

A REVISION OF THE *GAMBUSIA NICARAGUENSIS*  
SPECIES GROUP (PISCES:POECILIIDAE)

by

William L. Fink

ABSTRACT

In addition to *Gambusia nicaraguensis*, the species group includes *G. wrayi*, *G. mela pleura* and *G. his paniolae sp. nov.* *G. gracilior* is a junior synonym of *G. wrayi* and *G. dominicensis* is found to be a member of another species group. A key and zoogeographical notes are provided for the group.

Rivas (1963) published on subgenera and species groups in the genus *Gambusia*. He used only gonopodial characters in defining his groups, and I believe that his system is both natural and practical. Subsequent investigation has shown a need to review his findings and to make adjustments in the system. I have found that *G. dominicensis* is a member of another species group and that the species referred to as *dominicensis* by Rivas (1963) is actually undescribed. Otherwise, I accept his *G. nicaraguensis* species group and feel that its revision will help clarify other problems within the genus.

METHODS.—Methods are those of Fink (1971). Abbreviations are as follows: ANSP - Academy of Natural Sciences of Philadelphia; BMNH - British Museum (Natural History); GCRL - Gulf Coast Research Laboratory; UMMZ - University of Michigan Museum of Zoology; USNM - United States National Museum. Unless otherwise noted, lengths are standard length (SL); descriptions of coloration are from alcoholic specimens; all material examined is not included in the tables.

**DIAGNOSIS OF THE SPECIES GROUP.**—Length of gonopodium about one-third of SL. Ray 3 spines 6-12, usually 8-10, tapering to a point, reaching beyond terminal hook of ray 4p. Longest ray 3 spine, including inner process, shorter than combined axial length of its segment and the segments distal to it. Longest inner process of ray 3 shorter than combined axial length of its segment and the segment distal to it. Longest spine of ray 3 (without inner process) shorter than axial length of segments distal to ray 4p serrae (terminal hooked segment excluded). First and/or second segment distal to serrae of ray 4p not transversely enlarged, without ridgelike extensions on anterior and/or posterior margin; serrae of ray 4p entirely antrorse. Segments distal to elbow 3-7, usually 4-6, gradually reduced in width as compared to those proximal to elbow, partially or not coalesced along their anterior margin; elbow more or less triangular, entirely distal to serrae of ray 4p. Ray 4a reaching beyond terminal hook of ray 4p. Terminal hook of ray 4p distally acuminate, its distal margin forming a more or less sharp point. Gonopodial **suspensorium** with three or four, usually three, gonapophyses. Uncini always on second gonapophysis, frequently on the third (see figures 1 and 2 for gonopodial characters). Predorsal contour slightly convex, transversely flat to slightly convex; body axis straight. Body deepest at, or just anterior to, base of gonopodium in males, at, or just anterior to, pelvic fin insertion in females. Snout length less than interorbital width.

Ground color light tan to light brown, darker above, lighter below. Scale pockets margined with dark brown, widest dorsad; usually with a diffuse brown spot just above and behind the **opercle**; nape with a dark brown predorsal stripe; mouth and chin usually dark brown; dark suborbital bar present or absent; ventral edge of caudal peduncle with a faint dark line.

Anal rays 11; scales around caudal peduncle 16; total caudal ray elements on hypural plate 8-13, usually 8, 9, or 11 (see Tables 1-4 for meristic data). The cephalic lateral line system is described in part by Rosen and Mendelson (1960). The mandibular canal consists of two close-set grooves, one behind the other. The preopercular canal is either closed, open in several places, or completely open below the cheek; the ascending branch is an open groove. Pectoral fin of male sigmoid along dorsal margin. Pectoral rays of males gradually reduced in thickness from the second, the first abruptly much thinner and shorter, the fourth and fifth rays longest. The dentition consists of outer and inner rows of enlarged **incurved** canines, separated by a middle band of smaller incurved canines. Diagnosis based in part on Rivas (1963).

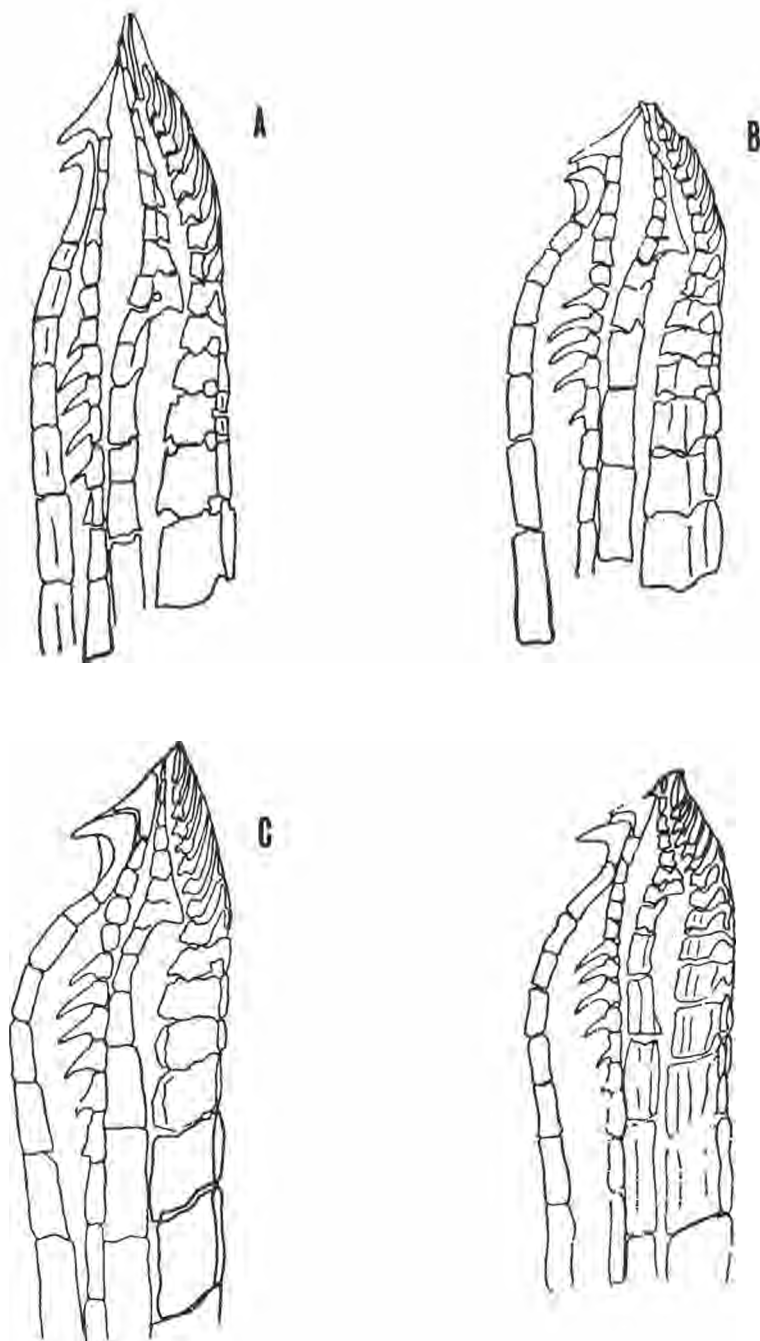


Figure 1. Gonopodia of members of the *Gambusia nicaraguensis* species group: a - *G. nicaraguensis*; b - *G. hispaniolae* (holotype); c - *G. wrayi* (lectotype); d - *G. melapleura*.

