J. Mar. biol. Ass. India, 1968, 10 (1): 133-151

URASPIS HELVOLA (FORSTER) (CARANGIDAE: PISCES) A DETAILED DESCRIPTION WITH REMARKS ON THE SPECIES OF THE GENUS *URASPIS* BLEEKER

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ACCORDING to Williams (1961) and Smith (1962) the genus *Uraspis* Bleeker is not known from the seas around India. However, the present author was able to collect large number of specimens of *Uraspis helvola* (Forster) of the length range 92-220 mm. (standard length) from the trawl catches in the Bay of Bengal, off the Andhra and Orissa coasts during 1964 and 1965 (Reuben, 1967). A critical study of the material showed that the morphometric and meristic characters of the species undergo marked changes during growth, and therefore the juveniles and adults are likely to be treated as different species unless a good series of specimens of intermediate lengths are examined. These changes that take place in the specific characters with growth have not been described before and are reported here. A detailed description of the species based on the material available is also given together with brief remarks on the species of the genus *Uraspis* Bleeker. As the problem of the species of *Uraspis* Bleeker is far from settled and as different views are held by different authors, a brief historical resumé is given below.

HISTORICAL RESUMÉ

Forster (1775) first described the white mouth crevalle, *Scomber helvolus* from Ascension Islands, Atlantic Ocean**, characterised by white and black mouth, uniserial teeth and normal scutes. Bleeker (1855) first instituted the genus *Uraspis*, characterised by biserial teeth and edentate tongue, palate and vomer, the type of which is *Uraspis carangoides* from Amboina, East Indies. But this genus was not recognised by Günther (1860). He described two species, namely, *Caranx uraspis* (=*U. carangoides* Bleeker) and *C. helvolus* (=*S. helvolus* Forster). Günther synonymised the previously described *C. micropterus* Rüppell (Rüppell, 1835, from Red sea) with *C. helvolus* (Forster).

A period of hundred years followed during which many species of *Uraspis* were described, based mostly on single specimens. Wakiya (1924) mentioned for the first time the presence of scutes on the lateral line with reversed keel points, that is, points directed anteriorly (and thus a unique feature in caragidae) characterising the genus *Uraspis*. Obviously this statement of Wakiya (1924) led the later workers, notably Jordan and Evermann, to regard this unique feature as the main generic character, resulting in the creation of yet another genus, *Leucoglossa* by them in Jordan, Evermann and Tanaka (1927) characterised by normal scutes. Williams

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** See note below page 144.

(1961) gave an excellent account of the existing literature of the species of *Uraspis* and on the ground that many of them represent geographical variations, recognised only three species, viz., (i) *U. wakiyai* (=*C.(U) uraspis* Wakiya, (ii) *U. heidi* Fowler, and (iii) *U. helvola* (Forster). Smith (1962) recognised only two species of *Uraspis*, namely, (i) *U. uraspis* (Günther) and (ii) *U. helvola* (Forster). He opined that *C. uraspis* Günther was a valid species and did not agree with Williams' view that *C. uraspis* Günther was inadequately defined because the type was missing. He synonymised *U. wakiyai* Williams with *U. uraspis* (Günther); at the same time *U. reversa* Jordan, Evermann and Wakiya which was treated as a doubtful synonym of *U. wakiyai* by Williams, and *U. heidi* Fowler which was recognised as a valid species, also by Williams, were both regarded by Smith as synonyms of *U. uraspis* (Günther).

The study of the available details in literature shows that the descriptions of various species have been based on specimens of different length groups. It is therefore possible that different stages (length groups) of the same species have been treated as different species by some of the earlier workers. It may be mentioned here that Fowler (1928), Williams (1961) and Smith (1962) have also envisaged the possibility of growth changes in certain specific characters, but these have not been studied before.

Material and Methods

The samples were collected from trawl catches at depths ranging from 20 to 50 m. between Latitudes 17° N. and 20° N. The methods of measurements and counts are the same as those described by Williams (1958) except that the method of scute count adopted here is different. Williams (1958 and 1961) has taken only armed scutes into account. But as Smith (1962) has pointed out 'the number of protruding spines is always lower than the total number of individual scutes of all sizes taken from the origin of the straight part of the lateral line to its end on the tail.' A few of the scales in the most anterior part of the straight part of the lateral line sometimes do not develop the structural peculiarities of scutes, for example, the number of non-scutellate scales observed in four specimens of 129, 142, 153 and 161 mm., ranged from 2-5 on the left side and 0-4 on the right side of the fishes. But their position indicated that they would become scutes and hence they have also been counted as scutes here, as was done by Berry (1959 and 1965) and Smith (1962). Scutes are counted on both sides of the fish and the average taken into account, as there is individual bilateral variation (from 1-6 scutes) in most of the specimens. Gill raker counts are made from the outermost arch on the left side. Fin and scute counts are made under magnification. Standard length from the tip of the snout to the base of the central caudal rays is used in this study unless otherwise mentioned.

Detailed Description of *Uraspis helvola* (Forster) from Indian waters

(Figs. 1. A and B; 2. A and B)

A description of adults more than 150 mm. in length has already been given by the author (Reuben, 1967). The description given below is based on 109 specimens ranging in size from 92-220 mm. Salient features of the morphometric and meristic characters are given in Tables I, II and III.

Genus *Uraspis* Bleeker, 1855

Uraspis Bleeker, 1855. *Natuurk. Tiidschr. Ned.-Ind.*, **8** : 418.

Leucoglossa Jordan and Evermann in Jordan, Everman and Tanaka, 1927, *Proc. Calif. Acad. Sci.*, ser. 4, **16** (20) : 660.

Type species *Uraspis carangoides* Bleeker, 1855.
Species *Uraspis helvola** (Forster, in Bloch and Schneider) 1801.

Scomber helvolus Forster, 1775, *Descriptiones Animalium*, pp. 414-415 *Descriptiones Animalium* . . . . , J. R. Forster, Ed. Lichtenstein 1844, 9 : 1-424 ; Forster in Bloch and Schneider, 1801, *Systema icthyologiae*, **I** : 38.

Caranx helvolus Cuvier and Valenciennes, 1833, *Histoire naturelle des poissons*, **9** : 104 ; Günther, 1850, *Catalogue of the acanthopterygian fishes in the collections of the British Museum*, **2** : 443 ; (in part) Fowler, 1928, *Mem. Bishop Mus.*, **10** : 147-148.

