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YOUNG CARANX IN THE WESTERN
NORTH ATLANTIC

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American Museum of Natural History

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YOUNG *CARANX* IN THE WESTERN NORTH ATLANTIC*

BY J. T. NICHOLS

American Museum of Natural History

Through the courtesy of Dr. A. E. Parr of the Peabody Museum, Yale University, I have recently had the privilege of studying young fishes of the genus *Caranx* in the Bingham Oceanographic Collection, obtained off shore in the western North Atlantic, 1927 to 1934. The five species characteristic of the West Indian fauna are represented as follows:

CARANX RUBER (BLOCH)

Of this species there is one specimen 25 mm. in standard length from the Caribbean south of Haiti in late March (Atlantis, 1933); one 23 mm. standard length, 5 of 28 to 48 mm., 2 of 52 and 62 mm., with 1 *bartholomaei* from the Windward Passage south of Guantanamo Bay, April 17 to 18 (Atlantis, 1933, surface); 5, 21½ to 25 mm. standard length, 33 of 26½ to 49 mm., 2 of 54 and 57 mm., with one small *bartholomaei*, Misteriosa Bank to Yucatan, April 11 (Atlantis, 1933). With this Caribbean series are 2, 21 and 35 mm. standard length, with 19 *bartholomaei* and one small *crysos* (Atlantis, 1934), presumably from 14° 42' N., 79° 18' W., Feb. 19, but place and date uncertain.

There are 32 specimens 14 to 26 mm. standard length, 1 of 34 mm., Havana to New York, May 10 to 15 (Mabel Taylor, 1932); 7 specimens 13 to 25 mm. standard length, 7 of 28 to 48 mm., with 33 *crysos*, from the mid-Gulf Stream, 38° 07' N., 68° 45' W. to 37° 12' N., 67° 39' W., August 21 to 22 (Atlantis, 1934).

DISTRIBUTION

Grown *Caranx ruber* are rather common about Cuba and Bermuda, plentiful in Haiti and the Bahamas, not plentiful about Porto Rico, occur in small numbers only in southern Florida, and are rare north of there on the mainland. Their preferred habitat seems to be islands and reefs.

The young are occasional but only occasional in the Carolinas (Natural History [N. Y.], 1935, XXVI, p. 268). I have recently examined one of 66 mm. standard length from sargassum off Charleston sent me by Mr. E. Milby Burton; but their habitat was unknown to me until they were found common in the Gulf Stream off Bimini in July, 1937, and a series from there of 34 measuring 17.5 to

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30 mm., and 9 from 31 to 43 mm. was examined (Copeia, 1937, no. 4, pp. 236-237). The Gulf Stream is obviously their Atlantic nursery ground. That they are not more frequent between it and the continent may be due to their entering mainly from its easterly edge, or perhaps they frequent the current rather than slack waters at the edges until large enough to migrate independently, when they must of necessity strike southward or be lost.

In the Caribbean young *Caranx ruber* are evidently more advanced at an earlier date. They are abundant between Cuba and Yucatan, and perhaps more generally distributed than in the Atlantic. It is suggested that high water temperatures may determine the distribution of young of this species.

DESCRIPTIVE NOTES

From this extensive series we have change of proportions of young as follows. Fifteen specimens of 13 to 19 mm. standard length have depth in same 2 to 2.2 (average 2.05); 32 of 20 to 26 mm., 2 to 2.4 (average 2.18); 11 of 26½ to 30 mm., 2.2 to 2.5 (average 2.35); 20 of 32 to 39 mm., 2.4 to 2.6½ (average 2.49); 16 of 41 to 49 mm., 2.5 to 2.9 (average 2.59); 4 of 52 to 62 mm., 2.7 to 2.9 (average 2.77½). These measurements show a somewhat greater depth than those of a smaller series taken in the Gulf Stream in 1937 (Copeia, 1937, l. c.). There is variation at the size at which depth begins to fall off noticeably in *C. ruber*. Although for the most part less deep than young *bartholomaei* at any size, material of this last to hand shows some overlap at lengths from 20 to 30 mm. The smallest *bartholomaei* with depth in length as much as 2 is 20 mm., the largest *ruber* with depth in length as little, 21½ mm. An exceptional *bartholomaei* has depth as much as 2.3 at 29 mm., the largest *ruber* with depth as little as 2.3 is 30 mm. Presumably the depth of both species falls off irregularly at about this critical size, a tendency which soon fades in the deep-bodied *bartholomaei*, and accelerates in the slender *ruber*.

