

REDESCRIPTION AND SYNONYMY OF THE WESTERN ATLANTIC DAMSELFISH *CHROMIS FLAVICAUDA* (GÜNTHER)

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ABSTRACT

The pomacentrid fish *Heliastes flavicauda* Günther is recognized as a senior synonym of *Chromis bermudae* Nichols, and distinct from *C. enchrysurus* Jordan and Gilbert. *Chromis flavicauda* is redescribed based on recently collected material from Bermuda and compared with the holotype, the only known specimen from Brazil. *C. flavicauda* is characterized by a distinctive color pattern consisting of: caudal and pelvic fins, and distal half to four-fifths of dorsal and anal fins brilliant yellow; at least posterior half of caudal peduncle yellow, remainder of body mostly blue; large black spot covering entire base and axil of pectoral fin. All western Atlantic species of *Chromis* are contrasted in a key.

Since the original description of *Heliastes flavicauda* Günther, 1880, from Brazil, there have been few references to the species and its taxonomic status has remained obscure. In his paper describing *Chromis scotti*, Emery (1968) gave a table comparing the four western Atlantic members of the nominal subgenus *Heliastes*, although acknowledging (p. 55) that the status of *Chromis flavicauda* and *C. enchrysurus* Jordan and Gilbert was uncertain. *Chromis bermudae* Nichols [= *C. flavicauda*] was not mentioned in Emery's paper. The specimens that he examined and identified as *C. flavicauda* were in reality representatives of the southern (Brazilian) population of *C. enchrysurus*, which differs somewhat from the Florida specimens with which they were compared. Geographic variation in *C. enchrysurus* will be treated in a separate paper.

Recent collections and observations of damselfishes made in Bermuda during an expedition of the Academy of Natural Sciences of Philadelphia have revealed the presence of five of the six known western Atlantic species of *Chromis*. The occurrence of the sixth species, *C. multilineata* (Guichenot), at Bermuda is confirmed on the basis of two historical museum specimens subsequently examined by the senior author. One of the *Chromis* photographed and collected at Bermuda was a strikingly beautiful species (Fig. 1) that could not be readily identified. Perusal of the literature on Bermuda fishes soon revealed that Nichols (1920) had named the species *C. bermudae*, based on specimens sent to him by Mr. Louis L. Mowbray. The original description of *Heliastes flavicauda* was sufficiently similar to that of *C. bermudae*, especially the appropriateness of the trival name, that a request was made to the British Museum to borrow the holotype. Direct comparison of the holotype with the recently collected Bermuda specimens leads us to recognize *C. flavicauda* (Günther) as a senior synonym of *C. bermudae* Nichols. A redescription of *C. flavicauda* is given below. The common name yellowfin chromis is suggested for this species. The use of the feminine gender for the genus *Chromis* is based on Emery (1975).

All measurements were made with dial calipers. In the description, counts are those of the holotype, followed in parentheses by those of the Bermuda specimens where differences exist. Caudal-fin lobe measurements are of the longest rays in each lobe, including any filamentous extensions; caudal concavity is the difference in measurement between longest and shortest caudal rays expressed as percentage of standard length; body depth is taken at the origin of the pelvic fins; inter-

orbital width is taken at the narrowest point between the eyes; caudal peduncle depth is the shallowest measurement on the peduncle; spines are measured from their base, even if the base is covered by scales; body width is measured at the widest point exclusive of an expanded belly; bony eye diameter is measured in an anterioposterior direction (vertical measurement will give a smaller diameter). The last two elements in the dorsal and anal fins have their bases closely approximated, share a common pterygiophore, and were counted as a single ray.

The following abbreviations are used for institutional depositories: AMNH—American Museum of Natural History, New York; ANSP—Academy of Natural Sciences of Philadelphia; BMNH—British Museum (Natural History).