Caranx micropterus Rüppell, 1835, Neue Wirbelthiere zu der Fauna von Abyssinien gehorig, entdeckt and beschrieben. Frankfurt-a. M : 46.

Uraspis carangoides Bleeker, 1855, *Naturk. Tiidschr. Ned. -Ind.*, **8** : 418.

Caranx uraspis Günther, 1860, *Catalogue of the acanthopterygian fishes in the collection of the British Museum*, **2** : 443 ; (in part) Fowler, 1928, *Mem. Bishop Mus.*, **10** : 147.

Caranx hullianus McCulloch, 1909, *Rec. Aust. Mus.*, 7 (4) : 319.

Caranx (*Uraspis*) *uraspis* (in part) Weber and de Beaufort, 1931, *The Fishes of the Indo-Australian Archipelago*, **6** : 260-261.

Leucoglossa herklotsi Herre, 1932, *Hong Kong Naturalist*, **3** (2) : 151.

Caranx (*Uraspis*) *helvolus* Hardenberg, 1936, *Treubia*, **15** : 374.

Uraspis pectoralis Fowler, 1938 b, *Proc. U.S. nat. Mus.*, **85** : 46-47.

Uraspis helvola (in part) Herre, 1953, *Res. Rep. U.S. Fish Serv.*, 20, p. 286 ; (in part) Williams, 1961, *Ann. Mag. nat. Hist.*, (13), **4** : 82 ; (in part) Smith, 1962, *Ichthyol. Bull.* 26, p. 507.

Uraspis wakiyai (in part) Williams, 1961, *Ann. Mag. nat. Hist.*, (13), **4** : 82.

Uraspis uraspis (in part) Smith, 1962, *Ichthyol. Bull.*, 26, p. 506.

* It appears that Forster's records made in 1775 have remained in manuscript for nearly 70 years until Prof. Lichtenstein edited them in 1844. However, Schneider has introduced some of the materials of Forster's manuscripts in his edition of Bloch's Fishes (*Ann. Mag. nat. Hist.*, 1845, **14** : 46-47). While Williams (1961) has given the date of original description as ' (Forster) 1775, Smith (1962) gives it as ' (Forster in Cuvier and Valenciennes) 1833.' As the earliest published record on this fish appears to be in Bloch and Schneider 1801, the date of description should perhaps be recorded as *U. helvola* (Forster in Bloch and Schneider) 1801.

TABLE I

Data on morphometric characters and maturity stages of Uraspis helvola (Forster) *from the Bay of Bengal*

Length groups in mm. (SL) Number of specimens	90-109 19	110-129 24	130-149 30	150-169 13	170-189 15	190-209 6	210-229 2	90-229 109
Proportions in SL.								
Head	2.67-3.06	2.75-3.06	2.84-3.07	2.91-3.08	2.92-3.11	2.94-3.07	3.02-3.19	2.67-3.19
Greatest depth	1.90-2.18	1.92-2.29	2.01-2.37	2.12-2.32	2.14-2.38	2.14-2.25	2.13-2.37	1.90-2.38
First predorsal distance	2.27-2.61	2.43-2.74	2.48-2.73	2.46-2.76	2.54-2.70	2.47-2.61	2.59-2.59	2.27-2.76
Second predorsal distance	1.78-1.96	1.88-2.09	1.88-2.09	1.92-2.08	1.94-2.05	1.87-1.99	1.96-2.00	1.78-2.09
Second preanal distance	1.50-1.65	1.52-1.63	1.55-1.76	1.56-1.67	1.58-1.66	1.54-1.66	1.64-1.68	1.50-1.76
Prepectoral distance	2.73-3.15	2.82-3.23	2.92-3.17	2.91-3.20	3.00-3.21	3.03-3.17	3.14-3.18	2.73-3.23
Prepelvic distance	2.48-2.89	2.59-3.00	2.61-3.00	2.66-2.88	2.70-2.91	2.73-2.90	2.88-2.90	2.48-3.00
Length second dorsal base	2.00-2.28	2.08-2.36	2.03-2.29	2.07-2.28	2.16-2.36	2.10-2.36	2.10-2.27	2.00-2.36
Length second anal base	2.54-2.87	2.64-3.05	2.55-2.90	2.69-2.87	2.70-3.04	2.62-2.94	2.56-2.78	2.54-3.05
Proportions in Head								
Eye	2.72-3.18	2.79-3.96	3.13-3.96	3.25-3.79	2.92-3.62	3.15-3.50	3.14-3.31	2.72-3.96
Snout	2.92-3.65	3.23-4.00	3.13-3.96	3.19-3.81	3.17-3.75	3.31-3.83	3.31-3.45	2.92-4.00
Interorbital	2.58-3.48	2.89-3.80	3.20-3.75	3.25-3.82	3.16-4.07	3.05-3.83	3.31-3.45	2.58-4.07
Suborbital	5.58-8.11	6.00-9.10	6.86-9.40	7.57-10.4	7.63-10.3	8.38-10.5	8.63-8.69	5.58-10.5
Postorbital	2.13-2.70	2.17-2.67	2.18-2.50	2.35-2.60	2.38-2.67	2.30-2.58	2.56-2.57	2.13-2.70
Upper jaw	2.06-2.45	2.17-2.60	2.18-2.46	2.29-2.48	2.22-2.44	2.31-2.39	2.38-2.40	2.06-2.60
Length of pectoral	1.01-1.26	0.98-1.18	0.89-1.08	0.88-1.00	0.87-0.94	0.89-0.99	0.88-0.99	1.26-0.87
Length of pelvic	0.93-1.37	0.95-1.95	1.28-2.46	2.00-2.44	2.11-2.59	2.46-2.74	2.51-2.72	0.93-2.74
Maximum height first dorsal	3.35-4.50	3.27-5.00	3.91-7.14	4.33-7.42	5.18-6.78	4.76-6.80	6.32-8.11	3.27-8.11
Maximum height second dorsal	0.97-1.50	1.11-1.63	1.33-1.87	1.68-1.83	1.68-2.07	1.83-1.97	2.04-2.09	0.97-2.09
Maximum height anal	0.95-1.69	1.36-1.79	1.47-1.90	1.63-2.12	1.78-1.94	1.80-2.09	2.04-2.23	0.95-2.23
Others								
Eye in snout	0.87-1.00	0.79-1.04	0.87-1.08	0.96-1.10	0.84-1.09	0.90-1.05	0.91-1.00	0.79-1.10
Eye in postorbital	1.12-1.45	1.15-1.70	1.27-1.69	1.25-1.57	1.13-1.39	1.23-1.42	1.18-1.29	1.12-1.70
Lateral line curved in lateral line straight	0.71-0.96	0.80-0.98	0.79-1.00	0.79-0.97	0.80-0.97	0.90-0.95	0.91-0.93	0.71-1.00
Maturity	Indt.	Indt-I	I	I-II	II-III	II-III	III-IV	Indt.-IV

SL=Standard Length ; Indt.=Indeterminate.