The pectoral of these Atlantic young *ruber* is noticeably more lengthened at corresponding small sizes before it definitely begins to elongate, than that of the Caribbean young. Thus in 39 Atlantic specimens from 13 to 26 mm. standard length, pectoral in head measures 1.4 to 1.8 (average 1.55); in 5 of 28 to 36 mm., 1.5 to 1.6 (average 1.54); in 3 of 43 to 48 mm., 1.4 to 1.5 (average 1.43). In 8 Caribbean specimens of 21 to 25 mm. it measures 1.5 to 1.8 (average 1.62½); in 26 of 26½ to 39 mm., 1.5 to 1.8 (average 1.63); in 17 of 41 to 62 mm., 1.3½ to 1.5 (average 1.45). This is not a geographic difference between Atlantic and Caribbean young, however, seen by comparing the same measurement in 39 specimens from the Gulf Stream off Bimini taken in 1937. In 22 of 17½ to 25 mm. it is 1.5 to 2.2 (average 1.72); in 16 of 27 to 35 mm., 1.5 to 2 (average 1.69); in one of 43 mm., 1.4. The series seem too large for these differences to be mere matters of chance, and they are presumably inherent in different lots of fishes, or induced by different environmental conditions.

The material is mostly too faded to show more than traces of the color pattern which is never bold in small *C. ruber*. The spinous dorsal is no more than gray where it tends to be blackish in *bartholomaei*, the ventrals pale instead of frequently dusky. Indistinct narrow pale cross streaks are occasionally present, and an exceptional specimen of 23 mm. has 6 distinct though faint narrow dark crossbands slightly wider than pale interspaces, from the front of the spinous dorsal to the last quarter of the soft dorsal, about one more than *bartholomaei* when similarly banded. Traces of the diagnostic dark stripe on the lower caudal lobe are usually present in the larger specimens (45 mm. and over), if only as an appreciable smudge diagonally across the peduncle,—and may occasionally be seen in specimens down to 29 mm. There are specimens of 20 to 30 mm., only to be differentiated from *C. bartholomaei* by more numerous gill-rakers on the lower limb of the first arch, upwards of 25 may be counted versus never more than 20.

CARANX BARTHOLOMAEI CUVIER AND VALENCIENNES

There are specimens of this species taken at various scattered dates and localities mostly in the Caribbean, but the only considerable number, 19 specimens, 6 of 17 to 23 mm. standard length, 9 of 29 to 44 mm., with 2 *ruber* and one small *crysos* (Atlantis, 1934) are presumably from 14° 42' N., 79° 18' W., Feb. 19, but place and date uncertain; 3 of 27 to 30 mm. are from 13° 33' N., 80° 40' W. to 15° 47' N., 78° 48' W., Feb. 18 to 20 (Atlantis, 1934, surface light at night). One specimen of 16 mm. is from 22° 12' 55" N., 74° 19' W., March 31 (Pawnee, 1927, 4000 ft. wire); 2 of 22 and 26 mm. from 26° 25' N., 69° 07' W. to 21° 05' N., 71° 25.5' W., Jan. 26 to 28 (Atlantis, 1934); 1 of 20 mm., with 40 *ruber*, from Misteriosa Bank to Yucatan, April 11 (Atlantis, 1933); 1 of 51 mm., with 8 *ruber*, from Windward Passage south of Guantanamo Bay, April 17 to 18 (Atlantis, 1933, surface); 1 of 25 mm., Caribbean, Feb. 2 (Atlantis, 1934); 1 of 20 mm., Caribbean off Panama, mid-Feb. (Atlantis, 1934); and one other of 41 mm., Caribbean (Atlantis, 1934).

DISTRIBUTION

Grown *Caranx bartholomaei* are rather common about Cuba and Bermuda, occur but in small numbers in southern Florida and are rare further north on our coast, though the species is reported in late summer and fall at Woods Hole, Mass. They are plentiful in the Bahamas and in Haiti, rather uncommon in Porto Rico.