Chromis flavicauda (Günther)
yellowfin chromis
Figures 1–3, 4c; Table 1

Heliastes flavicauda Günther, 1880: 7, pl. 30, fig. D (original description; coast of Pernambuco, "Challenger" sta. 122).—Fowler, 1941: 172 (listed).

Chromis flavicauda (Günther).—Jordan and Gilbert, 1882: 286 (allied to new species *Chromis enchrysur*).

Chromis flavicauda (non Günther) [misidentification = *C. enchrysur*].—Bullis and Thompson, 1965: 55 (reported from several Caribbean localities).—Emery, 1968 (description, comparison, photograph).—Emery, 1973: 656 (status uncertain, distribution).—Thresher, 1975: 26–27 (status uncertain, extremely similar to *C. enchrysur*).—Smith, 1976: 64 (West Indian counterpart of *C. enchrysur*).

Chromis bermudae Nichols, 1920: 60 (original description; Bermuda, allied to *C. enchrysur*).—Collette, 1962: 442 (listed as a synonym of *C. enchrysur*).

Heliastes bermudae (Nichols).—Beebe and Tee-Van, 1933: 188 (description, known only from type).

Diagnosis.—A species of *Chromis* with the following combination of characters: dorsal-fin spines XIII; anal-fin rays 11; body depth 37–48% SL; caudal and pelvic fins, and distal half to four-fifths of dorsal and anal fins brilliant yellow; at least posterior half of caudal peduncle yellow, remainder of body mostly blue; large black spot covering entire base and axil of pectoral fin.

Description.—Dorsal fin XIII, 11 (11 or 12); anal fin II, 11; pectoral fin 18; pelvic fin I, 5; gill rakers on first arch 8 + 1 + 18 (6–8 + 1 + 17–20 = 24–28); tubed lateral-line scales 15 (15–18, usually 17); vertical scale rows from upper edge of gill opening (25–27); horizontal scale rows from base of dorsal fin to middle of lateral line (exclusive of dorsal base sheath scales) 2½; from lateral line to anal fin origin 9; teeth conical, multiserial, (21–29, usually 26–28) in outer row of upper jaw and (19–26, usually 21–23) in outer row of lower jaw.

The following proportional measurements are in standard length unless otherwise stated: body moderately elongate, depth 2.1–2.7, and compressed, width 2.1–2.8 in depth; head length 2.9–3.5; predorsal length 2.3–2.9; prepelvic length 2.1–3.0; preanal length 1.4–1.8; caudal fin 2.7–4.0; caudal concavity 8.3–13.1; pectoral fin 3.2–4.2; pelvic fin 2.9–4.2. The following measurements are in head length: snout length 3.4–5.1; eye diameter 2.3–3.0; interorbital width 2.8–3.6; caudal peduncle depth 1.9–2.6; first dorsal spine 3.3–5.9; fourth dorsal spine 1.7–2.6; first dorsal spine into fourth spine 1.7–2.8; ultimate dorsal spine 2.1–4.2; longest dorsal ray 1.4–1.9; first anal spine 3.6–5.8; second anal spine 1.6–2.2; first anal spine into second spine 2.1–3.2; longest anal ray 1.4–1.9; anal-fin base into dorsal-fin base 2.3–3.0.

Single nasal opening on each side of snout; mouth terminal, oblique, small, the maxilla reaching slightly beyond a vertical at anterior edge of eye; head smoothly rounded with convex, steeply sloping forehead (Fig. 4c); opercle with a single,