(Synonymy is briefly dealt with again in the discussion).

D. I (P)+VIII+I 25-29 ; A. II+I 19-22 ; P. I-II+I 20-23 ; scutes, 32-40.

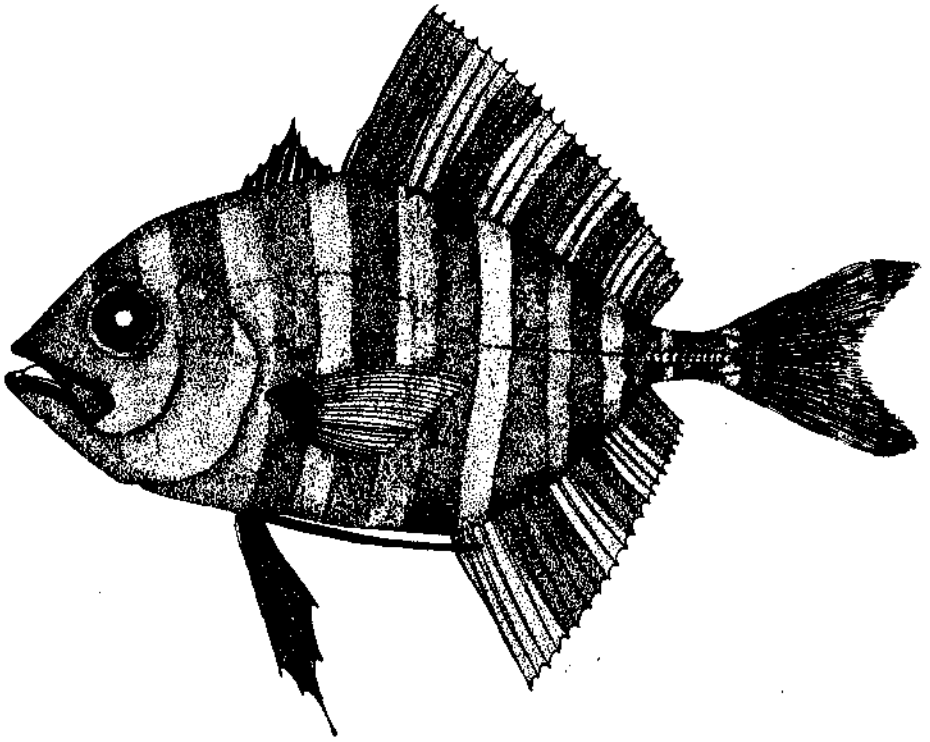

FIG. 1 A. *Uraspis helvola* (Forster), 92 mm. (juvenile).

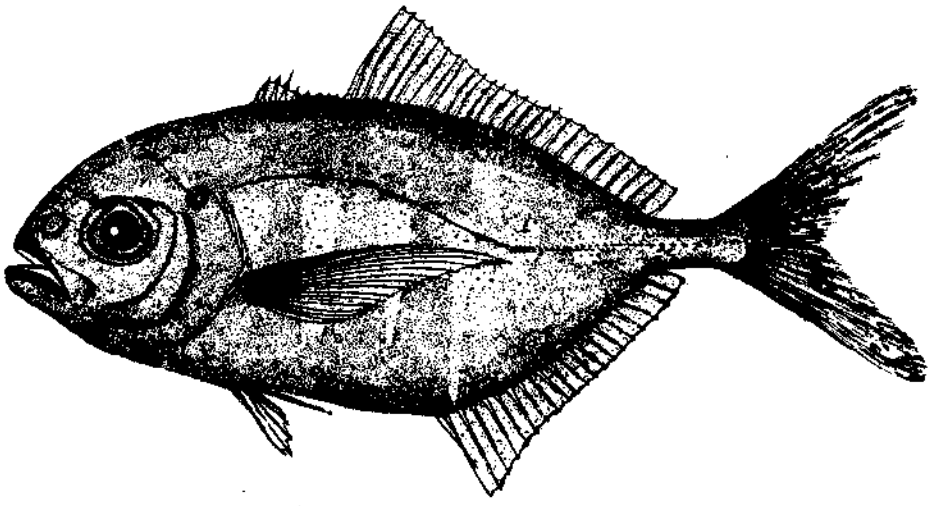

FIG. 1 B. *Uraspis helvola* (Forster), 220 mm. (adult).

Vertebrae (including urosyle) 10+14 (based on 13 specimens ranging from 92-210 mm. in length).

Body oblong, compressed, dorsal profile strongly convex from snout to caudal peduncle ; caudal peduncle slender, base wider than high. Ventral profile slightly convex to isthmus, then almost straight to origin of anal fin and thence ascending in convex line to caudal peduncle. Depth 1.90 to 2.38, head 2.67 to 3.19 in length. Head obtusely convex, nearly as high as long ; eye 2.72 to 3.96, snout 2.92 to 4.00, interorbital 2.58 to 4.07, suborbital 5.58 to 10.40, postorbital 2.13 to 2.70 and upper jaw 2.06 to 2.60 in head ; eye 0.79 to 1.10 in snout and 1.12 to 1.70 in postorbital. Eye with feebly developed adipose lids, snout rather blunt, nostrils typically ovoid, closely adjacent before eye. Cleft of mouth oblique, a little below level of eye in small fish and opposite lower margin of eye in adults ; the lower jaw slightly longer ; upper jaw moderatly protrusible and maxilla with a large posterior expansion reaches a point between anterior edge of eye and centre of pupil.

Teeth in jaws many, conspicuous, acute and curved, in 2-3 series in juveniles and uniserial in adults (see the account on teeth) ; none on vomer, palatines and tongue. Tongue, inside front of lower jaw and most of palate covered by a thick white membrane, rest of mouth dusky. Gill rakers on outermost gill arch (left) 4-6+I+12-15 ; the inner edges of rakers with minute, bony setae ; largest gill raker (lower limb) 1.57 to 2.50 and largest gill filament 1.35 to 1.91 in eye.