When young this species is an inhabitant of drifting gulf weed. It has been found with weed in southern Florida, in the eastern edge of the Gulf Stream off Bimini, Bahamas, and is abundant with the weed in summer at Cape Lookout, North Carolina, apparently rare on the coast north of the Carolinas.

The significant thing about the species in this collection of young fishes is its

small numbers almost everywhere, and its absence in the Gulf Stream. Presumably its nursery grounds are rather among stagnant weed, at or beyond the edge of the current. Though it might be assumed, as in the case of *ruber*, to enter the stream mostly on the east side, it is abundant on the west side as has been mentioned (Cape Lookout).

DESCRIPTIVE NOTES

For comparison with *Caranx ruber*, we have change of proportion of young as follows. Three specimens 16 to 19 mm. in standard length have depth 1.7 to 1.9 (average 1.80); 9 of 20 to 26 mm., $1.8\frac{1}{2}$ to 2.1 (average 1.95); 5 of 27 to 30 mm., 2 to 2.3 (average 2.13); 6 of 31 to 40 mm., 2 to 2.2 (average 2.10); 2 of 41 and 44 mm., 2.1 and 2.2 (average 2.15); and one of 51 mm., 2.1.

The color pattern of these specimens is badly faded. One of 20 mm. standard length has dark cross-bands unusually well developed. It has 5 dark bands completely across the body, broader than the interspaces above, averaging equal to them below, and a slanting dark mark behind the eye; spinous dorsal and ventrals more or less dusky. The dark bands are less bold than in *hippos*. Various specimens have more or less dusky ventrals, particularly larger ones, though one of 16 mm. shows this character which distinguishes young *bartholomaei* from young *ruber*. It is probably not constant for *bartholomaei*, however, even in fresh material. Three or 4 show the slanting dark mark between nape and eye which is more characteristic of this species than of *ruber*. Eleven of the 26 specimens, ranging from 17 to 44 mm. standard length, show large indistinct pale spots or blotches irregularly covering the body (Amer. Mus. Novitates, 1937, No. 967, pp. 4-5). This pattern seems to be diagnostic of *bartholomaei*, a concealment adaptation to sargassum, and that nine of the series of 15 show it leads me to suppose that this series was taken in weed, though not specifically so labelled.

CARANX CRYOS (MITCHILL)

There is 1 specimen 18 mm. in standard length with 19 *bartholomaei* and 2 *ruber* (Atlantis, 1934), presumably from $14^{\circ} 42' N.$, $79^{\circ} 18' W.$, Feb. 19, but place and date uncertain; 20 of 13 to 25 mm., 12 of 28 to 43 mm., 1 of 72 mm., with 14 *ruber*, from $38^{\circ} 07' N.$, $68^{\circ} 45' W.$ to $37^{\circ} 12' N.$, $67^{\circ} 39' W.$, August 21 to 22 (Atlantis, 1934); 16 specimens, 10 of 12 to 26 mm., 4 of 28 to 48 mm., with 2 small *sexfasciatus*, from $36^{\circ} 48' N.$, $68^{\circ} 55' W.$ to $38^{\circ} 59' N.$, $69^{\circ} 46' W.$, August 27 to 28 (Atlantis, 1934, in sargassum).

DISTRIBUTION

Grown *Caranx crysos* are plentiful in the Bahamas, from southern Florida to North Carolina, and occur northward to Cape Cod in summer. They are apparently also plentiful on the South American coast, less plentiful though generally distributed in the West Indies, Atlantic shore of the Isthmus, about

Cuba, Haiti, Porto Rico, uncommon at Bermuda. The identical species occurs in West Africa from where I have examined a specimen.

Young (50 mm. or less in length) are surprisingly rare. The only specimen I have previously had to examine (22 mm. long) was taken among weed in the Gulf Stream off Bimini in July with numerous *C. ruber* (Amer. Mus. Novitates, 1938, No. 1014, p. 1, fig. 1). It is then of much interest to obtain this series in late August from further northeast in the Stream, which is evidently a nursery ground for the species, very likely the important nursery ground for it in the western Atlantic. The majority are of such a small size at this point that they must be drifted far to the east before they reach a stage to navigate independently of currents, and so far as we know this is a littoral rather than pelagic fish when grown. An hypothesis that there is regular interchange between the continents of America and Africa, eastward in the north and westward in the south, should be investigated.