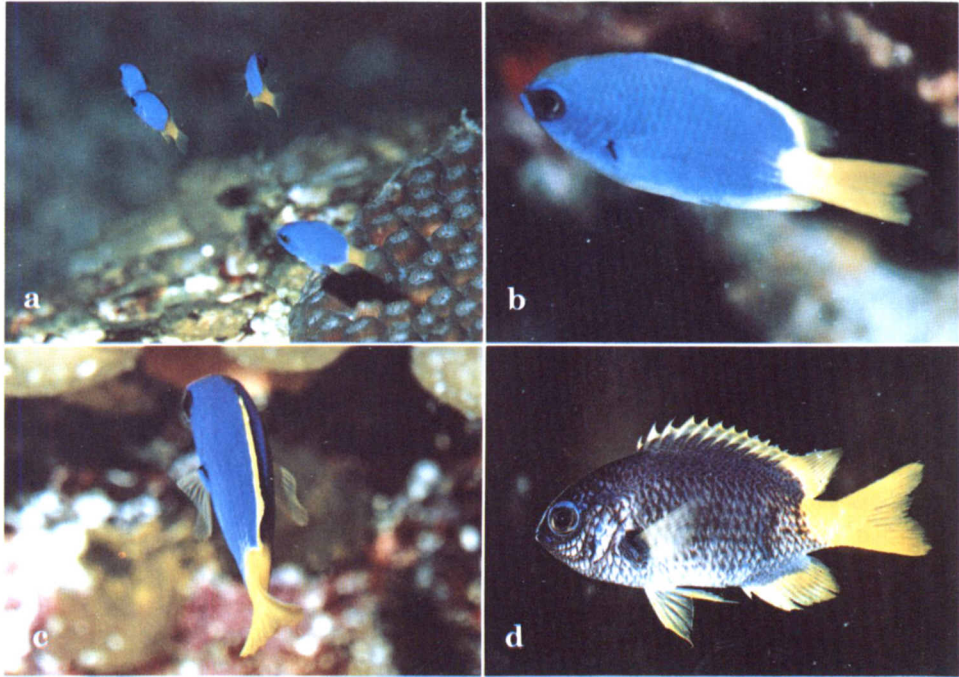


Figure 1. *Chromis flavicauda*: juveniles (a) and adults (b-c) photographed in Bermuda at ca. 55 m depth by P. L. Colin; (d) stress and immediate postmortem coloration in adult (photograph by W. F. Smith-Vaniz).

large posteriodorsally positioned spine; preopercle smooth except at ventral angle where it is rough to slightly serrate; preorbital (lacrymal), second and third suborbital bones reflexed from the cheek; ventral margins of these bones smoothly concave from the snout to posterior edge of lips, where convex angle occurs; remainder of suborbital bones adnate to cheek and covered with scales; approximately 4–5 slightly vertically elongate suborbital scales anterior to angle of jaw; cheek with 3 major scale rows and 2–4 accessory scales below suborbital bones; scales absent in area between the nostrils and upper lip and just posterior to lower lip; large, strongly ctenoid scales present on remainder of body, and extending onto basal half of two-thirds of dorsal, anal and caudal fins; pectoral fin scaled only basally; pelvic fin naked except for a large axillary scale and two enlarged interpelvic scales; pelvic fin with a membranous connection, hidden by axillary scale and extension of the enlarged interpelvic scales, from belly and extending 5–10% of the length of the innermost ray. Caudal fin moderately forked, upper lobe longer than lower lobe, each lobe sometimes with a filamentous extension; three short, procurrent spines precede caudal rays of both lobes.

Life color of undisturbed Bermuda adults: caudal and pelvic fins, and distal half to four-fifths of dorsal and anal fins brilliant yellow; at least posterior half of caudal peduncle yellow, remainder of body mostly blue, paler ventrally; interorbital and nape sometimes green; bright electric blue line extends from a V-shaped origin on snout to posteriodorsal margin of eye; iris brown; large black spot covering base and axil of pectoral fin. Immediate postmortem coloration and color of recently captured individuals brought to the surface is similar to the