Scales small. Cheeks and part of operculum scaled, rest of head naked. Breast naked ventrally and laterally for a short distance towards pectoral base. Lateral line anteriorly with a low regular arch, joins straight section about middle of second dorsal fin. Curved lateral line 0.71 to 1.00 in straight part of lateral line. Scutes present along whole of straight part of lateral line which extends slightly beyond base of the central caudal rays. In juveniles the anterior and posterior parts of the straight part of lateral line has retrose scutes and the middle portion antrose scutes ; in adults only retrose scutes seen. (See the account on scutes).

Procumbent dorsal spine completely covered. First dorsal fin low, spines basally strong and their tips produced into very small filaments ; fourth dorsal spine largest, 3.27 to 8.11 in head ; eighth spine smallest ; first predorsal distance 2.27 to 2.76 in length. Second dorsal fin high, first two to three rays highest, 0.97 to 2.09 in head ; spine of the second dorsal about as high as fourth first dorsal spine in juveniles, higher than fourth first dorsal spine in adults ; second predorsal distance 1.78 to 2.09 ; anterior rays not falcate in juveniles, may be slightly falcate in adults, following rays gradually decreasing in size posteriorly ; tips of fin rays produced into very small fine filaments, the edge of fin nearly round in juveniles and nearly straight in adults ; length second dorsal base 2.00 to 2.36 in length of fish. Anal spines almost embedded. Second anal fin is slightly lower than second dorsal fin and in other respects the same as second dorsal. Spine of second anal fin nearly one third of first anal ray. First two to three anal rays highest, 0.95 to 2.33 in head ; second preanal distance 1.5 to 1.76 ; length second anal base 2.54 to 3.05 in length of fish. Pectoral fin in young fishes short, nearly round, not quite reaching the join of curved and straight lateral lines ; in adults, long, falcate, reaching beyond join of lateral lines ; length of pectorals 1.26 to 0.87 in head ; prepectoral distance 2.73 to 3.23 in length. Pelvic fin in young fishes long, slender, filamentous and subfalcate, reaching well beyond origin of second anal ; in adults strong and nearly falcate reaching upto about anus ; length of pelvic fin 0.93 to 2.74 in head ; prepelvic dis-

tance 2.48 to 3.00 in length. Caudal forked, lobes rounded in juveniles ; acute in adults ; with 22 to 24 caudal rays.

Head brownish, cheeks little darker, eye dark, two dark brown bands, one on nape and the other on postorbital. Body brownish with seven dark brown cross bands, which are wider than the interspaces, carried across on to the dorsal and anal fins in juveniles ; in adults brown bands or blotches on body. Caudal fin pale, fin margin dusky.

As stated already the important characters, namely, scutes, teeth, relative lengths of pectoral and pelvic fins and colour of fins, cross bands etc., undergo marked changes with growth of the fish. Therefore these are dealt with in detail below.

Scutes (Fig. 2A and B) : As is well known, a scute (in Carangidae) is a modified scale situated along the straight part of the lateral line. It is vertically and usually horizontally expanded with respect to other body scales, with the posterior margin

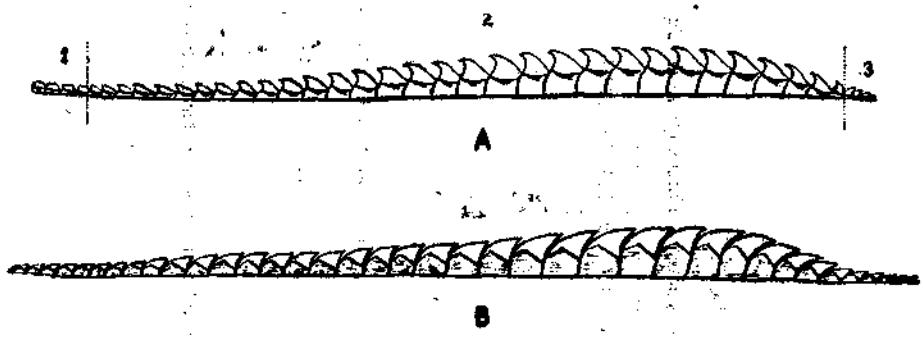

FIG. 2. Diagramatic representation of lateral line scutes in *Uraspis helvola* (Forster). A. (1) Anterior retrose scutes, (2) Middle antrose scutes and (3) Posterior retrose scutes in a juvenile, 92 mm. B. Retrose scutes in an adult, 220 mm.

either terminating in a posteriorly projecting, flattened or slightly elevated spine or ending in an apex (Berry, 1959). But in U. *helvola* it is observed that the vertically expanded keels of some scutes develop anteriorly directed or vertically directed or posteriorly directed obtuse or cuneate or slender spines or denticles ; in the latter case the scutes are identical with the usual carangid scutes. The scute is referred to as normal or retrose when the lateral keel has a posteriorly directed point and reversed or antrose when the lateral keel has an anteriorly or vertically directed point. The average total number of scutes in individual specimens ranged from 32-40 with the mean at 35.5. In all the specimens examined the straight part of the lateral line, posterior to the last scute, is continued beyond the base of the caudal and bears 6-10 very simple scales. Data on the number and nature of scutes present in different size groups are given in Tables II and III.

It will be seen from the Tables that the average total number of scutes remain almost constant over the entire length range studied (92-220 mm.) ; but between length groups there is considerable difference with regard to the number of scutes of different categories. In specimens below 150 mm. there are two types of scutes, the anterior and posterior retrose and the middle antrose. But in fish above 150 mm. there is only one type, namely, retrose. Furthermore it can be seen that the average

TABLE II

Data on scutes and teeth of Uraspis helvola (Forster) *from the Bay of Bengal.*

Length groups in mm. (SL). Number of specimens examined	90-99 6	100-109 13	110-119 13	120-129 11	130-139 14	140-149 16	150-159 8	160-169 5	170-179 7	180-189 8	190-199 2	200-209 4	210-219 1	220-229 1
Scutes (average)														
ar :	5.5	6.9	8.8	11.5	17.3	20.7								
ma :	25.0	23.6	21.0	16.9	10.4	7.6	Fish above 150 mm. have normal scutes only.							
pr :	4.7	5.0	5.3	6.5	7.5	6.9								
average total :	35.2	35.5	35.1	34.9	35.2	35.8	35.1	34.5	34.6	35.8	34.8	36.0	36.00	34.0
Teeth (series)	3-2	3-2	2	2	2	2-1	1	1	1	1	1	1	1	1

ar=anterior retrose or normal scutes ; *ma*=middle antrose or reversed scutes ; *pr*=posterior retrose or normal scutes.
SL=Standard Length.

