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NOTES ON CARANGIN FISHES

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I.—ON YOUNG *CARANX HIPPOS* (LINNAEUS)

Species of the genus *Caranx* show certain changes with age which frequently lead to misidentification of even our familiar local species. This is particularly the case because these changes, probably for the most part parallel in the different species, vary with each species as to extent or size at which they take place. I therefore have it in mind to record them as opportunity offers with the idea of making helpful that which is confusing in our present stage of recorded knowledge of the subject.

Through the courtesy of Mr. E. Milby Burton, Director, ten specimens of young *Caranx hippos* from South Carolina in the collection of the Charleston Museum have been loaned to me for study. They were taken in 1931 to 1934, between June 30 and September 25, and measure from 23 to 65 mm. in standard length.

The most obvious proportional differences between these specimens and the adult are that they are deeper and more compressed, depth in standard length, 1.9 to 2.6 versus 2.8 to 3; head, 2.8 to 3.1 versus 3.5 to 3.7; eye in head, 2.8 to 3.5 versus 5; the front of second dorsal and anal are lower, and pectoral less falcate, shorter than versus equal to or longer than head. The chord of the curve of lateral line, in the straight part, varies from 1.1 to 1.3; and 20 to 29 scutes can be counted, somewhat less than in the adult.

The largest of the eight specimens, that of 65 mm. standard length, would be recognized off-hand as a *Caranx hippos*. It is large enough so that the characteristic form of head and body, dentition, naked breast with patch of small scales before the ventrals and fin counts are easily appreciable, and in it the front of the soft vertical fins are moderately elevated; the color very like that of the adult except that there is no dark mark on the pectoral base. The smallest specimens are quite different, and due to this and their small size could scarcely be identified with certainty except in series.

The slight change of depth of body in the size range of the ten is com-

plicated by individual variation. Two specimens of 23 to 25 mm. have the depth 1.9 to 2.1; 3 of 31 to 33 mm., 2.2 to 2.4; 4 of 37 to 50 mm., 2.4 to 2.6; one of 65 mm., 2.6.

The lengthening of the pectoral and front of the soft vertical fins progresses more evenly. The pectoral is bluntly pointed in 5 specimens of 23 to 33 mm., pointed in 3 of 37 to 40 mm., falcate in 2 of 50 to 65 mm. It is 1.5 to 1.7 in head in 5 of 23 to 33 mm.; 1.3 in one of 37 mm.; 1.4 in one of 39 mm.; and 1.2 in 3 of 40 to 65 mm. Soft dorsal and anal are not or just appreciably elevated in front in 6 of 23 to 37 mm.; slightly elevated in one of 39 mm., slightly more so in one of 50 mm., and moderately elevated in one of 65 mm.

In 2 of 23 to 25 mm. scales are barely appreciable on sides. The scaleless breast is appreciable from 31 mm. up; its patch of scales not appreciable in 3 of 31 to 33 mm.; more evident in one of 37 mm. than in three of 39 to 50 mm. but scarcely appreciable in these 4; very evident in one of 65 mm.

The two smallest specimens of 23 and 25 mm. have conspicuous dark cross-bands, a curved band through the eye, short band on upper part of opercle, and 5 on the body, these last as broad or broader than interspaces above and narrower or faint in the silver below; spinous dorsal more or less dusky. In 4 specimens of 31 to 37 mm. this banded color pattern is conspicuous and consistent, perhaps more bold in the smaller of these. There are 5 dark bands on the body about as broad as the interspaces, also a band diagonally back from top of eye and down below it, one across the border of the opercle, and the peduncle at base of caudal is dark. The spinous dorsal is blackish and there is sometimes a trace of dusky on the front angle of the soft dorsal. One of 39 mm. is the same but the opercular band more confined to the upper angle of the opercle; and one of 40 mm. is like it, but with the spinous dorsal merely dusky as is also the lobe of the soft dorsal; in one of 50 mm. the band through eye and 5 on body are present but faint, the opercular band is present on the back, but the opercle has merely a restricted dusky blotch on its upper angle, spinous dorsal and lobe of soft dorsal are slightly dusky; one of 65 mm. retains only faint traces of 5 dark cross-bands on the body; its spinous dorsal, and soft dorsal lobe are slightly dusky, and there is a conspicuous blackish blotch on the upper angle of the opercle. The juvenal color pattern then holds between 20 and 40 mm., is fading between 40 and 50, and only slight traces of it remain at 65. The juvenal pattern is not always so well marked as in this South Carolina material. Two specimens of 31 and 36 mm. from Moriches Bay, Long

Island, July 26, 1934, are silvery, bands only faintly indicated, spinous dorsal blackish.

