distribution : Natal, East African Coast, Muscat, east and west coasts

of the mainland of India, Andamans, Sri Lanka (Ceylon), Penang, Singapore, Thailand, Java, Amboina, Cape York and Japan.

(c) Chirocentrus nudus Swainson, 1839

(Plate 1, figs 2, 4, 6; plate II figs 3, 4)

Chirocentrus russellii Swainson, 1838, *Nat. Hist. Amin., 1* : 289 (on Wahlah of Russell, 1803, Fishes of Coremandel 2 : 78, pl. 199, Vizagapatnam) (*nomen oblitum* vide Whitehead, 1967, *Bull. Br. Mus. Nat. Hist. Suppl.* 2 : 115)

Chirocentrus nudus Swainson, 1839, *Nat. Hist. Anim.*, **2** : 294 (also on wahiah)' Deraniyagala, 1952, *A coloured atlas of some vertebrates from Ceylon*, **1** : 10, Munro 1955, *Marine Fresh water Fish Ceylon* p. 34 : Rofen et al., 1963, *Hand book food fishes Gulf of Thailand*. p. 212–215; Luther, 1968, *J. mar. boil. Ass. India* (1966), 8 (1) : 193, pl. 1 (2) ; White head, 1973, *Ibid* 168, fig. 3.

Chirocentrus dorab Herre 1941 (*nce.* Forskal), *Rec. Indian Mus.*, 42 : 10.

D. iv–v 12–14, A. iv–v 27–32; P. i 13–14; Pelv. i 6; GR 2-5 + 12-18.

In percentages of standard length: body depth 15.1–20.1, depth at orbit 10. 3–11. 9, head length 17. 4–19. 9, snout length 5. 0–6.1, eye diameter 3.2–4.3, pectoral fin length 14.8-17.8, pre-dorsal distance 66.1–70.4, depth of caudal peduncle 7.6-9.1 and caudal fin length 22. 6–26.6.

Maxilla reaches beyond preopercular margin in fish over 210 mm standard length, Pterotic lacking any spines extending rearward from its posterolateral corner.

Colour in fresh specimens : On the upper surface bluish green (grey in formalin preserved fish) descending in a diffused manner to the mid-lateral region; lower surface silvery. Dorsal fin in fresh condition whitish with a tinge of yellow (the latter becoming intense on preservation), except for a dark streak on its front border over the first three unbranched rays and over the posterior border of the last ray. Anal fin hyaline, but turns yellow on preservation. Pectoral and caudal dark grey, acquiring an yellow tinge on preservation.

Remarks : Whitehead, Boseman and Wheeler (1966) discussed the taxonomic status of *Chirocentrus hypselosoma* and redescribed Bleeker's holotype, considering it cospecific with *C. nudus* Swainson. The type, 320 mm SL, however, has a pectoral fin length 11.7% of standard length and the maxilla just reaches the lower anterior-angle of the pre-operculum (14.8–17.8%, and maxilla reaching beyond pre-opercular margin in *C. nudus* over 210 mm, SL, *vide* Luther, 1968) and hence it is clearly within the range of *C. dorab*. However. Bleeker's atlas figure and a non-typical Bleeker specimen labelled *C. hypselosoma* (BMNH 1876. 11. 28. 1) agree with C. *nudus* (Whitehead, 1973).

Distribution : Natal, Persian Gulf, east and west coasts of the main land of India, Andamans, Sri Lanka (Ceylon), Penang, Thailand, Java, Sarawak, Koh Kong and Canton.