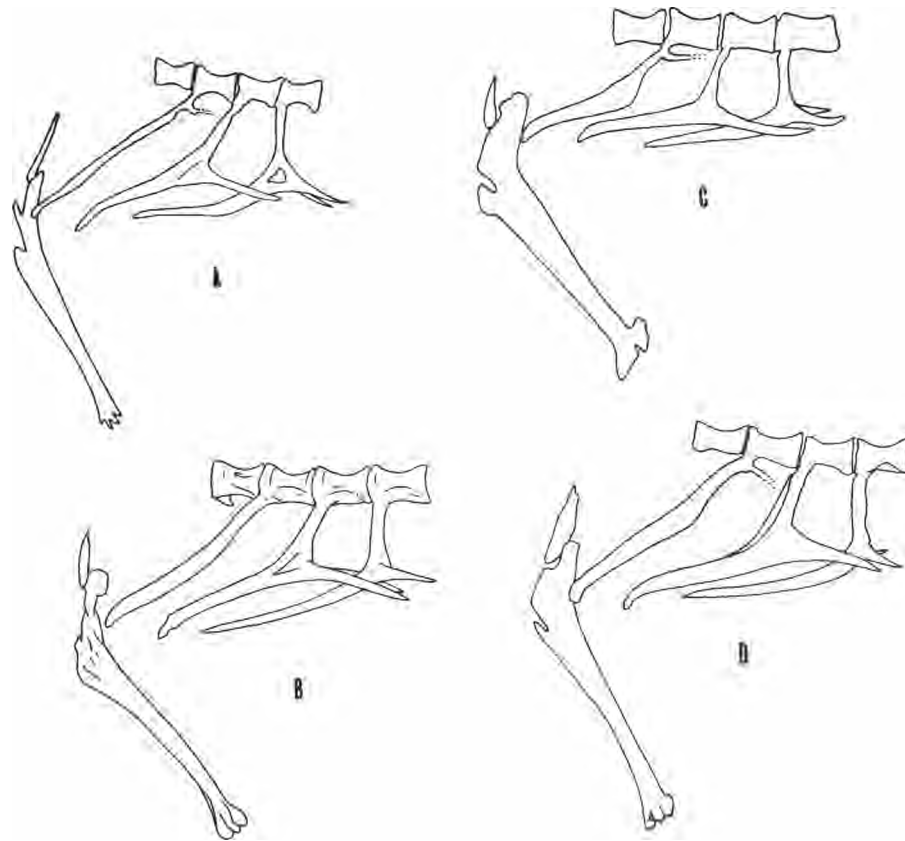


Figure 2. Gonopodial suspensoria of the *Gambusia nicaraguensis* species group:  
a - *G. nicaraguensis*; b - *G. hispaniolae*; c - *G. wrayi*; d - *G. mela pleura*.

KEY TO THE GAMBUSIA NICARAGUENSIS  
SPECIES GROUP

1a.—Dorsal rays 7-9, usually 7 or 8. Pectoral rays 12-14, usually 13. Lateral scales 28-31, usually 29 or 30. Vertebrae 30-32, usually 30 or 31. Caudal fin elements on hypural plate 8. Tip of gonopodium tapered to a sharp point; most distal spine of ray 3 often elongate. Central America from Lake Izabal, Guatemala to Gatun Lake, Panama and San Andres Island, Colombian West Indies.

*G. nicaraguensis*.

1b.—Dorsal rays 8-12, usually 9-12. Pectoral rays 13-17, usually 14 or 15. Lateral scales 30-33, usually 31 or 32. Vertebrae 31-33, usually 32 or 33. Tip of gonopodium not tapered to a sharp point; most distal spine of ray 3 usually not elongate. Caudal elements on hypural plate 8-13, usually 9 or 11.

2a.—Dorsal rays 8-10, usually 9. Lateral scales 30-32, usually 31. Spines of ray 3 of gonopodium 9-12, usually 10. Ray 4a of gonopodium with distinct arch; last segment of ray 4a often arched to overlap tip of terminal hook of ray 4p. Profile of gonopodium at ray 3 spines distinctly convex, spines of ray 3 abruptly shorter towards tip of gonopodium. No abrupt constriction in ray 4a proximal to the elbow. Haiti and western Dominican Republic.

*G. his paniolae* new species.

2b.—Dorsal rays 8-12, usually 9-12. Lateral scales 30-33, usually 31 or 32. Spines of ray 3 of gonopodium 6-11, usually 8 or 9. Ray 4a of gonopodium without distinct arch; last segment of ray 4a usually straight and parallel to axis of gonopodium. Profile of gonopodium at ray 3 spines not distinctly convex; spines of ray 3 not abruptly shortened toward tip of gonopodium. Abrupt constriction present proximal to elbow. Jamaica.

3a.—Dorsal rays 8-10, usually 9. Branched caudal rays 12-16, usually 14. Pectoral rays 13-15, usually 14. Caudal elements on hypural plate 9-10, usually 9. Fins usually spotted, spots often in rows. Jamaica.

*G. wrayi*.

3b.—Dorsal rays 10-12, usually 11 or 12. Branched caudal rays 16-20, usually 16-18. Pectoral rays 15-17, usually 15. Caudal fin elements on hypural plate 11-13, usually 11. Fins unspotted. Bluefields River and Shrewsbury River, Jamaica.

*G. melapleura*.

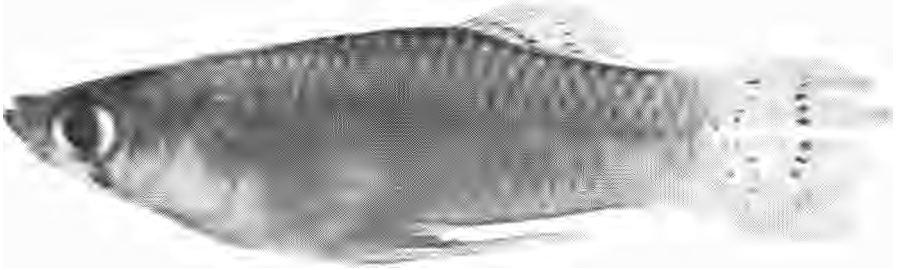


Figure 3. *Gambusia nicaraguensis* (UMMZ 173370). Top - Male, 18 mm, Bottom - Female, 32 mm.