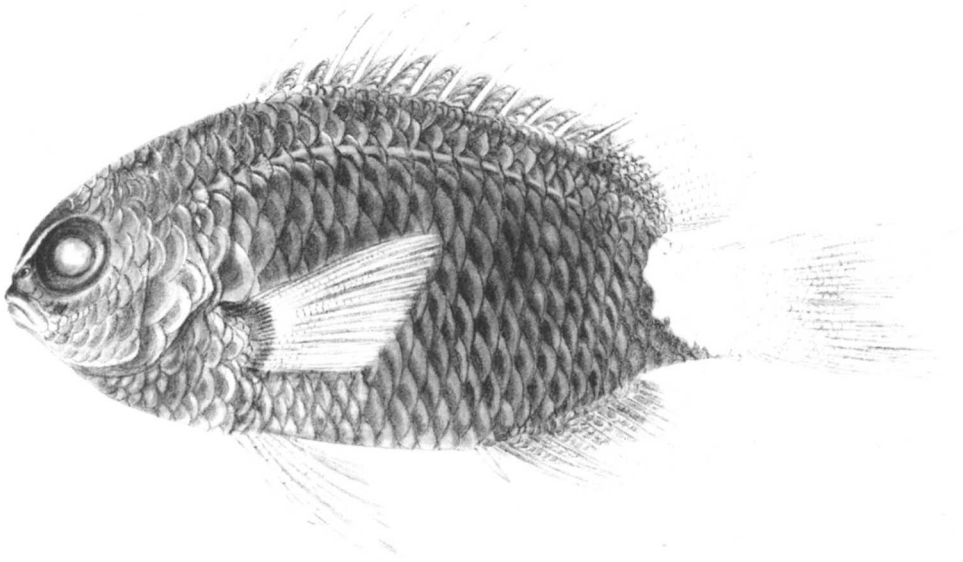


Figure 2. *Chromis flavicauda*, ANSP 133933; 59.5 mm SL, Bermuda (drawn by Mary H. Fuges).

above except the body is purple instead of blue. In the original description, the color of the Brazilian holotype was recorded as "sky-blue (in spirits) with purple reflexions; abdomen purplish; end of the tail and caudal fin yellow; a deep black spot superiorly on the axil of the pectoral." It should be noted that the original drawing of *C. flavicauda* is inaccurate in depicting the dorsal and anal fins and caudal peduncle as uniformly dark. The pigmentation of the caudal peduncle ("tail") also contradicts the original description—see above.

The coloration of juveniles is essentially identical to that of the adults. In alcohol, the blue areas of the body and fins are brown and, except for the black pectoral spot, the fins are otherwise pale or transparent.

Remarks.—Only the holotype was available to compare the Brazilian population of *Chromis flavicauda* with the 29 Bermuda specimens. Given this constraint, only a few differences appear to exist between these two geographically widely separated populations. The holotype has 15 tubed lateral-line scales, while the Bermuda specimens have either 17 or 18 lateral-line scales except for one specimen which has 15 scales on one side only. Finally, in the holotype the pale area of the caudal peduncle is more restricted (Fig. 3a) and the black pigment on the pectoral-fin base is more reduced ventrally (although the axil coloration is virtually identical to that of the Bermuda specimens). These differences are not unexpected in such widely separated populations, and similar geographical variation in morphology and coloration has been observed in *Chromis enchrysurus*. None of the morphometric characters of *C. flavicauda* listed in Table 1 was found to be significantly different ($P = > .05$) when compared using a modified "t" test to assess the probability that a single sample is drawn from a general population.

Although several authors have stated that *Chromis flavicauda* and *C. enchrysurus* are closely allied species, we doubt that they are each others' nearest relatives. In Bermuda, where both species occur sympatrically, adults of *Chromis*

Table 1. Summary of morphometric data for Brazilian holotype and Bermuda specimens of *Chromis flavicauda* (expressed as a percentage of standard length)