TABLE III

Meristic data on Uraspis helvola (Forster) *from the Bay of Bengal*

Dorsal fin rays		Anal fin rays		Pectoral fin rays		Gill rakers						Scutes	
						Upper		Lower		Total (including the odd gill raker in the centre)			
N	F	N	F	N	F	N	F	N	F	N	F	N	F
25	1	19	5	20	18	4	10	12	2	18	4	32	1
26	25	20	58	21	46	5	72	13	20	19	20	33	8
27	50	21	42	22	32	6	27	14	77	20	58	34	18
28	28	22	4	23	13			15	10	21	23	35	32
29	5									22	4	36	25
												37	17
												38	6
												39	1
												40	1
Total 109		109		109		109		109		109		109	
Mean 27.10		20.41		21.37		5.16		13.87		20.03		35.45	

N=Number of fish examined; *F*=Frequency.

number of anterior retrose scutes increases from 5.5 in 90-99 mm. group to 20.7 in 140-149 mm. group while the average number of antrose scutes decreases from 25 in 90-99 mm. group to 7.6 in 140-149 mm. group. The average number of posterior retrose scutes slightly increases from 4.7 in 90-99 mm. group to 7 in 140-149 mm. group. Thus the data show that while the average number of antrose scutes decreased with increase in size of the fish there was corresponding increase in the number of retrose scutes. And since the total number of scutes remains constant it is obvious that there is a transformation of the antrose scutes into retrose ones with increase in size of the fish.

A critical study of the material showed that this transformation takes place from both anterior and posterior sides of the straight part of the lateral line, which is more active in the former than in the latter. The physical development of enlarging and hardening continues with growth of the fish (Berry, 1959). Observations on a good series of specimens to study the mode of change in the scute point direction have shown that the reversed scutes in the juveniles have obtuse or slender, prominent, more or less curved anterior keel points, and as growth proceeds enlargement of the keel in the posterior direction is effected gradually, culminating in a posteriorly directed point while the anterior points of the keel become less angular and finally blunt. As the scutes become ankylosed with growth the posterior points of the preceding scutes completely cover the anterior points of the succeeding scutes, thereby giving no indication of the presence of the blunt anterior points. This process of change in the nature of scutes with growth from reversed through lateral to normal scutes is remarkable in this fish.

Considerable individual variations in the degree of transformation have been observed. Complete transformation of reversed scutes is attained at variable lengths within 130-150 mm. Although it is apparent from the data that by the time the fish attains 150 mm. length the change from reversed to normal scutes is complete, a few specimens even in the smaller length groups, namely, 130-139 mm. and 140-149 mm. have completed the scute transformation. Individual bilateral variation in the nature of the scutes is observed in a few specimens under 150 mm. For example, in two specimens at 132 and 142 mm. the scutes on the left side have become completely retrose while a few antrose scutes (4-7) are still persisting on the right side.

Teeth : Teeth in jaws in length groups below 150 mm. are usually biserial or triserial, sharp, slender, not densely situated and slightly curved conicals. The innermost series in the lower jaw is continued to the posterior region of the jaw and is more prominent and larger than the outer series which are not continued to the posterior region of the jaw. On the other hand, the outer series in the upper jaw is prominent and large and continued to the posterior region ; the inner series consists of smaller teeth and are not present in the hindermost and foremost regions of the jaw. In length groups above 150 mm. teeth in jaws are uniserial, sharp, stout, densely situated and hardly curved conicals ; the outer series of teeth in the lower jaw and the inner series of teeth in the upper jaw gradually disappear. The data on teeth (Table II) in different size groups clearly showed that this change in the nature of teeth occurs with increase in the length of the fish. The triserial and biserial teeth persist up to 107 mm. and 147 mm. respectively. The teeth in one fish out of eleven examined in 120-129 mm. group and four fish out of fourteen examined in 130-139 mm. group have become almost uniserial and in the rest teeth are biserial. In 140-149 mm. group out of sixteen fish, the teeth in three are almost uniserial and in six uniserial, and in the rest teeth are biserial. In 150-159 mm. group one fish out of eight examined had teeth almost uniserial and the rest had uniserial teeth.

This change from pluriserial to uniserial teeth takes place almost simultaneously in both jaws. However, exceptions are noticed in three cases, i.e., in a fish at 136 mm. teeth in upper jaw have become uniserial while in the lower jaw biserial teeth still persist ; in a fish at 140 mm. teeth in lower jaw have become uniserial while in upper jaw a few teeth of the inner series persist ; and in a fish at 146 mm. the lower jaw teeth have become uniserial while those in upper jaw are irregularly uniserial.

Furthermore, the number of teeth in the outer series in lower jaw and inner series of teeth in the upper jaw decreases while the number of prominent inner series in lower jaw and outer series in upper jaw increases with increase in length of the fish. The decrease in the number of less prominent extra series of teeth in both jaws might occur as follows. It is possible that teeth in outer series in lower jaw and inner series in upper jaw move on to the prominent series, inner in lower jaw and outer in upper jaw, thereby effecting an increase in the number of uniserial prominent teeth from smaller to bigger size groups. This assumption is supported by the fact that in juvenile fish the maxillary and dentary bones supporting the teeth are wider and less compact than those of the adults in which they are narrow and compact.

Pectoral and Pelvic fins : Length of pectoral fin increases with length of the fish. Pectoral in the smallest length groups (90-99 mm.) is nearly round and tends to become falcate with increase in length of fish. The average pectoral fin length is 29.2 mm. in 90-99 mm., 49.4 mm. in 140-149 mm. group and 79.0 mm. in 220-229 mm. group. On the other hand pelvic fin in smaller length groups is remarkably long, slender, filamentous and subfalcate. It is observed that the average pelvic fin length is 33.8 mm. in 90-99 mm. group. But interestingly enough, there is a gradual reduction in the length of the fin with increase in size of the fish from 100-150 mm. (Table I). This appears to be brought about by fraying of the filamentous portion of the fin. In fish above 150 mm. the pelvic fin is short, strong, and nearly falcate and from this point the length of the fin increases with increase in length of the fish. The average length of the pelvic fin is 23.8 mm. in 140-149 mm. group and 27.6 mm. in 220-229 mm. group.