## **Gambusia nicaraguensis** Gunther

(Fig. 3)

*Gambusia nicaraguensis*.—Günther, 1864: 336 (original description; Lake Nicaragua, Nicaragua). Gunther, 1869: 483 (listed), pl. 82, fig. 3 (female figured). Gill and Bransford, 1877: 178 (listed), 180 (listed), 187 (listed). Eigenmann, 1893: 57 (listed). Garman, 1895: 85 (synonymized with *G. gracilis*). Jordan and Evermann, 1896a: 316 (listed). Jordan and Evermann, 1896b: 679 (in key), 682 (description). Regan, 1906: 96 (synonymy; description). Miller, 1907: 105 (description of specimens from Puerto Barrios; brackish water). Regan, 1913: 982 (dorsal rays; lateral scales; distribution), 983, fig. 168a (gonopodium figured), 985 (synonymy; description from types). Regan, 1914: 67 (compared to *G. yucatanana*). Fowler, 1916: 433 (compared with *G. mcnieli*), 435 (in part; *G. sexradiata* listed as *G. nicaraguensis*). Meek and Hildebrand, 1916: 315 (in key), 316 (synonymy; discussion; gonopodium figured). Eigenmann, 1920a: 16 (listed). Eigenmann, 1920b: 20 (listed from Panama). Eigenmann, 1922: 180 (listed; range). Hubbs, 1926: 24 (in key), 34 (in part; *G. dovii* and *G. yucatanana* synonymized with *G. nicaraguensis*; *G. mcnieli* doubtful), pl. 2 (gonopodium of *G. sexradiata* incorrectly labeled as *G. nicaraguensis*). Jordan, Evermann, and Clark, 1930: 186 (listed). Breder, 1933: 566, fig. 385 a-c (male, female and gonopodium figured), 567 (misidentified as *G. affinis speciosa*). Hubbs, 1935: 9 (listed from Guatemala). Myers, 1935: 307 (compared to *G. beebei*). Hubbs, 1936: 162-163 (range), 225 (listed; *G. nicaraguensis sexradiatus* described), 227 (compared to *G. yucatanana*). Hildebrand, 1938: 296 (listed; discussed; corrects Breder's misidentification). de Buen, 1940: 38 (listed, in part). Breder, 1944: 86 (listed; corrects misidentification). Rosen and Gordon, 1951: 270 (*G. sexradiata* discussed as *G. nicaraguensis*), 272 (*G. nicaraguensis* species group). Rosen and Gordon, 1953: 25 (gonopodium of *G. sexradiata* mislabeled as *G. nicaraguensis*). Rosen and Mendelson, 1960: 209, fig. 4f (sensory canals). Rivas, 1963: 334 (Hubbs' synonymization of *G. dovii*, *G. mcnieli*, and *G. yucatanana*), 335 (synonymization of *G. mcnieli* and *G. aestiputeus*; listed), 336, fig. 2f (gonopodium figured), 344 (*G. nicaraguensis* species group; species status discussed; type locality doubtful). Rosen and Bailey, 1963: 86, fig. 39h (gonopodium figured as *G. aestiputeus*), 94 (synonymy; type locality doubtful; in *G. affinis* species group). Bussing, 1966: 229 (brief description), 237 (listed from Costa Rica). Miller, 1966: 790 (range; may be introduced in Rio Chagres basin).

*Paragambusia nicaraguensis*.—Meek, 1904: 133 (new genus based on *G. nicaraguensis*). Meek, 1907: 113 (description).

*Gambusia dovii*.—Regan, 1913: 982 (dorsal rays; lateral scales; distribution), 986 (original description; Lake Nicaragua). Fowler, 1916: 435 (discussed). Hubbs, 1926: 34 (synonymized with *G. nicaraguensis*). Rivas, 1963: 334 (Hubbs' synonymization).

*Gambusia mcnieli*.—Fowler, 1916: 433 (original description; Panama), 434, fig. 5 (figured). Hubbs, 1926: 34 (status doubtful). Jordan, Evermann, and Clark, 1930: 186 (listed). Rivas, 1963: 334 (Hubbs' synonymization discussed), 335 (synonymized with *G. nicaraguensis*).

*Gambusia aestiputeus*.—Fowler, 1950: 87 (original description; San Andres Island, Colombian West Indies), fig. 42 (male figured), fig. 43 (gonopodium figured). Rivas, 1963: 335 (synonymized with *G. nicaraguensis*). Rosen and Bailey, 1963: 86, fig. 39h (gonopodium figured), 94 (listed; perhaps conspecific with *G. nicaraguensis*).

TYPES.—The syntypes of *G. nicaraguensis* (BMNH 1952-12-31: 1-5; USNM 151461) have been examined. There are five females in the BMNH series (the sixth female listed in the original description is the specimen loaned to the USNM). These specimens were collected by Dow, supposedly in Lake Nicaragua. Rivas (1963) and Rosen and Bailey (1963) indicate that subsequent collecting has produced no *Gambusia* from Lake Nicaragua. Rivas (*op. cit.*) stated that these fish probably came from one of the Atlantic drainage streams of Nicaragua. In any case, the types are similar to *Gambusia* found from Honduras to Panama.

The type of *G. dovii* was not examined. Hubbs (1926) stated that it was apparently selected from the type series of *G. nicaraguensis*. *Gambusia dovii* was based on slight proportional and meristic differences.

*Gambusia mcnieli* is based on one female in very poor condition. I have examined the holotype (ANSP 6818) and find it to be well within all parameters of *G. nicaraguensis*. Fowler (1916) stated that *G. mcnieli* had paler spotting than *G. nicaraguensis* but I have found this character to be variable. He also gave a lateral-scale count of about 20; as well as I can determine there are 28 lateral scales. Hubbs (1926) stated that this specimen and one collected by Hildebrand (1938) are the only *Gambusia* collected from Pacific drainages. However, exact locality data for these specimens were not given, so they are not included in fig. 9.

*Gambusia aestiputeus* was described by Fowler (1950) from San Andres Island of the Colombian West Indies. I have examined two male paratypes (ANSP 71776-77) and find them to be *G. nicaraguensis*. Fowler's lateral-scale count (25+2) was inaccurate, as the paratypes have 29 lateral scales. Fowler's figure does not show the sigmoid dorsal margin of the pectoral fin present on the paratypes, and the figured gonopodium is unrecognizable.

NAME.—The name is derived from the type locality, Nicaragua.

GONOPODIAL CHARACTERS.—Ray 3 spines 6-11, usually 9 or 10.



Segments distal to elbow of ray 4a 3-7, usually 5. Segments distal to serrae of ray 4p 4-7, usually 5. Serrae of ray 4p 4-6, usually 5 (fig. 1a).

Gonopodium slender and pointed. The spines of ray 3 more convex than in *G. wrayi* and *G. mela pleura* and longer than those of *G. hispaniolae*; the last spine of ray 3 is very long and slender. Specimens from the northern part of the range generally have more spines on ray 3.

**GONOPODAL SUSPENSORIUM.**—Based on 27 adult males, there are three gonapophyses. Uncini are absent on the first gonapophysis, usually present on the second and third. Parapophyses usually present on first gonapophysis, sometimes present on second (fig. 2a). The gonapophyses are sometimes strongly arched ventrally, especially in specimens from the southern part of the range. This character is, however, not consistent, and many specimens have gonapophyses similar in shape to other members of the species group.

**MERISTIC CHARACTERS.**—Vertebrae 30-32, usually 31; caudal fin elements on hypural plate 8; dorsal rays 7-9, usually 7 or 8; branched caudal rays 11-14, usually 12; pectoral rays 12-14, usually 13; lateral scales 28-31, usually 30; gill rakers 11-15, usually 13 or 14.