Holotype	Character	Range	N	\bar{x}
59.4	Standard length (mm)	35.1–68.5	24	
46.5	Depth (pelvic-fin origin)	37.1–48.2	24	44.68
—	Body width	15.8–21.1	22	18.21
33.2	Head length	26.0–34.6	24	32.23
8.3	Snout length	6.0–9.3	24	7.95
12.0	Eye diameter	10.3–14.0	24	12.25
9.8	Interorbital width	9.4–11.0	24	10.35
14.8	Caudal-peduncle depth	11.7–15.4	24	13.89
42.9	Pre-dorsal length	34.3–42.8	24	39.95
72.4	Pre-anal length	55.5–74.0	24	68.38
43.4	Pre-pelvic length	33.8–48.0	24	42.10
24.1	Anal base length	18.2–25.1	24	22.47
59.7	Dorsal base length	48.5–62.4	24	55.94
8.3	1st dorsal spine length	5.1–9.0	24	7.04
18.5	4th dorsal spine length	10.9–18.2	24	15.02
14.3	12th dorsal spine length	8.7–15.1	24	11.87
14.3	Ultimate dorsal spine length	7.6–15.0	24	11.22
—	Longest dorsal-fin ray	15.0–23.0	24	19.77
7.2	1st anal spine length	4.5–8.7	24	6.67
18.9	2nd anal spine length	15.0–19.5	24	17.29
—	Longest anal-fin ray	14.3–24.6	23	19.35
—	Longest caudal-fin ray	22.0–36.5	22	30.29
21.0	Shortest caudal-fin ray	17.1–25.3	23	22.10
—	Caudal concavity	7.6–12.0	16	9.92
—	Pectoral fin length	24.1–30.8	24	28.09
18.5	Pelvic spine length	14.4–19.8	24	17.96
23.6	Pelvic fin length	22.8–34.4	24	29.15

enchrysur have noticeably deeper, more robust bodies and are mostly gray, strongly countershaded, with dusky or gray fins devoid of any trace of yellow.

Distribution and ecology.—*Chromis flavicauda* is locally abundant at Bermuda where it has been observed and collected at depths of 52–61 m. It was found on level bottoms, usually covered with coralline algae rhodoliths, and occurred closer to the substrate than did individuals of *C. enchrysur* and *C. insolata* (Cuvier) observed in the same areas. The Brazilian holotype was reported (Tizard et al., 1885: 215) to have been collected 23 miles offshore in 55 m over rough bottom.

The occurrence of level bottom, rocky substrates at depths of approximately 50 m is limited in the Caribbean, but extensive observations (P. L. Colin, pers. comm.) of such habitats on banks off Grand Cayman Island and northwest Puerto Rico failed to establish the presence of *C. flavicauda*. Examination of thousands of photographs taken by the Harbor Branch Foundation's Link submersibles off Florida at the estimated proper depths, revealed the presence of *C. enchrysur* but no *C. flavicauda* in the area. Observations by other scientists in submersibles and numerous deep-water collections elsewhere in the Caribbean have also failed to record this distinctive species.

We have no explanation for the disjunct distribution of *C. flavicauda*, if it actually exists, but note that it appears unlikely that present ocean isotherms in the region could account for such a distribution. We predict that subsequent collections will show *C. flavicauda* to have a more northern distribution in South America. Collette and Rützler (1977) have shown that the large volume of silt-laden freshwater produced by the Orinoco River in Venezuela and the Amazon