It may be more than coincidence that *crysos* and *ruber*, our two species with young most confined to the Stream, grow into the slenderest, swiftest, and presumably individually widest ranging. If it is temperature that holds the young of *crysos* in the Stream, as has been suggested for *ruber*, they must be more sensitive to it than grown fish, for grown *crysos* enters temperate waters more freely than any other except *hippos*. If there is a food habit factor of which gill-rakers may be a criterion, those of *ruber* are the finest and most numerous, but *crysos*, though more related to *sexfasciatus* and *hippos*, with few gill-rakers, has the next most numerous, more than *bartholomaei* which is closely related to *ruber*.

DESCRIPTIVE NOTES

Proportional changes with growth in *Caranx crysos* over 100 mm. standard length have recently been published (Amer. Mus. Novitates, 1938, No. 1014, pp. 2-3), and one can now complete them, for smaller sizes. Fourteen specimens 12 to 19 mm. in standard length have depth in same 2 to 2.2 (average 2.08); head, 2.4 to 3 (2.69); eye in head, 2.5 to 3 (2.67); pectoral 1.4 to 1.8 (1.59); curve lateral line (chord) in straight part, 1.5 to 1.6 (1.57). Sixteen specimens of 20 to 26 mm. have depth 2.2 to 2.6 (average 2.38); head, 2.7 to 3.2 (2.96); eye, 2.7 to 3 (2.96); pectoral, 1.4 to 1.6 (1.46); curve lateral line in straight part, 1.5 to 1.8 (1.62); about 30 to 34 (average 31.1) scutes may be counted. Five specimens of 28 to 30 mm. have depth 2.5 to 2.7 (average 2.56); head, 3 to 3.2 (3.04); eye 3 to 3.3 (3.06); pectoral, 1.5 (1.5); curve lat. line in straight part, 1.6 to 1.8 (1.72); 32 to 38 (35.2½) scutes may be counted. Eight specimens of 31 to 40 mm. have depth 2.6 to 3 (average 2.76); head, 3 to 3.4 (3.17½); eye, 3 to 3.5 (3.29); pectoral, 1.3 to 1.5 (1.45); curve lat. line in straight part, 1.6 to 1.8 (1.65); 33 to 38 (36.1) scutes may be counted. Three specimens of 42 to 48 mm. have depth 2.7 to 2.8 (2.77); head 3.2 to 3.3 (3.27); eye, 3.3 to 3.5 (3.43); pectoral 1.4 (1.4); curve lat. line in straight part, 1.6½ to 1.7½ (1.70); 30 to 41

(34.7) scutes may be counted. The one larger specimen of 72 mm. has depth, 3; head, 3.4; eye, 3.5; pectoral, $1.2\frac{1}{2}$; curve of lat. line in straight part, 1.7; scutes, 47. Of almost exactly the same depth below 20 mm., and at larger sizes, their depth falls off more rapidly than that of *ruber* and they are more slender than that species between 30 and 40 mm.

Small young of *Caranx crysos*, down to the smallest sizes in this series, may be recognized by the character of the pigment spots on the body, some of which are larger and more conspicuous than in other members of the genus at comparable sizes (Amer. Mus. Novitates, 1938, No. 1014, fig. 1). Some of the specimens are paler, some darker, but aside from these punctulations few show traces remaining of any pattern; one of 18 mm. has 6 dark bands on the sides separated by narrower interspaces; two or three of from 20 to 26 mm. have about 7 or 8 faint dark crossbands on the body; and one of 48 mm. a dark edge to the corner of the gill-cover. The relatively long straight part of the lateral line will differentiate *crysos*, except from *sexfasciatus*, which is deeper with bolder cross-bands. Other species have punctulations not differing in kind from those of *crysos* but usually less heavy, less variable in size (none so large), and less conspicuous.