Colour : There are marked differences between juvenile and adult colouration. In a fish of 92 mm. there are nine vertical dark brown cross bands, two on head and seven on body, which are wider than the interspaces ; the bands on body extend on to the dorsal and final fins. The positions of the cross bands are : the first band on the nape ; the second in front of first dorsal fin, passes through postorbital ; the third from the first dorsal fin, passes through pectoral base and pelvic base ; the fourth from the anterior portion of the second dorsal fin to the anus ; the fifth from the dorsal fin to anal spines ; the sixth from the dorsal fin through the join of curved and straight lateral lines to anterior anal fin rays ; the seventh from dorsal fin to middle of anal fin ; the eighth from posterior portion of dorsal fin to the posterior portion of anal fin and the ninth on the caudal peduncle.

But the cross bands are prominent only in juveniles. In 150-159 mm. group the extension of the bands on the median fins is faint. The colour of the bands as well as the body and fins is also less pronounced in adults than in juveniles. There is a regularity in the pattern of disappearence of the cross bands. The process of disappearence starts from the dorsal and ventral sides of the bands then gradually extends towards the centre. Thus the bands begin to disappear first from the outer margin of the median fins ; in adults only blotches, representing the middle portions of the original bands, can be recognised. The first dorsal fin is dark in juveniles and

changes to light brown in adults. The colour of second dorsal and anal fins in juveniles is dusky, with few anterior rays tipped white, and changes to light hyaline in adults except that the edges of the fins are still dusky. Pelvic fins in juveniles are black and change to light hyaline in adults.

Previous records from the Indian Ocean : One specimen from Algoa Bay, South Africa, Smith (1962) ; two specimens off the coast of Tanganyika Territory and one specimen off the Kenya Coast, Williams (1961) ; one specimen from Red Sea, Rüppel (1835) ; one specimen from Muscat, Jayakar in Williams (1961).

Distribution : Agulhas Waters, Mozambique Channel, Somalian Waters, Red Sea, Gulf of Oman, Bay of Bengal, South China Sea, Philippine Waters, Indian Ocean Equatorial counter Current Region, Java and Flores Seas, Sulu and Celebes Seas, Tasman Sea Waters and ? Atlantic Southern Gyrals.*

Discussion

The present study has revealed that significant changes occur in the nature of scutes, teeth, pectoral fin, pelvic fin and cross bands on body of *Uraspis helvola* with growth. But these are features which have been used in the past as characters in the systematic accounts on *Uraspis* and allied genus *Leucoglossa*. Therefore in the light of the present observations it becomes necessary to reasses the position and relationships of *Uraspis* and *Leucoglossa*. As already stated the genus *Leucoglossa* was created by Jordan and Evermann to include fishes with normal scutes as opposed to *Uraspis* which in their opinion has only reversed scutes. Fowler (1949) recognised *Leucoglossa* as a valid genus although earlier (in 1928) he had not done so on the ground that the presence of reversed scutes might be a variable feature or a condition of age. But Williams (1961) did not recognise *Leucoglossa* because ' *Uraspis* Bleeker *senso stricto* does not have reversed scute points as a diagnostic feature.' The present study clearly shows that the nature of scutes is a feature varying with growth and age ; *U. helvola* below 150 mm. has both normal and reversed types of scutes whereas above this size it has only normal scutes. It will be remembered here that the genus *Leucoglossa* was instituted by Jordan and Evermann on the basis of specimens more than 270 mm. in length ; therefore this genus having been differentiated from *Uraspis* primarily on the basis of the nature of scutes, cannot be regarded as valid. Thus the present study adduces further proof in support of Williams' (1961) contention that *Leucoglossa* Jordan and Evermann is only a synonym of *Uraspis* Bleeker.

Since the number of series of teeth and the nature of scutes change with growth they cannot be accepted as diagnostic characters of the genus *Uraspis* Bleeker. On the other hand the other characters, namely, edentate tongue, palate and vomer as

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* There is some confusion regarding the type locality of *S. helvolus* Forster. According to Forster the type is from Ascension Island, Atlantic Ocean. Doubt as to the correctness of his statement was expressed by later workers on this subject (Günther, 1860 ; Jordan and Evermann, 1905 ; Fowler, 1928). Williams (1961) maintains that there is little proof to show that Forster's type locality is incorrect except that *U. helvola* (Forster) does not seem to have been identified from the Atlantic Ocean since that date. Smith (1962) opines that Forster's type is from Atlantic. *U. helvola* as defined here occurs only in the Indian Ocean and Southern and Western Pacific. Hence the author feels that the type locality could be Ascension Island, Pacific Ocean, as opined by Fowler (*op. cit.*), unless sufficient proof is shown to the contrary.

given by Bleeker (1855) when he first instituted the genus and the salient features of the type, namely, swollen tongue and white palate membranes in contrast with blackness of rest of the mouth amply define the genus.

Williams (1961) recognised three species of *Uraspis*, namely, (i) *U. wakiyai*, (ii) *U. heidi* Fowler and (iii) *U. helvola* (Forster). *U. wakiyai* is a new name proposed by him for *C. (U) uraspis* (non Günther) Wakiya because, according to him Günther's *C. uraspis* was indeterminate as the type was missing and could not be used as a valid name for Wakiya's specimens. He separated *U. wakiyai* from *U. heidi* Fowler on the ground that the cross bands on body extend on to the dorsal and anal fins in the former while they are restricted on to the body in the latter. Further he separated *U. wakiyai* and *U. heidi* from *U. helvola* on the ground that the former have biserial teeth, antrose scutes and cross bands on body while the latter has uniserial teeth, retrose scutes and no cross bands on body. But the present observations on *U. helvola* show that, (i) the extension of cross bands on to the dorsal and anal fins is a typical juvenile features and these bands gradually disappear first from fins and then from the dorsal and ventral parts of the body, with increase in size of the fish and (ii) biserial teeth and antrose scutes also are juvenile characters and they become transformed into uniserial teeth and retrose scutes respectively in fish above 150 mm. It therefore follows that the basic criteria adopted by Williams (1961) for species differentiation are not reliable. In fact all the essential characters of *U. wakiyai* agree with those of the juveniles of *U. helvola* (Table 1). Therefore *U. wakiyai* Williams is treated here as a synonym of *U. helvola* (Forster).