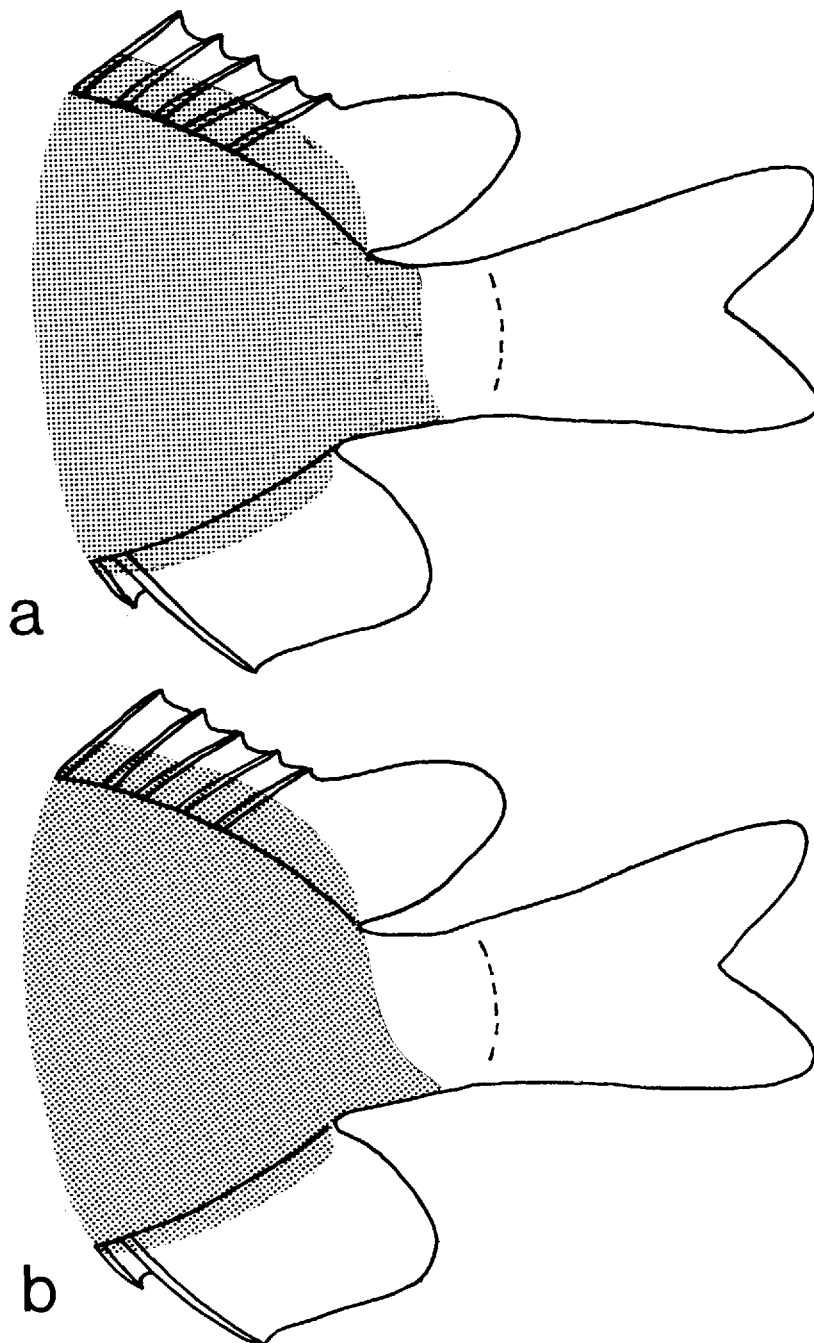


Figure 3. Semidiagrammatic illustration showing variation in caudal peduncle pigmentation in *Chromis flavicauda*: a, holotype; b, Bermuda specimen.