CARANX SEXFASCIATUS QUOY AND GAIMARD

There is one specimen 25 mm. in standard length from $21^{\circ} 43' 20''$ N., $72^{\circ} 39' 15''$ W., April 7 (Pawnee, 1927, 500 to 1000 ft. wire); 2 specimens of 12 and 15 mm., with 16 *crysos*, from $36^{\circ} 48' N.$, $68^{\circ} 55' W.$ to $38^{\circ} 59' N.$, $69^{\circ} 46' W.$, August 27 to 28 (Atlantis, 1934, in sargassum).

DISTRIBUTION

This is a circumtropical species in warm seas, with several poorly defined races. These specimens presumably belong to the West Indian race, *Caranx sexfasciatus fallax* Cuvier and Valenciennes, but another occurs on the coast of Brazil (Rio de Janeiro, Amer. Mus. Novitates, 1938, No. 998, p. 2).

Grown *Caranx sexfasciatus fallax* occur, but in small numbers, from southern Florida to North Carolina, and are rare or absent further north. They are plentiful in the Bahamas and in Haiti, common about Cuba, and the most abundant member of the genus in Porto Rico and Bermuda.

I have examined a few scattered young of 40 to 50 mm. standard length from North and South Carolina and Havana, of less than 70 mm. from Porto Rico, but have no knowledge of where they are common, or what their proper habitat may be. These three specimens are the smallest I have seen.

DESCRIPTIVE NOTES

For comparison with somewhat larger specimens (Amer. Mus. Novitates, 1937, No. 967, pp. 3-4) the two 12 and 15 mm. in standard length have depth,

1.6 to 1.9 (average 1.75); head, about 2.6; eye, about 2.5; pectoral, 1.5 to 1.6 (average 1.55); curve of lateral line in straight part, $1.3\frac{1}{2}$ to 1.4 (average $1.37\frac{1}{2}$). The 25 mm. specimen has depth, 1.9; head, 2.7; eye, 3.1; pectoral, 1.5; curve of lateral line in straight part, $1.5\frac{1}{2}$; and about 21 scutes may be counted. The three have 4 to 5 broad dark cross bands on the body, the larger specimen a less distinct slanting dark band from nape to eye, and the spinous dorsal largely blackish.

CARANX HIPPOS (LINNAEUS)

There is only one specimen of this species, 13 mm. in standard length, Feb. 15 (Atlantis, 1934).

DISTRIBUTION

Grown fish are plentiful along shore from southern Florida to the Carolinas, and the most common species in summer north to Cape Cod, small sizes entering estuaries rather freely. They are common about Cuba, fairly common about Haiti, not common about Porto Rico and in the Bahamas, apparently unknown at Bermuda. Specimens from Brazil and West Africa seem to be racially differentiable from those of the United States and West Indies.

Young are rather common occurring scatteringly near shore from Florida to South Carolina, and northward to Cape Cod in late summer and fall. We have one from gulf-weed off Bimini, and they doubtless not infrequently occur in weed, though under jellyfish is probably a more usual hover for them. They become free swimming in shallow water at a small size. The practical absence of young *hippos* in this collection confirms their littoral rather than off-shore habitat.

DESCRIPTIVE NOTES

As the one specimen is somewhat smaller than those previously reported on (Amer. Mus. Novitates, 1937, No. 967, pp. 1-3), its proportional measurements are given. Standard length, 13 mm.; depth in this length, $1.6\frac{1}{2}$; head, 2.8; eye in head, 3; pectoral, 1.6; curve of lateral line (chord), in straight part, 1. Five broad dark bands crossing upper part of body, somewhat broader than the interspaces, another to the upper angle of the opercle, and a slanting band from nape to eye; spinous dorsal mostly blackish.

SUMMARY AND CONCLUSIONS

(1) The Gulf Stream is confirmed as a nursery ground for *Caranx ruber*, from May to August. In April young of this species averaging a little more advanced, are also found in the Windward Passage south of Guantanamo Bay, and plentifully in the Caribbean between Misteriosa Bank and Yucatan.

(2) Study of the considerable series of young *Caranx ruber* shows that this species is appreciably though but little more slender than *C. bartholomaei* at the

smaller sizes, with a slight overlap in depth between the critical lengths of 20 and 30 mm. standard, presumably due to variation in each, of the size at which depth falls off.