**MORPHOLOGICAL CHARACTERS.**—Head shorter than distance between dorsal and anal fin origins. Mandible width less than **interorbital** width; width of orbit greater than snout width in males, less than, to greater than snout width in females; lateral gape slightly greater than half of front gape. Origin of dorsal fin nearer pectoral insertion than caudal base in males, nearer caudal base in females. Gonopodium reaching to or beyond vertical from mid-length of depressed last dorsal ray. End of anal base at vertical from first or second dorsal ray in females. Depressed dorsal fin shorter than to longer than distance from **snout tip** to pectoral fin insertion in males, shorter in females. Depressed dorsal fin reaching beyond a point midway between end of its base and vertical from middle of caudal base. Anal fin of females falcate. The second pectoral ray of males often has a fleshy expansion at its distal quarter.

**COLOR.**—The faint brown stripe from the orbit to over and past the pectoral fin, usually present in other members of the group, is usually absent or very diffuse. Suborbital dark bar usually present, sometimes extending on sub- and **interopercle**. The sides are **usually** spotted, the spots often in rows; often with a patch of melanophores just anterior to anal fin origin. Dorsal and caudal fins with two or three scattered rows of dark spots, with melanophores scattered over the fin and concentrated around the fin margin. Anal fin with numerous small melanophores concentrated around the third to seventh rays, and extending almost to tip of gonopodium.

**SIZE.**—Examined males ranged from 16.1-29.3 mm, females from 18.1-35.0 mm.

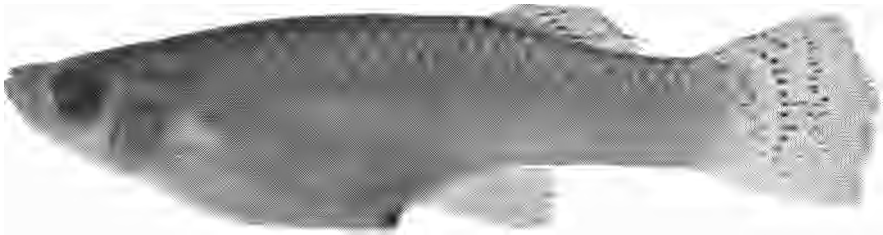
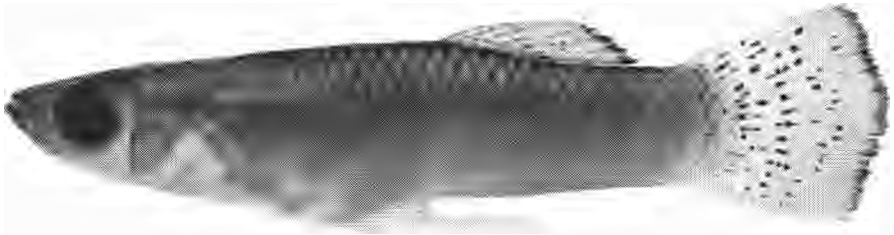


Figure 4. *Gambusia hispaniolae* (USNM 204867). Top - Male paratype, 27 mm. Bottom - Female paratype, 35 mm.

**DISTRIBUTION.**—*Gambusia nicaraguensis* is found in fresh and brackish waters from Lago de Izabal and Puerto Barrios, Guatemala, southward to Gatun Lake, Panama (Rosen and Bailey, 1963). It is also found at San Andres Island, Colombian West Indies (fig. 9).

**REMARKS.**—*Gambusia nicaraguensis* shows clinal variation only in number of spines of ray 3 wherein spines are more numerous in fish from the northern parts of the range.

*Gambusia nicaraguensis* shares a superficial resemblance to two other Central American and Mexican species, *G. puncticulata yucatanica* Regan and *G. sexradiata* Hubbs, both of which are in different species groups. All three have spotting in rows along the sides and the females have darkly pigmented, falcate anal fins. This convergence suggests similar selective pressures in the areas these species inhabit. The range of *G. nicaraguensis* does not overlap that of either of these species, but *G. sexradiata* and *G. p. yucatanica* are sympatric in southern Mexico and northern Guatemala. As shown in the synonymy, *Gambusia nicaraguensis* has often been confused with these species.

*Gambusia nicaraguensis* seems to be a direct descendant of the progenitor stock of the species group. Although the other members of the group are found mainly in fresh water, *G. nicaraguensis* tolerates salt water.

**MATERIAL EXAMINED.**—**PANAMA:** ANSP 6818, Panama (0,1). UMMZ 180761, Barro Colorado (5,14). USNM 78790, Colon (1,3). UMMZ 180698, Rio Chagres (20,9). USNM 109094, Mt. Hope (Dry Dock) Canal Zone (0,2). **NICARAGUA:** USNM 205561, Chihuahua Creek near junction with Rio Mico, 2 km below "El Recreo" (0,1). BMNH 1952-12-31:1-5, "Lake Nicaragua" (0,5). USNM 151461, "Lake Nicaragua" (0,1). **HONDURAS:** GCRL 3688, Cortes, Boca del Rio Cienquita, Gulf of Honduras; approx. 15°48'16"N, 87°56'45"W. (2,5). UMMZ 173298, Rio Tulian at Tulian (11,30). UMMZ 173370, Rio Salado Canal, Atlantida (20,30). **GUATEMALA:** GCRL 3687, Izabal, Bahia de Matias de Galvez; approx. 15°43'46"N, 88°38'25"W. (1,0). **COLOMBIAN WEST INDIES:** ANSP 71776-77, San Andres Island (2,0).

### ***Gambusia hispaniolae* new species**

(Fig. 4)

*Gambusia dominicensis.*—Rosen and Gordon, 1951: 271 (in part), 271 fig. 8 (gonopodium figured). Rosen and Mendelson, 1960: 205, fig. 2a; 209, fig. 4k (sensory canals of head). Rivas, 1963:344-345 (in *G. nicaraguensis* species group). Rosen and Bailey, 1963: 96 (in part). Minckley and Koehn, 1966: 47, fig. 1d (gonopodium figured as undescribed form from Cuba).

**TYPES.**—USNM 204865; holotype; adult male; 24.4 mm; Haiti, Source

Trou-Caiman, Cul-de-Sac Plain, Dept. de l'Quest; 7 April 1951; L. R. Rivas, L. Bonnefil and S. Y. Lin coll. USNM 204866; allotype; adult female; 37.5 mm. USNM 204867; paratypes; 366 (199 adult females, 57 young, 56 immature males, 54 adult males). Allotype and paratypes collected with holotype.

**NAME.**—The name refers to the range of the species, the island of Hispaniola.

**GONOPODIAL CHARACTERS.**—Ray 3 spines 11 (9-12, usually 10). Segments distal to elbow of ray 4a 5 (4-6, usually 6). Segments distal to ray 4p serrae 5 (4-6, usually 5). Ray 4p serrae 5 (3-6, usually 5).

Gonopodium (fig. 1b) much blunter than in *G. nicaraguensis*. The ray 3 spines are shorter than in other members of the species group. There is no constriction in ray 4a proximal to the elbow; the most distal segment of ray 4a often curves to overlap the tip of the distal hook of ray 4p. Ray 4a distinctly arched, resulting in a wide space between rays 4a and 4p.