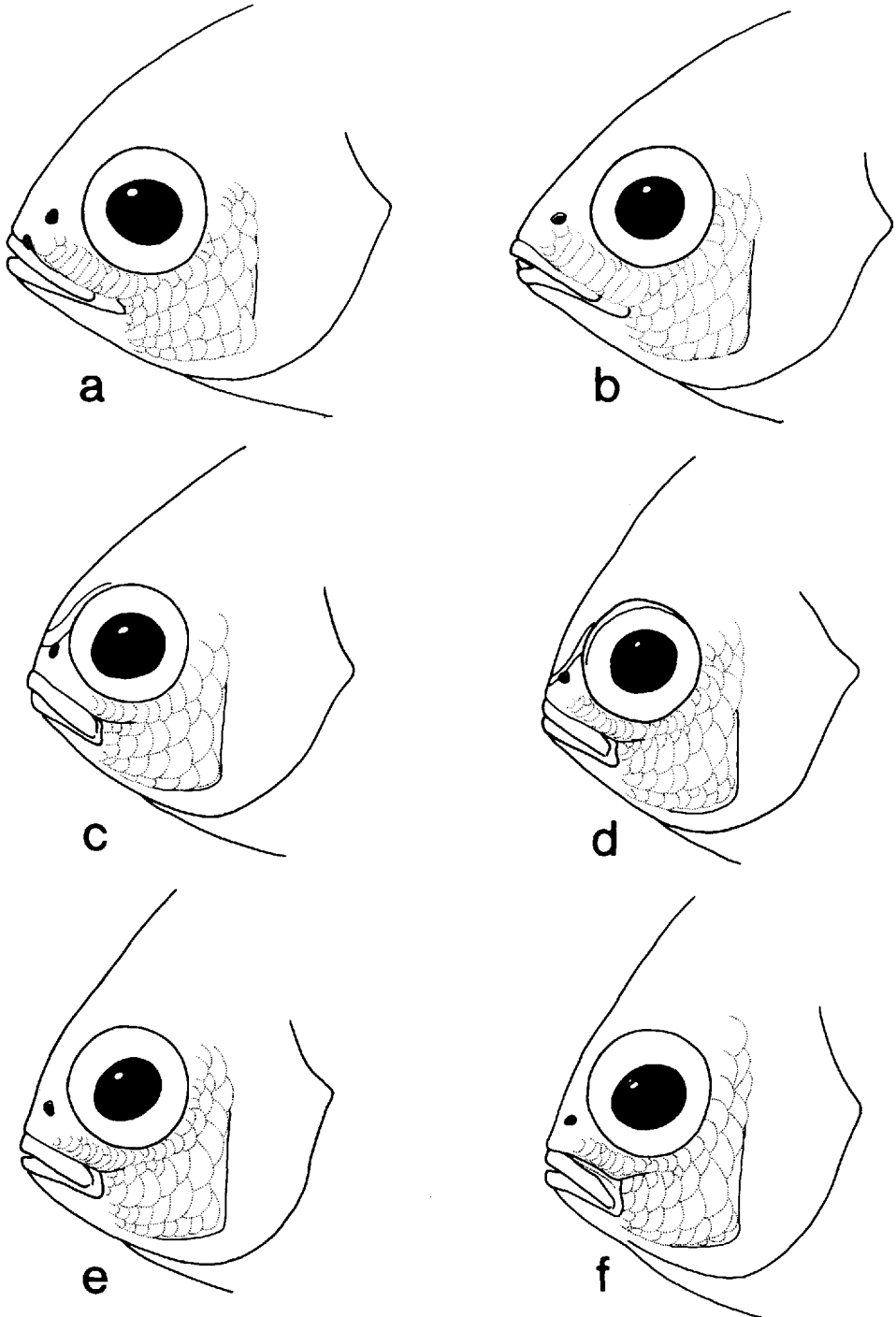


Figure 4. Head configuration, suborbital and cheek scalation in Western Atlantic *Chromis*: a, *C. multilineata*, ANSP 122729, Grenada; b, *C. cyanea*, ANSP 107814, Bahamas; c, *C. flavicauda*, ANSP 133934, Bermuda; d, *C. enchrysurus*, ANSP 134053, Bermuda; e, *C. insolata*, ANSP 133220, Bermuda; f, *C. scotti*, ANSP 121097, Haiti.

in Brazil is not a zoogeographic barrier to reef species occurring deeper than 50 m, and suggested that endemism in the tropical marine fauna of Brazil may be confined to species with a bathymetric distribution limit of approximately 50 m.