DESCRIPTION OF SOME ANATOMICAL CHARACTERS

The air-bladder in *C. dorab* is

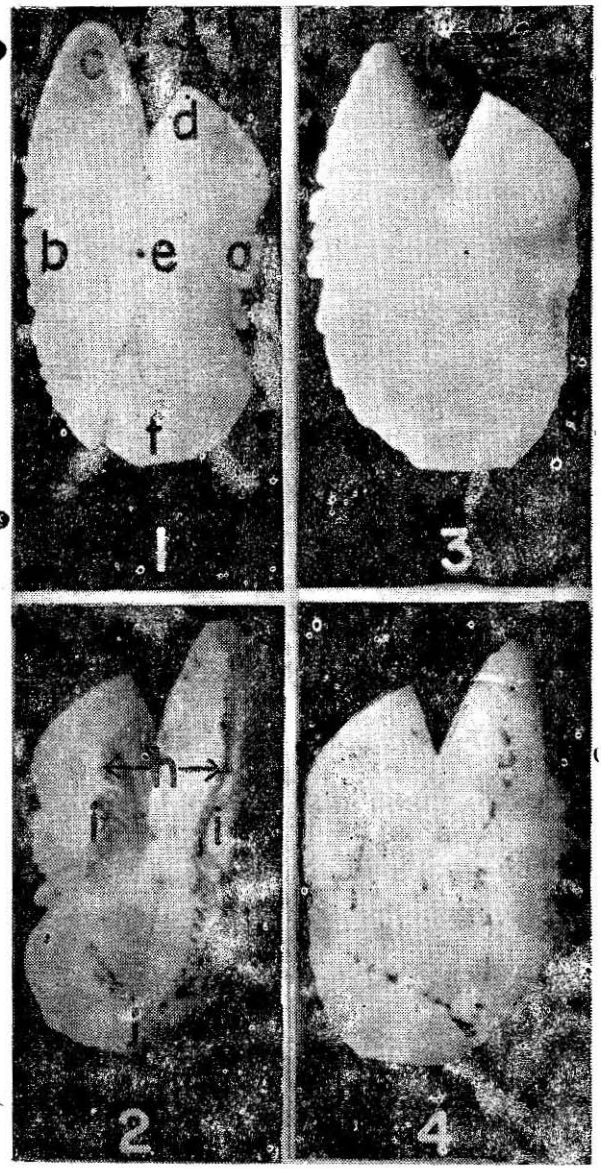

Plate III

Left sagittae of *Chirocentrus* figs 1 & 2 : Outer and inner views respectively of sagitta of *C. nudus*, 714 mm fork length. Figs. 3 and 4; Outer and inner views respectively of sagitta of *C. dorab*, 712 mm fork length. The sulcus of each otolith has been highlighted by rubbing a lead pencil across the raised margins : (a) Dorsal margin ; (b) ventral margin ; (c) rostrum (anteriorly projecting "nose-piece" ventral to sulcus) ; (d) antirostrum (anteriorly projecting portion above sulcus) ; (e) nucleus (taken as the centre of the otolith for measuring the radius of the otolith, to the tip of the ventral limb) ; (f) posterior end ; (g) sulcus (the groove, channel or pitted area on the inner face fo each sagitta) ; (h) ostium (mouth or front part of sulcus) ; (i) raised margins of sulcus ; (j) cauda (tail or posterior part of sulcus).

whitish, opaque and relatively thick, whereas it is light pink, translucent and thinner in *C. nudus*. The otolith (sagitta) of *C. nudus* is elongated in broad outline, about twice as long as high (Plate III). Its inner surface is convex and the outer surface is roughly concave anteriorly and nearly flat over the posterior half. The anterior end is forked, the ventral arm (rostrum) being longer and tapering than the dorsal arm (antirostrum). The posterior end is rounded, although occasionally incised or bulged at one or two places. The dorsal and ventral contours of the otolith are more or less parallel. The ventral margin is nearly even but occasionally incised in the middle. The dorsal margin is slightly concave in the middle with a few notches within and thin for some distance from the edge towards the nucleus. Rostrum pointed; length of its free portion nearly half in total otolith length in smaller sizes but it becomes less in larger fish. Ostium about one half as high as otolith at that point. Cauda nearly rounded posteriorly and usually terminates well in advance of the posterior margin of otolith. Towards the cauda the dorsal ridge of the sulcus is discontinuous with a depression on the surface of the otolith.

The otolith (sagitta) of *C. dorab* is nearly oval in broad outline, the ventral contour being evenly convex and less than twice as long as high (plate III). The ventral margin is generally crenate, it being more marked in small fish. The dorsal margin nearly straight in the middle. The ridge dorsal to the sulcus, after the break as in the other species, descends steeply to meet the ridge ventral to the sulcus. In the other details the otolith resembles the otolith of *C. nudus*.

Thus, the two species of *Chirocentrus* show some difference in the shape and configuration of their otoliths. Apart from the several common features between the otoliths of the two species, the break in the ridge along the dorsal border of the sulcus towards the cauda and the associated depression on the surface of the otolith in the same area seems to be a common feature for the two species. Whether or not this is a characteristic feature of the genus *Chirocentrus* alone requires further study.

Ridewood (1904) and Bardack (1965) figured the neurocranium of *C. dorab*. Whereas the two short spines on the postero-lateral border of the pterotic (squamosal of Ridewood, *op. cit.*) were both described and figured by Bardack, Ridewood did not describe them; The figure of the skull, however, indicates two projections on this bone indicating the presence of the two spines on the pterotic. These two skulls dealt with by them could therefore be considered as belonging to C. *dorab* (Forskal).

GENERAL REMARKS

Till recent years, fishery workers

in India considered the genus *Chirocentrus* to be represented by a single species, *C. dorab*, evidently following Day (1878, 1889), Devanesen and Chidambaram (1953) described only *C. dorab* under the genus. It is quite obvious that their figure attributed to this species (Plate XI, p. 11) is actually *C. nudus* as could be seen from the long pectoral and the extension of the maxilla beyond pre-opercular margin. Prabhu (1953), considered the dorab fishery along the coasts of the Palk Bay and the Gulf of Mannar to be constituted chiefly of *C. dorab* However, extensive observations on the relative composition of the two species of *Chirocentrus* on the southeast and southwest coasts of India by the author have revealed that *C. nudus* is dominant of the two. It formed about 80% of the total number of several thousands of both the species examined over a period of five years (1964-69) from the Palk Bay and the Gulf of Mannar. Talwar (1976) during an ichthyological survey of the Orissa Coast, observed the entire catch of *Chirocentrus* belonging to *C. nudus*.

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