Smith (1962) believed that ' None of the characters on which different species have been based, i.e., uniserial or biserial teeth, antrose or retrose scute points, variation in fin and gill raker counts and lengths of pectoral and pelvic, appear to be singly of significance at specific level. They are accountable as developmental change and not to unusual variability in carangid fishes '. He recognised two species of *Uraspis* and distinguished them as follows :

A. Pelvic always longer than half length of pectoral. Some teeth distinctly and strongly curved. Some scute points antrose with age ..... *uraspis.*

B. Pelvic shorter than half length of pectoral. Teeth erect, hardly recurved. Scute points retrose..... *helvola.*

However, the present investigation shows that all the characters used by Smith (1962) to distinguish the two species can be seen in the same individual at different stages of growth. Furthermore, it is also found during the present study of *U. helvola* (Forster) that some specimens with pelvic fins less than half length of pectoral fins have a few scutes reversed. Pelvics longer than half length of pectoral are juvenile characters of *U. helvola*. Smith's statement that ' some acute points antrose with age ' (for *U. uraspis*) can probably be attributed to the fact that he regarded *U. reverse* (with 12 antrose scutes at 265 mm. length) as a synonym of *U. uraspis*. His specimen of *U. uraspis* at 45 mm. length has no antrose scutes. But *U. reversa* can probably be regarded as a valid species. Hence there is reason to regard Smith's *U. uraspis* as a synonym of *U. helvola* and is treated as such here. Smith's specimen (*U. uraspis*, smallest so far known) at 45 mm., William's specimen (*U. wakiyai*) at 66 mm., and the present author's small specimens at sizes

TABLE IV

Comparison of certain characters of Uraspis helvola (Forster) *and its synonyms. Data derived from the text figures are given in parenthesis*

Nominal species	*U. uraspis* (Günther)	*U. wakiyai* Williams	*U. pectoralis* Fowler	*L. herklotsi* Herre	*C. micropterus* Rüppell	*C. helvolus* Jayakar in Williams, 1961	*C. helvolus* (Forster)	*U. helvola* (Forster)
Standard length	45 mm.	66 mm.	170.5 mm.	180 mm.	180 mm.	260 mm.	265 mm.	92-220 mm.
Locality	South Africa	East Africa	Philippines	Hong Kong	Red Sea	Muscat	?Ascension Islands	Bay of Bengal
Source of data	Smith, 1962	Williams, 1961	Type specimen	Williams, 1961	Smith, 1962	Type specimen	Type specimen	Present author
Proportions in Standard length								
Head	2.50	2.87	2.95	3.15	2.90	3.17	3.31	2.67-3.19
Greatest depth ..	2.10	2.31	2.38	2.20	2.40	2.69	2.71	1.90-2.38
Second predorsal distance	(1.77)	(2.00)	1.95	..	(2.08)	1.70	2.05	1.78-2.09
Length second dorsal base	(2.20)	(2.16)	2.33	..	(2.00)	2.52	2.16	2.00-2.36
Prepectoral distance ..	(2.67)	(3.00)	2.74	..	(3.00)	3.10	2.94	2.73-3.23
Prepelvic distance ..	(2.78)	(3.00)	2.43	..	(2.78)	2.97	2.97	2.48-3.00
Proportions in Head ..								
Eye	2.50	3.83	3.28	3.35	3.40	4.25	3.49	2.72-3.96
Pectoral fin ..	1.40	1.60	0.94	0.91	(0.95)	0.83	0.88	1.26-0.87
Pelvic fin	(0.80)	0.80	2.61	2.40	(2.47)	2.58	2.35	0.93-2.74

Other characters								
Scutes	32*	26-27*	36*	31*	30*	34*	33*	32-40*
Teeth in jaws ..	2-3 irregular rows, uniserial behind.	Biserial, posteriorly on lower jaw uniserial	Uniserial	Uniserial	Uniserial	Multiserial**	Uniserial	Triserial to uniserial
	*Lateral keels all end in lateral to slightly retrose blunt points	*Armed scutes only. Majority reversed.	*Normal	*Direction of scute points not mentioned, presumed normal.	*Normal	*Normal **Multiserial teeth appear to persist even upto 260 mm. This could be a geographical variation. Williams (1961) gives teeth as uniserial	*Normal	*Majority reversed in juveniles, normal in adults.

Note :—Data on the type of *U. pectoralis* Fowler was kindly supplied by Mr. William F. Smith-Vaniz of the United States National Museum. Dr. Peter J. Whitehead has kindly examined the type of *C. helvolus* (Forster) and also a specimen first catalogued as *C. helvolus* and subsequently designated as *C. jayakari*, kept in the British Museum. In a personal communication to the author Dr. Whitehead says that the heads of *C. helvolus* (Forster) and *C. jayakari* are rather different. 'The preorbital is much deeper in *C. jayakari*, the head is deeper, and the dorsal profile of the head much more sharp-edged. Also, there is a difference in the operculum and suboperculum'. However, in the present account *C. jayakari* is regarded as a synonym of *U. helvola* (Forster).

ranging from 92-99 mm. together show a gradual change in the nature of scutes as mentioned below:

(i) Smith's *U. uraspis* at 45 mm. has the lateral keels of scutes all ending in lateral to slightly retrose blunt points.

(ii) Williams' *U. wakiyai* at 66 mm. has 75 per cent of the posterior scutes (i.e., about 20 out of 26) antrose ; the remainder of the scutes decreasing in size anteriorly, the scute points changing through laterally to posteriorly directed.

(iii) The present author's small specimens of *U. helvola* of the size range 92-99 mm. have 24-26 antrose scutes in the middle portion of the straight lateral line the anterior 4-7 scutes have lateral to slightly retrose points and the posterior 4-7 scutes have retrose points.