There are no data to hand as to the age of these individuals, where they were spawned, or their rate of growth. They may have drifted for some distance or have been spawned nearby, for adults might be expected to occur in the latitude of Charleston. In 1931, one of 37 mm. was collected Aug. 20, 3 of 39 to 50 mm., Sept. 2, one of 65 mm., Sept. 10; in 1932, 2 of 31 to 33 mm., June 20; in 1933, one of 31 mm., Sept. 25; and in 1934, 2 of 23 to 25 mm., July 19. They are probably spawned in the spring and summer, and grow more rapidly after passing a length of 50 mm., when juvenal drifting habits and color are being replaced by more actively predaceous habits and habitus of the adult. Supposing the 1931 specimens to be more or less one group, it is indicated that this is the case.

Possibly there is a change of life accounting for lack of material below 20 mm., just as there is probably some such change above 50 mm.

Unfortunately there is no *Caranx latus* material of between 20 and 40 mm. standard length available for comparison with this Charleston Museum series of *Caranx hippos* but we have to hand 6 specimens of from 42 to 67 mm. from various localities. These show the subtle change of form with increase of size that there is in both species, a change not adequately expressed by change of depth or other measurements found. The body becomes less ovate, the soft dorsal and anal bases less oblique, that is the angle between them less.

The 67 mm. specimen from Porto Rico in July is surprisingly like much larger fish in appearance and proportions, except that pectoral and lobes of vertical fins are somewhat shorter. It has a slight dusky blotch along the edge of the upper angle of the opercle, spinous dorsal and end of soft dorsal lobe dusky, no other markings. It has depth in length, 2.5; eye in head, 3; pectoral 1.1. For comparison, 2 specimens from Porto Rico of 103 and 107 mm. have depth, 2.5; eye, 3.3 and 3.5; pectoral, 1. One of 265 mm. from Nassau has depth, 2.6½; eye, 3.7.

Small *latus* lose the greater depth and larger eye less with increasing size than do small *hippos*. Two of 42 mm. standard have depth, 2.3 to 2.5; eye, 3 to 3.1; 2 of 48 and 50 mm. depth, 2.4 to 2.5; eye, 3; of 62 and 67 mm., depth, 2.5; eye, 3 to 3.1. The lengthening of the pectoral and front of the soft vertical fins proceeds much as in that species—at 42 mm. pectoral, 1.3 to 1.5, rather bluntly pointed to pointed; front of soft vertical fins slightly to moderately elevated; at 48 to 50 mm. pectoral, 1.3 to 1.4, slightly falcate to falcate, front of soft vertical fins

moderately elevated; at 62 to 67 mm., pectoral, 1.2 to 1.1, falcate, front of soft vertical fins well elevated. The lengthening of the front of the soft vertical fins seems to be slightly more advanced in *latus*.

The scaling on the breast is easily appreciable in all 6 small *latus* examined, a definite character to separate them from *hippos* down to 42 mm. at least. An even more tangible difference is curve of lateral line in straight part, 1.5 or 1.6—1.1 to 1.3 in *hippos* of comparable size.

A *Caranx latus* of 48 mm. standard length from South Carolina, October 28, 1929, Charleston Museum, has 5 faint dark bands across the body as in *hippos*, but broader, distinctly broader than the pale interspaces, and noticeably lacks the dusky blotch on the opercle. The dark top of its peduncle is produced downward in a slight sixth cross-mark, but this is also the case only in a lesser degree in a *hippos* of 50 mm. The five specimens of from 42 to 62 mm. have faint broad dark cross-bands on the sides more or less distinctly indicated, and it may be that at smaller sizes there is a definite bold pattern comparable to that in this other species, perhaps with the bands broader. In the two specimens of 42 and one of 50 mm. an oblique band can be made out slanting downward and forward to eye, and in one of the former there is also a trace of the same below eye, but unlike *hippos*, this is only slightly less oblique than the part above. In the four from 42 to 50 mm. there is no opercular band or mark. One of 62 mm. has a slight dusky edging at the upper corner of the opercle and 4 bands only on the body, faintly indicated dorsad. The five specimens of from 42 to 62 mm. have the spinous dorsal more or less dusky darkest in front, and in all of these but one of 42 mm., the lobe of soft dorsal is more or less dusky.

On the other hand the American Museum has an excellent series of *Caranx bartholomaei* obtained some years ago by Russell J. Coles at Cape Lookout, N. C. The pattern of this species known to drift in the gulfweed distinguishes it at once off-hand from these others when they are too small to show the elevated front of vertical fins. Nine specimens have been examined from 38 to 70 mm. standard length. They are more bicolored, dark above and pale below, the line of demarcation cutting across the head below the eye, without definite dark cross-bands on the body, the nearest approach to same being dark interspaces between silvery blotches that some have on the flanks; and the ventrals are consistently dusky even in the smallest, instead of consistently pale. There is frequently a more or less distinct dark band from the nape downward and forward through the eye, which, however, is narrower than the similarly placed one in *hippos*, and maintains its general slanting direc-

tion below the eye instead of turning directly downward. The spinous dorsal is consistently blackish in all these specimens, even the largest. Scaling on the breast is appreciable in all but not very obvious in any. The concealing coloration of one 46 mm. long to notch of caudal (about 42 standard) when taken from drifting gulf-weed off the east coast of Florida, by the writer in 1917, was noted as "golden olive with irregular bars of silvery white along the back and belly and spots of the same on side; diffuse dusky bar through eye."