**GONOPODIAL SUSPENSORIUM.**—Based on 42 adult males, there are three gonapophyses. The first and second gonapophyses usually angle ventrad just proximad to their distal tips; with a slight constriction in the bone at the point where the angle begins. Uncini absent on the first gonapophysis, present on the second (in 40 specimens), and usually present on the third. The uncini on the second gonapophysis are usually about half the length of the gonapophysis. Parapophyses usually present on the first gonapophysis, sometimes present on the second (fig. 2b).

**MERISTIC CHARACTERS.**—Vertebrae 31-32, usually 32; caudal fin elements on hypural plate 8-9, usually 9; dorsal rays 9 (8-10, usually 9); branched caudal rays 13 (12-14, usually 13 or 14); pectoral rays 13 (13-14, usually 14); lateral scales 31 (30-32, usually 31); gill rakers 15 (13-18, usually 15).

**MORPHOLOGICAL CHARACTERS.**—Head slightly shorter than distance between dorsal and anal origins in males, shorter to slightly longer in females. Mandible width less than interorbital width; lateral gape about half of front gape; width of orbit less than to greater than snout width in males, less than snout width in females. Origin of dorsal fin midway between pectoral fin insertion and caudal base in some males, usually nearer pectoral fin insertion; dorsal origin closer to caudal base in females. Gonopodium reaching to or slightly beyond vertical from midlength of depressed last dorsal ray. End of anal base usually below vertical from second or third dorsal ray in females. Depressed dorsal fin shorter than or equal to distance from snout tip to pectoral fin insertion in males, shorter in females. Depressed dorsal fin reaching to or just before a point midway between end of its base and vertical from middle of caudal base in males, similar in females. Anal fin of females subtriangular or rounded.

**COLOR.**—Some specimens with a diffuse faint dorsolateral brown stripe extending posteriad from above and behind the orbit to over the pectoral fin; suborbital dark bar absent. Lateral body often with a few small scattered dark spots; dorsal fin with two rows of scattered large spots, with many smaller melanophores scattered throughout the fin membrane; distal fin margin black. Anal fin sometimes pigmented along its rays in males; dusky in females, with many scattered melanophores on and between the rays. Caudal fin with two or three irregular vertical rows of scattered spots, the first on the fin base; caudal distally dusky, margined with minute melanophores, melanophores restricted to rays proximad.

**SIZE.**—Examined males ranged from 18.1-29.8 mm, females from 19.7-51.8 mm.

**DISTRIBUTION.**—*Gambusia hispaniolae* is found in the fresh waters of Haiti and western portions of the Dominican Republic; no collections are available from the eastern Dominican Republic (fig. 9).

**REMARKS.**—*Gambusia hispaniolae* is the dominant *Gambusia* in Haiti. It has previously been called *G. dominicensis* but examination of the type series of that species (BMNH 1913-1-22:10-11) shows that the name *dominicensis* does not apply to the present form. *G. hispaniolae* differs from *G. dominicensis* in its higher lateral-scale count (30-31 compared to 29), in the absence of a dark suborbital bar, and in the gonopodial suspensorium. Gonopodial characters are particularly distinctive in the arch in ray 4a and the shorter ray 3 spines in *G. hispaniolae*. *Gambusia dominicensis* (figs. 7 and 8) seems to be a member of the *G. nobilis* species group. There are two males in the type series of *G. dominicensis*; the gonopodium of one (with three gonapophyses) was mounted on a slide and figured by Regan. There is one adult female and one immature female in the type collection but Regan (1913) indicated the presence of only one female.

*Gambusia beebei* Myers and *G. pseudopunctata* Rivas, both in the *G. punctata* species group, also occur in Haiti. It is possible that these were once widespread in Haiti but have been displaced to their now restricted localities by *G. hispaniolae*.

There is one collection of *G. hispaniolae* (UMMZ 136377) reported from Cienfuegos, Cuba. I have examined these specimens and am certain that there was an error in labeling. Robert R. Miller states (pers. comm.) that this collection was not sent directly to the UMMZ by the collector, Edgar Folk, and that the chance for locality error is good. The gonopodium of one of these fish was figured in Minckley and Koehn (1966) and labeled as an undescribed species. Their figure is inaccurate in that the ray 3 spines should be slightly longer.

**MATERIAL EXAMINED.**—HAITI: USNM 88337, Bon Reepos

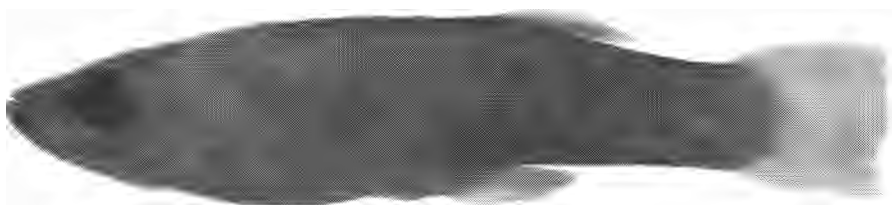
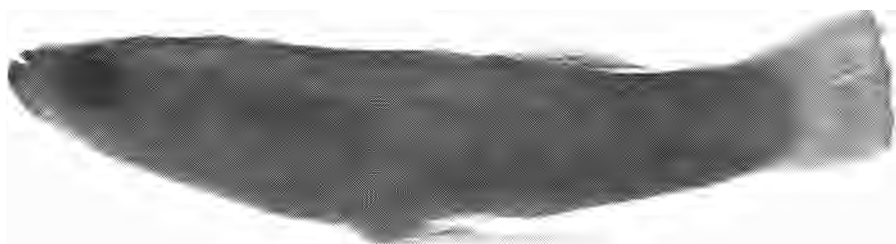


Figure 5. *Gambusia wrayi* (BMNH 1912-12-20:7-16). Top - Male paralectotype, 31 mm. Bottom - Female paralectotype, 26 mm.

(2,2). USNM 205580, drainage ditch along road from St. Marc to Gonaives about 18 km N of St. Marc, Dept. de l'Artebonite (6,25). USNM 204865, 204866, 204867, Source Trou-Caiman, Cul-de-Sac Plain, Dept. de l'Quest (1,0; 0,1; 20,30). USNM 205566, Riviere de l'Estere at bridge of road from St. Marc to Gonaives, Dept. de l'Artebonite (20, 30). USNM 205552, spring at Dessalines, Dept. de l'Artebonite (10,25). USNM 205557, Source Solorience, near shore of Etang Saumatre, at SE end of lake, Dept. du Sud (10,9). USNM 205575, Riviere Grise at bridge of road from Port-au-Prince to St. Marc, about five mi NE of Port-au-Prince, (Croix des Missions), Dept. de l'Quest (9,17). USNM 205554, spring at Manneville, near shore of NW end of Etang Saumatre, Dept. de l'Quest (3,14). **DOMINICAN REPUBLIC:** USNM 205553, Rio Negua at San Cristobal, Prov. of Trujillo (2,3). USNM 205582, Cachon de Papito at road from Barahonda to Cabral, near Laguna de Cabral (Rincon), Prov. of Barabona (8,30). **CUBA?:** mislabeled? UMMZ 136377, drainage ditch in Cienfuegos (6,5).