Material examined.—Thirty specimens, 35.1–68.5 mm SL, including holotype. HOLOTYPE. BMNH 1879.5.14.7 (59.4 mm SL), Brazil, Pernambuco, ca. 8°06'S, 34°53'W, 55 m, 10 Sept. 1876, Challenger sta. 122. OTHER MATERIAL (all from Bermuda): AMNH 7317 (58.0, holotype of *Chromis bermudae*); USNM 175774 (1.46.9), Challenger Bank, 57 m, 30 June 1955; ANSP 133934 (10.40.7–58.3), 31°57'N, 65°10.7'W, 58 m, 20 July 1975, sta. 10; ANSP 133932 (3.54.3–55.0, including 2 cleared and stained), same data as sta. 10, 21 July 1975, sta. 11; ANSP 134032 (5.35.1–68.5), 32°27.4'N, 64°53.7'W, 56 m, 24 July 1975, sta. 19; ANSP 134019 (3.43.5–62.6), 32°29.3'N, 64°47.7'W, 55 m, 25 July, sta. 21; ANSP 133931 (4.40.2–53.7), 32°27.7'N, 64°53.4'W, 55–56 m, 26 July 1975, sta. 23; ANSP 134024 (2.42.1–44.2), 32°22'30"N, 64°56'30"W, 61 m, 8 Aug. 1975, sta. 48; ANSP 133933 (1.59.5), 32°23'30"N, 64°35'W, 53–58 m, 10 Aug. 1975, sta. 50.

KEY TO WESTERN ATLANTIC SPECIES OF *CHROMIS*

- 1a. Dorsal-fin spines XII; caudal fin deeply forked to lunate (caudal concavity 27–41% SL); sub-orbital scales much higher than wide (Figs. 4a–b) 2
- 1b. Dorsal-fin spines XIII, caudal fin slightly to moderately forked (caudal concavity 8–22% SL); suborbital scales roughly circular (Figs. 4c–f) 3
- 2a. Bony tubercle projecting above upper lip from maxilla; pectoral-fin rays 18–20; gill rakers on lower limb of first arch 22–25; body color green-gray or brown, dark pectoral spot extending posteriorly onto axil, margin of dorsal fin pale, pale spot sometimes present on dorsum of caudal peduncle *C. multilineata* (Guichenot)
- 2b. No bony tubercle projecting above upper lip; pectoral-fin rays 16–18; gill rakers on first arch 21–22; body color blue, no dark pectoral spot, margin of dorsal fin dark, no pale spot on dorsum of caudal peduncle *C. cyanea* (Poey)
- 3a. Distal half of spinous dorsal fin and at least posterior half of caudal peduncle abruptly pale (brilliant yellow in life); large black spot covering at least dorsal half of base and entire axil of pectoral fin *C. flavicauda* (Günther)
- 3b. Distal half of spinous dorsal fin dark or dusky and caudal peduncle not abruptly pale (except in some individuals of *C. enchrysur*); spot on base and axil of pectoral fin, if present, not as above 4
- 4a. Juveniles, and frequently adults, with a bright blue V-line on the snout and head (usually discernable in preserved specimens) that continues dorsolaterally across the body and terminates below the middle of the spinous dorsal fin; caudal fin color pale—usually yellow, sometimes gray or dusky *C. enchrysur* Jordan and Gilbert
- 4b. If present, bright blue V-line on snout and head terminates at posteriodorsal margin of orbit; caudal fin color dark—gray, blue or olive 5
- 5a. Body color of adults olive-gray with a dark pectoral spot, juveniles lime green dorsally, abruptly dull olive below; ultimate dorsal-fin spine 12–16% SL; anal-fin rays usually 11 (rarely 12) *C. insolata* (Cuvier)
- 5b. Body color of adults and juveniles dark to bright blue, often not counter shaded, with dark pectoral spot small or absent; ultimate dorsal-fin spine 15–19% SL; anal-fin rays usually 12 (occasionally 11 or 13) *C. scotti* Emery

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