Presumably the differently patterned *hippos* and *latus* do not regularly occur in the weed, but follow bits of drift, or jelly-fish as a "hover," a habit frequently associated with banded color in small fishes.

I have seen no specimens of corresponding sizes of the more slender *Caranx crysos*. The technical character of more numerous gill-rakers should differentiate them at any size. *Caranx latus* seems to be a generalized intermediate in some respects, perhaps a parent form, between *hippos* and *crysos*, and is at times confused with this last; but it has about 16 gillrakers on the lower limb of the first arch, versus 25 or 30 in *crysos*.

II.—ON YOUNG *HEMICARANX AMBLYRHYNCHUS* (CUVIER AND VALENCIENNES)

Eight small specimens of *Hemicaranx* collected by L. L. Mowbray off Miami Beach, Fla., December 27, swimming under medusae were reported on in Copeia, 1922, No. 109, p. 59. They range from 22 to 58 mm. long to base of caudal and increase in depth with size, depth in length, 2.1 in the largest. These specimens have recently been reexamined. The two smallest 22 to 23 mm. long, have the characteristic large black opercular blotch present, and the rather high soft vertical fins dusky grayish, but the dark bands on the body, conspicuous at a larger size, only faintly indicated. Such changes of form and color with increasing size are probably correlated with entering a deep-bodied, banded, drifting life-phase.

There was later opportunity to compare a larger specimen 76 mm. long to base of caudal taken off Stono, S. C., August 12, 1931 (Charleston Museum, No. 31. 190. 11), still in this drifting phase for its depth was still 2.1. It had four faint dark cross-bands on the body and one above the conspicuous black opercular blotch, dorsals and ventrals more or less dusky grayish. Its pectoral was longer, 1.2 versus 1.5 in head, bluntly pointed versus rounded; the caudal well forked, its upper lobe appreciably the longer, instead of but moderately forked.

Recently three additional specimens from Charleston County, South Carolina, corroborating these age changes have been received from E. Milby Burton of the Charleston Museum, one of 73 mm. collected August 12, and two of 92 and 93 mm. to base of caudal, collected August 26, 1936. All have the large black opercular blotch present, and the smallest has four broad dark bands on the sides, wider than the interspaces. Traces of these bands are present in only one of the others, and they presumably fade out at about 80 mm. The pectoral is becoming longer and more falcate with increasing size, pointed and a little shorter than the head in the smaller, more or less falcate and a little longer than the head in the two larger. In the 73 mm. specimen the soft dorsal is high and even, in the 93 mm. specimen the fronts of soft dorsal and anal are slightly elevated. In the smaller specimen the caudal lobes are equal, in the two larger the upper lobe distinctly the longer.

Whereas the bands are developed and lost and the fin form is changing in sizes examined, the body retains its depth. Measurements of 73 and 76 mm. specimens are: depth in standard length, 2.2, 2.1; head, 3.5; eye in head, 3.7, 3.9; curve of lateral line in its straight part, 2.2, 2.4; height of curve in its length, 3; dorsal soft rays, 28, 29; anal, 26, 25; scutes, 49, 43. The 92 and 93 mm. specimens have depth, 2, 2.1; head, 3.7, 3.5; eye, 3.5, 3.6; curve lateral line in straight part, 2.5, 2.4; height of curve in its length, 3, 3.3; dorsal, 27, 28; anal, 26, 24 (est.); scutes, 52, 51. If as supposed *Caranx falcatus* Holbrook (1860, Ichth. S. C., Pl. XIII, fig. 2) is the adult of the same fish, the body later becomes somewhat more slender.

Hemicaranx marginatus Bleeker is closely allied to *H. amblyrhynchus* but seems to be slightly less deep, with slightly larger eye, fewer fin rays, and blacker fins. Two specimens of 79 and 82 mm. standard length examined from the mouth of the Congo have depth, 2.25, 2.4; eye, 3.4, 3.35; dorsal soft rays, 27, 25; anal, 22, 21. On the other hand *Hemicaranx rhomboides* Meek and Hildebrand (1925, 'Fishes of Panama,' Field Mus. Zool. Ser., XV, pt. 2, p. 345, Pl. XXV, fig. 2, Colon) is presumably young *H. amblyrhynchus*, the characters given to differentiate it being those of that fish when young.