### **Gambusia wrayi** Regan

(Fig. 5)

*Gambusia wrayi*.—Regan, 1913: 982 (dorsal rays; lateral scales; Jamaica), 983b (gonopodium figured), 988 (original description; Jamaica), pl. XCIX, figs. 3-4 (male; female). Hubbs, 1926: 24 (in key), 36 (listed). Jordan, Evermann, and Clark, 1930: 186 (listed). Myers, 1935: 308-10 (compared to *G. beebei*). Rivas, 1963: 333 (listed), 335 (listed), 344 (in *G. nicaraguensis* species group). Rosen and Bailey, 1963: 96 (listed; species doubtful; in *G. affinis* species group). Rivas, 1965: 118 (validity of species). Caldwell, 1966: 34 (considered a valid species).

*Gambusia gracilior*.—Regan, 1913: 982 (dorsal rays; lateral scales; Jamaica), 983c (gonopodium figured), 989 (original description; Jamaica), pl. XCIX, figs. 5-6 (male; female). Hubbs, 1926: 25 (in key), 36 (listed). Jordan, Evermann, and Clark, 1930: 186 (listed). Myers, 1935: 309 (compared to *G. beebei*). Rivas, 1944: 47 (compared to *G. baracoana*). Rosen and Mendelson, 1960: 209, fig. 4j (sensory canals). Rivas, 1963: 333 (listed), 334 (listed), 344 (in *G. nicaraguensis* species group; species doubtful). Rosen and Bailey, 1963: 96 (listed; in *G. affinis* species group; species doubtful). Rivas, 1965: 118 (validity of species). Caldwell, 1966: 34 (listed, status doubtful).

TYPES.—The syntypes of *G. wrayi* (BMNH 1912-12-20:7-16) have been examined, including the slide mount of the gonopodium of the figured specimen. In the absence of a lectotype I so designate this specimen (29.1 mm, male, BMNH 1912-12-20:7) together with the mounted gonopodium. Other specimens in the type series are designated paralectotypes.

My examination of the types of *G. gracilior* (BMNH 1969-9-8:1-14) shows that proportional differences noted by Regan (1913) fall within the range of *G. wrayi*. Proportional differences are not distinctive and since *G. wrayi* has page priority, *G. gracilior* becomes a junior synonym.

NAME.—The species was named after the collector, C. A. Wray.

**GONOPODIAL CHARACTERS.**—Ray 3 spines 9 (6-11, usually 8); segments distal to elbow of ray 4a 5 (3-5, usually 4); segments distal to serrae of ray 4p 4 (3-5, usually 4); serrae of ray 4p 5 (3-7, usually 4).

The gonopodium (fig. 1c) is moderately pointed, more or less intermediate between *G. hispaniolae* and *G. nicaraguensis*. There is a constriction immediately proximal to the elbow of ray 4a, there is no arch at the elbow, and the last segment is usually long, slender, and straight (not as long as in *G. nicaraguensis*).

**GONOPODIAL SUSPENSORIUM.**—There are three gonapophyses in the 47 adult males examined. Uncini absent on the first gonapophysis, present on the second, and usually present on the third. The uncinatoid process on the second gonapophysis is usually about half as long as the gonapophysis. Parapophyses are always present on the first gonapophysis, occasionally present on the second. The gonapophyses angle ventrad just proximal to their tips, usually with a slight constriction at the point of angle (fig. 2c).

**MERISTIC CHARACTERS.**—Vertebrae 33 (32-33, usually 33; one specimen with 35); caudal fin elements on hypural plate 9 (9-10, usually 9); dorsal rays 9 (8-10, usually 9); branched caudal rays 14 (12-16, usually 14); pectoral rays 14 (13-15, usually 14); lateral scales 32 (30-33, usually 32); gill rakers 15 (12-16, usually 14).

**MORPHOLOGICAL CHARACTERS.**—Head shorter than to longer than distance between origins of dorsal and anal fins. Mandible width greater than interorbital width in males, less than interorbital width in females. Width of orbit less than to greater than snout width in males, less than snout width in females. Origin of dorsal fin closer to pectoral fin in males, closer to caudal base in females. Gonopodium reaching from before to past a vertical from mid-length of depressed last dorsal ray. End of anal base below a vertical from second or third dorsal ray in females. Depressed dorsal fin shorter than distance from snout tip to pectoral fin insertion. Depressed dorsal fin reaching slightly before to slightly beyond a point midway between end of its base and vertical from middle of caudal base in males, shorter in females. Anal fin of females subtriangular or rounded.

**COLOR.**—There is usually a faint brown stripe from the orbit extending above the pectoral fin, continuing posteriad at least to a vertical from the dorsal fin origin and to the caudal fin base in some specimens. Sub-orbital dark bar faint but usually present. Body often lightly spotted as



far forward as the pectoral fin insertion. Dorsal fin with two rows of small scattered black spots; there are small melanophores scattered over the dorsal fin base and along the fin margin. Caudal fin usually with two or three rows of small black spots, some individuals have scattered spots only, others may have pigment only at the apices of the caudal ray branches. Usually with numerous small melanophores along caudal fin margin, fin membranes immaculate elsewhere. The anal fin has scattered small melanophores, often arranged in rows between and parallel to the rays.

**SIZE.**—Examined males ranged from 16.2-32.2 mm, females from 21.0-56.4 mm.

**DISTRIBUTION.**—*Gambusia wrayi* is found in the fresh waters of Jamaica, with the greatest density of population in the southern drainages.

**REMARKS.**—*Gambusia wrayi*, the common fresh-water species of Jamaica, is replaced in brackish and salt waters by *Gambusia* p. *puncticulata*, although they occasionally occur together.

**MATERIAL EXAMINED.**—JAMAICA: BMNH 1912-12-20:7, Jamaica (1,0). BMNH 1912-12-20:7-16, Jamaica (2,7). BMNH 1969-9-8:1-14, Jamaica (2,4). USNM 205577, Byndloss River at road from Elvar-ton to Linstead, two mi N of Linstead (16,30). USNM 205578, Patterson Spring, Duhany Pen, at bridge on road from Kingston to Morant Bay, one mi W of Morant Bay (20,30). USNM 205564, Middlequarter Spring at road from Laconia to Black River, six mi N of Black River (20,30). USNM 205574, Black River Spa spring, at Black River Town 200 yds. from the sea (20,30). USNM 205570, Spring Head Spring at fresh-water pond on road from Black River to Parrotte, six mi SE of Black River (20,30). USNM 205562, Salt River at road from Old Harbour to pumping station, about 2.5 mi N of pumping station (8,21). USNM 205581, Blue Hole Spring near mouth of Alligator Pond River (17,8). USNM 205579, mangrove ditch along road from Manchioneal to Port Morant, two mi NE of Port Morant (2,9). USNM 205573, spring at road from Black River to Savanna la Mar, 14 mi NE of Savanna la Mar (20,19). USNM 205565, Cave River at Borobridge, Cockpit County (20,30). USNM 205563, Albiou Pond springs on road from Kingston to Morant Bay, 16 mi E of Kingston (13,8). USNM 205583, Comonte Pond River, 2.5 mi W of Savanna la Mar (20,30). USNM 205571, Ferry River, one mi above bridge, on road from Kingston to Spanish Town (4,9). USNM 205569, Milk River at road from Porus to Four Paths, about one mi E of Porus (7,18). USNM 205568, Milk River at road from Alley to Rest (6,11).