This also shows that Smith's specimen of *U. uraspis* and William's specimen of *U. wakiyai* can probably be different stages in the development of *U. helvola.*

Species of Uraspis *Bleeker from the Indian Ocean and Southern and Western Pacific :*—The morphometric and meristic characters of the various stages of *U. helvola* from Indian waters agree with those of the nominal species already described from the Indian Ocean and Southern and Western Pacific (Table IV). In the light of the present results it would appear that the synonymies given by Williams (1961) and Smith (1962) also require revision. It is significant that the recorded lengths of the various nominal species from these regions assigned to *U. uraspis* by Smith (1962), namely, *U. carangoides* Bleeker (1855), 129 mm. Total length, (=*C. uraspis* Günther, 1860) ; *C. hullianus* McCulloch (1909), 112 mm. Total length ; *U. wakiyai* Williams (1961), 51 and 66 mm. ; and *U. uraspis* (Günther), Smith (1962) 45 mm are less than 150 mm., and the recorded lengths of those species assigned to *U. helvola* (Forster) by Williams (1961) and Smith (1962), namely, *S. helvolus* Forster in Bloch and Schneider 1801, 260 mm., (=*C. helvolus* Cuvier and Valenciennes (1833) ; *C. helvolus** Jayakar in Williams (1961), 265 mm. ; *L. herklotsi* Herre (1932), 180 mm. ; *C. micropterus* Rüppell (1835), 180 mm. ; *U. pectoralis* Fowler (1938 (i), 170.5 mm., are more than 150 mm. The species assigned to *U. uraspis* (Günther) by Smith (1962) are characterised by two or three series of teeth, lateral to antrose scute points, long filamentous pelvic fin (pelvic more than half length of pectoral) and the cross bands on body extending on to the dorsal and anal fins ; but as already stated these are the characters of juvenile *U. helvola.* The species assigned to *U. helvola* (Forster) by Smith (1962) are characterised by uniserial teeth, retrose scutes, shorter pelvics (pelvics less than half length of pectoral), and cross bands on body not extending on to the dorsal and anal fins ; these are the characters of adult *U. helvola.* Hence it would appear that what has been regarded by Smith (1962) as *U. uraspis* in the region mentioned above, is probably the juvenile of *U. helvola* ; and that a single species of *Uraspis* (*U. helvola*) is represented in the Indian Ocean and Southern and Western Pacific.

A provisional key to the species of Uraspis: A critical study of the published details of the species of the genus *Uraspis* and the data kindly supplied by the different museums on the type specimens** shows that the various nominal species described by different authors fall into three distinct groups with reference to the homogeneity

* See note below Table IV.
** See Table IV.

of characters ; (i) those from the Indian Ocean and Southern and Western Pacific, (ii) those from the Northern and Eastern Pacific (Japan and Hawaii) and (iii) those from the Atlantic Ocean. They are represented by *U. helvola* (Forster), *U. reversa* Jordan, Evermann and Wakiya, in Jordan *et al.*, 1927 and *U. heidi* Fowler, 1938 (ii) repectively. It is apparent that in all essential meristic details the three species show remarkable similarity. In view of the fact that the species of *Uraspis* show remarkable growth changes it is necessary to examine good series of material to differentiate species at all stages. The limited size range of the specimens examined by the earlier workers as also the absence of information on important morphometric characters in the original descriptions restricts the scope of detailed comparison of the different species. However, from the available data and the known length ranges it is seen that the three species mentioned above show differences in a few morphometric characters. A provisional key to the three species is given below.

1. Second predorsal distance distinctly longer than second dorsal base.... .....*U. helvola* (Forster)

2. Second predorsal distance about equal to or ditsinctly less than second dorsal base.

   (*a*) Depth 2.33-2.55 ; prepectoral distance 3.33-3.83 and prepelvic distance 3.00-3.33 in standard length..... .....*U. reversa* Jordan, Evermann and Wakiya.

   (*b*) Depth less than 2.30 ; prepectoral distance less than 3.30 and prepelvic distance less than 3.00 in standard length.....*U. heidi* Fowler.*

SUMMARY

A detailed description of *Uraspis helvola* (Forster) based on 109 juvenile and adult specimens of the length range 92-220 mm. in standard length from the Bay of Bengal is given. A critical study of the graded series of specimens revealed interesting changes in certain characters (scutes, teeth, fins and colour) with growth.

In fish below 150 mm. there are two types of scutes, namely, the anterior and posterior retrose scutes and the middle antrose scutes. The antrose scutes get transformed gradually into retrose scutes with increase in size of the fish and in fish above 150 mm. there are only retrose scutes. Teeth in jaws in fish below 150 mm. are usually triserial or biserial and become uniserial in fish above 150 mm. The length of pectoral fin increases with length of the fish. On the other hand pelvic fin in smaller length groups is remarkably long, slender and filamentous. There is a gradual reduction in the length of pelvic fin with increase in size of the fish from 100-150 mm. In fish 150 mm. in length pelvic fin is short, strong and nearly falcate and from this point the length of the fin increases with increase in length of the fish. The colour and cross bands on body are prominent in juveniles and gradually become less pronounced in adults.

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* Future examination of good series of specimen material with wider ranges might obviate some of the characters used here to distinguish *U. heidi* and *U. reversa*. Dr. Frederick H. Berry in a personal communications says that *U. heidi* Fowler is a junior synonym of *U. secunda* (Poey).

In the light of the present results it is shown that *U. wakiyai* Williams (1961) and *U. uraspis* (Günther) of Smith (1962) from Western Indian Ocean are probably the juveniles of *U. helvola* (Forster). Detailed synonymy along with the previous records of the species from the Indian Ocean and the general distribution of *U. helvola* are given. A provisional key is also given to the three species of the genus *Uraspis* Bleeker considered valid, namely, (i) *U. helvola* (Forster) (ii) *U. reversa* Jordan, Evermann and Wakiya and (iii) *U. heidi* Fowler.

Acknowledgements

The author is a grateful to Dr. S. Jones for his valuable suggestions, help and encouragement in the course of this investigation. The author wishes to express his sincere thanks to Dr. K. V. Sekharan for going through the manuscript critically and offering advice for improving this paper, and to Dr. P. S. B. R. James for reading the typescript and giving helpful suggestions. The author's sincere thanks are also due to Dr. Peter J. Whitehead of the British Museum (Nat. Hist.), Dr. James E. Böhlke of the Philadelphia Academy of Natural Sciences, Dr. Frederick H. Berry of the Bureau of Commercial Fisheries, Miami Florida, Dr. W. I. Follett of the California Academy of Sciences, Dr. John D. Hopkirk of the University of California and Mr. William F. Smith-Vaniz of the United States National Museum for kindly supplying the data on the type specimens.

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* Not referred to in the original.