(3) The absence of young *Caranx bartholomaei*, most specialized for drifting in gulf-weed, from Gulf Stream localities, is evidence that its nursery grounds are not in the current but in comparatively dead water at or beyond the edges of same.

(4) A nursery ground for *Caranx crysos* for which none was previously known, is discovered in the Gulf Stream between latitudes 37° 12' and 38° 59' N., longitudes 67° 39' and 69° 46' W., in late August.

(5) The presence of young *Caranx crysos* so far to the northeast at a small average size suggests the possibility that this species may drift to the west coast of Africa where it also occurs. The rarity of young *C. crysos* and *C. ruber*, with nursery grounds in the Gulf Stream, along the coast of the United States, is discussed but not explained.

(6) This first good series of young *Caranx crysos* of less than 50 mm. standard length to be studied, confirms the character of pigment spots, of which some are scatteringly large and conspicuous, as one to distinguish this species from its relatives at small sizes. Another good character is the relatively long straight part of the lateral line. The depth of *Caranx crysos* is the same as that of *Caranx ruber* at less than 20 mm., but then falls off more rapidly and it is a somewhat slenderer fish at between 30 and 40 mm.

(7) The few specimens of *Caranx sexfasciatus* add nothing to our scant knowledge of the habits and habitat of its young; and that but a single specimen represents *Caranx hippos* confirms its nursery grounds to be inshore rather than off-shore. The somewhat smaller size of these specimens of the two than of those previously examined, makes them of some interest.

(8) Young caranxes of from 15 to 40 mm. in standard length, look quite unlike the adults, and their specific characters of fin-rays, gill-rakers, scales, can frequently not be determined with precision, or without difficulty. The following key which can now be drawn up for the five under discussion, will give an idea of their resemblances and differences, and be helpful in distinguishing them or identifying any individual.

KEY TO YOUNG CARANX OF WEST INDIAN REGION

- 1 Deeper, depth in standard length less than 2.0 see 2
 Moderately deep, depth in standard length 2.0 to 2.6 see 5
 More slender, depth in standard length, 2.7 or more see 4
- 2 Body usually without bands, curve of lateral line about equal to straight part; dorsal soft rays, 24 to 28; anal, 22 to 25; ventrals often dusky and sometimes pale blotches on the body *bartholomaei*
 Body with about 5 dark cross-bands. Dorsal soft rays, 18 to 21; anal, 16 to 18. Ventrals not dusky, and never pale blotches on the body see 3
- 3 Curve of lateral line in straight part, 1 to 1.3 *hippos*
 Curve of lateral line in straight part, 1.3½ to 1.6 *sexfasciatus*
- 4 Curve of lateral line in straight part, 1 to 1.3 *ruber*
 Curve of lateral line in straight part, 1.5 to 1.8 *crysos*
- 5 Curve of lateral line in straight part, 1.5 to 1.8; about 30 to 40 scutes may be counted at 20 to 40 mm.; body usually without bands, when these are present they are more than 5 and usually indistinct, pigment spots relatively conspicuous, some relatively large and scattered; depth in length 2.4 and upwards at 25 mm. and upwards *crysos*
 Curve of lateral line in straight part, 1.35 to 1.6; about 20 to 30 scutes may be counted at 20 to 40 mm.; body with about 5 distinct dark bands; depth 2 (or less) to 2.5 between 25 and 40 mm. *sexfasciatus*
 Curve of lateral line in straight part, 1.3 or less see 6
- 6 Body with about 5 (usually bold) dark crossbands; dorsal soft rays, 18 to 21; anal, 16 to 18; ventrals not dusky, and never pale blotches on the body *hippos*
 Body without or with indistinct crossbands, dorsal soft rays, 24 to 28; anal, 22 to 25 see 7
- 7 Depth in length, not more than 2.3, 2.1 or less at under 26 mm.; not more than 20 gill rakers on the lower limb of the first arch; ventrals frequently dusky, and sometimes pale blotches on the body *bartholomaei*
 Depth in length, upwards of 2.4 at over 30 mm.; upwards of 25 gill-rakers on the lower limb of the first arch; ventrals rarely slightly dusky, never pale blotches on the body *ruber*