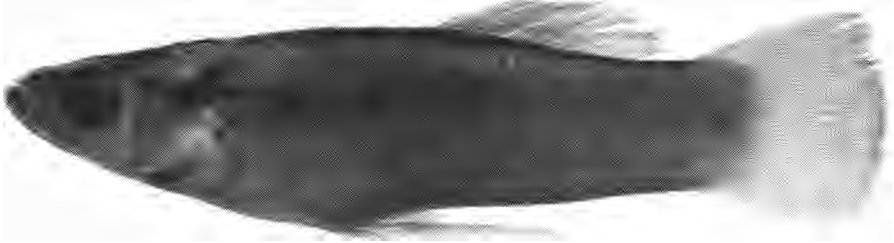


Figure 6. *Gambusia melapleura* (USNM 205555). Top - Male, 34 mm.  
Bottom - Female, 31 mm.

## **Gambusia melapleura** (Gosse)

(Fig. 6)

*Poecilia melapleura*.—Gosse, 1851: pl. I, fig. 3 (female figured), 84 (original description; Bluefields, Jamaica).

*Poecilia melanopleura*.—Bleeker, 1860: 486 (spelling emended).

*Haplochilus melanopleurus*.—Günther, 1864: 317 (redescription based on types).

*Gambusia melapleura*.—Jordan, 1886: 564 (listed). Jordan and Evermann, 1896a: 316 (listed). Hubbs, 1926: 24 (in key), 35 (synonymy; status uncertain). Myers, 1935: 308 (compared to *G. beebei*). Rivas, 1963: 335 (listed), 344-345 (in *G. nicaraguensis* species group; status confirmed). Rosen and Bailey, 1963: 95 (synonymy; status uncertain; in *G. affinis* species group). Rivas, 1965: 118 (validity of species). Caldwell, 1966: 34 (listed; considered as valid).

*Gambusia melanopleura*.—Garman, 1895: 88 (synonymy; description). Regan, 1913: 982 (dorsal rays; lateral scales; distribution), 988 (synonymy; description based on types).

*Fundulus melapleurus*.—Jordan and Evermann, 1896b: 637 (in key), 659 (description from Gunther).

**TYPES.**—There are seven female types deposited in the British Museum (Natural History), BMNH 1849-12-27:90-95 (only radiographs of these have been examined). L. R. Rivas obtained a series of topotypes from the pool where the original series was collected and states (pers. comm.) that the type locality is essentially the same today as illustrated by Gosse (1851). The following description is based on the topotypes and a collection from the Shrewsberry River.

**NAME.**—The name refers to the dark line that extends from the orbit along the side of the fish. Bleeker (1860) changed the original name to *melanopleura*, but this name is invalid under Article 32 of the International Code. It should be noted that the syntypes are labeled *melano pleura*.

**GONOPODIAL CHARACTERS.**—Ray 3 spines 7-10, usually 8; segments distal to elbow of ray 4a 3-6, usually 4; segments distal to serrae of ray 4p 4-6, usually 4; serrae of ray 4p 4-6, usually 4.

Gonopodium (fig. 1d) similar to *G. wrayi*. However, ray 4p is not as constricted proximal to the elbow as in *G. wrayi*.

**GONOPODIAL SUSPENSORIUM.**—There are usually three gonapophyses, rarely 4, in the 47 adult males examined. Uncini are absent on the first gonapophysis, always present on the second, and usually present on the third. The first gonapophysis is relatively straight, slightly constricted just above the tip, then angles ventrad. The second gonapophysis is angulate and also bends ventrad at its tip (fig. 2d).

**MERISTIC CHARACTERS.**—Vertebrae 31-33, usually 33; caudal elements on hypural plate 11-13, usually 11; dorsal rays 10-12, usually 11 or 12; branched caudal rays 16-20, usually 18; pectoral rays 15-17, usually 15; lateral scales 30-32, usually 31 or 32; gill rakers 12-16, usually 14.

**MORPHOLOGICAL CHARACTERS.**—Head shorter than distance between origins of dorsal and anal fins in males, shorter than to slightly longer than this distance in females. Mandible width less than interorbital width; width of orbit less than snout width; lateral gape less than half to about half of front gape. Dorsal fin origin closer to pectoral fin in males, closer to caudal base in females. Gonopodium reaches vertical from end of dorsal base but not a vertical from mid-length of depressed last dorsal ray. End of anal base below a vertical from the second or third dorsal ray in females. Depressed dorsal fin equal to or longer than distance from snout tip to pectoral fin insertion in males, shorter in females. Depressed dorsal fin reaching to or beyond a point midway between end of its base and vertical from middle of caudal base. Anal fin of female rounded.

**COLORATION.**—There is a broad diffuse brown stripe originating just above and behind the orbit, becoming more diffuse caudad. Sub-orbital dark bar absent. Occasionally with a few dark spots on the body or fins, but these are few and not arranged in a pattern. Dorsal and caudal fin rays margined with melanophores, those on the dorsal rays darker; caudal and dorsal fins often edged with black; fins otherwise colorless.

**SIZE.**—Examined males ranged from 20.6-34.2 mm, females from 25.4-59.1 mm.

**DISTRIBUTION.**—*Gambusia melapleura* has been collected only at the type locality, Bluefields, Jamaica and at the headwater spring of the Shrewsbury River, Jamaica (fig. 9).

**REMARKS.**—*Gambusia melapleura* is a large species of restricted range. According to L. R. Rivas (pers. comm.), this form may have been more wide-ranging during periods of lowered sea levels in the Pleistocene and was isolated when water levels rose. *Gambusia melapleura* is closely related to *G. wrayi*, and one may be the ancestral stock of the other. It differs from *G. wrayi* in gonopodial proportions, number of dorsal fin rays, branched caudal rays, pectoral rays, and number of caudal fin elements on the hypural plate.

**MATERIAL EXAMINED.**—**JAMAICA:** USNM 205555, Bluefields River at Old Rest House (20,30). USNM 205559, Shrewsbury River headwater spring, about eight mi NE of Savanna la Mar, Westmoreland. BMNH 1849-12-27:90-95, Jamaica (0,7) radiographs only.

#### ZOOGEOGRAPHY

Distributional evidence suggests that there have been at least three West Indian invasions by *Gambusia* and that the *G. punctata* group was

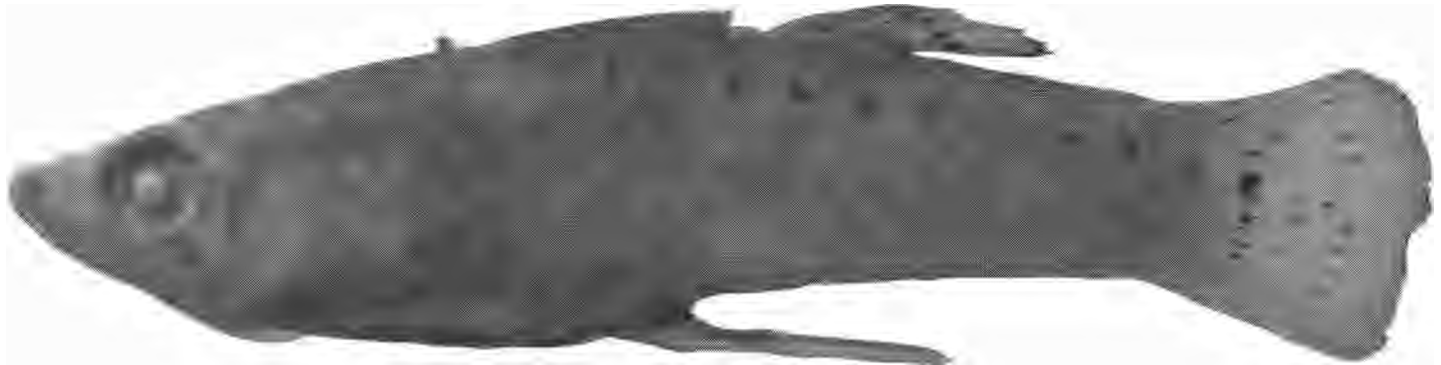


Figure 7. *Gambusia dominicensis* (BMNH 1913-1-22:10-11), male syntype, 20 mm.

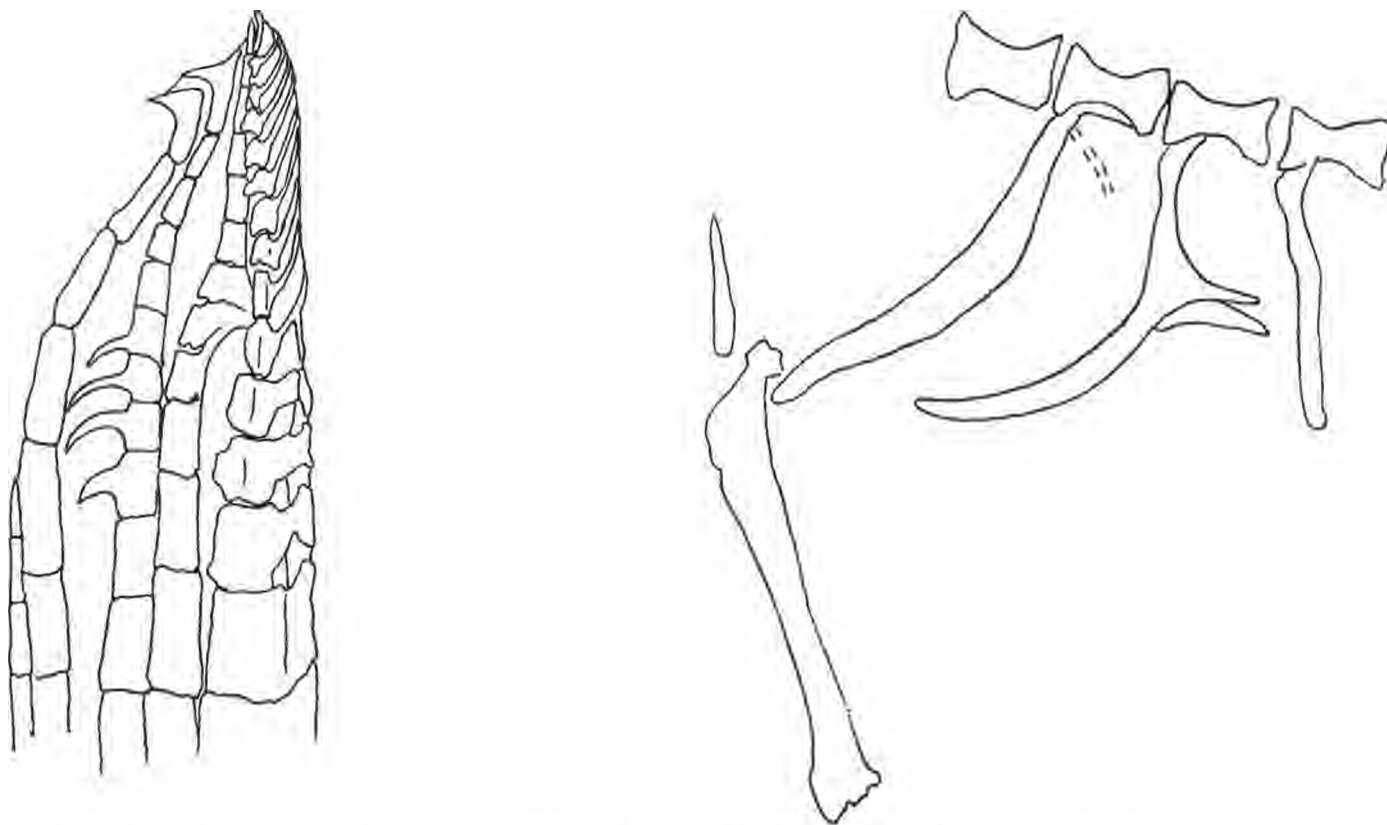


Figure 8. *Gambusia dominicensis* (BMNH 1913-1-22:10-11). Left - Gonopodium of male syntype. Right – Gonapophysis of female syntype.

probably the first of these. Members of this group are widespread in the waters of Cuba and were probably once so in Haiti. The group is now represented in Haiti by two relict fresh-water populations, one each of *G. beebei* Myers and *G. pseudopunctata* Rivas. They are potential competitors with *G. hispaniolae* but neither occurs with this species. It would appear that *G. hispaniolae* is the more successful *Gambusia* on Hispaniola and that members of the *G. punctata* group have been reduced to relict status by *G. hispaniolae*. It further appears that continued survival of the members of the *G. punctata* group in Haiti depends on the exclusion of *G. hispaniolae* from their now restricted habitats.

We also find members of the *Gambusia puncticulata* group in Cuba, the Bahamas, Jamaica, the Cayman Islands, and Yucatan. These have probably entered the West Indies from Yucatan to Cuba, thence to the other islands by waif dispersal or other means. Members of this group do not usually compete with the other groups as they are predominantly brackish and salt-water fishes. Only in northwestern Cuba is there potential competition with *G. rhizophorae* Rivas.

If Regan's locality is correct, the *G. nobilis* group is represented in the West Indies by *G. dominicensis*. The type series was supposedly collected in Haiti, but no specimens have since been collected. The presence of this species in Haiti opens up several possibilities concerning the zoogeography of the genus. Speculations on this species group, however, should await further collecting.

The *G. nicaraguensis* group is found in Central America (sharing its range only with *G. tuma* Rosen and Bailey of the *G. nobilis* group), Jamaica, and Hispaniola. The group doubtless descended from a Central American ancestor which dispersed from the Honduras-Nicaraguan area to Jamaica, thence to Haiti. Although the insular members of the group are now virtually confined to fresh waters, *G. nicaraguensis* occurs in brackish and salt water. For further discussion see Rivas (1958) and Rosen and Bailey (1963).

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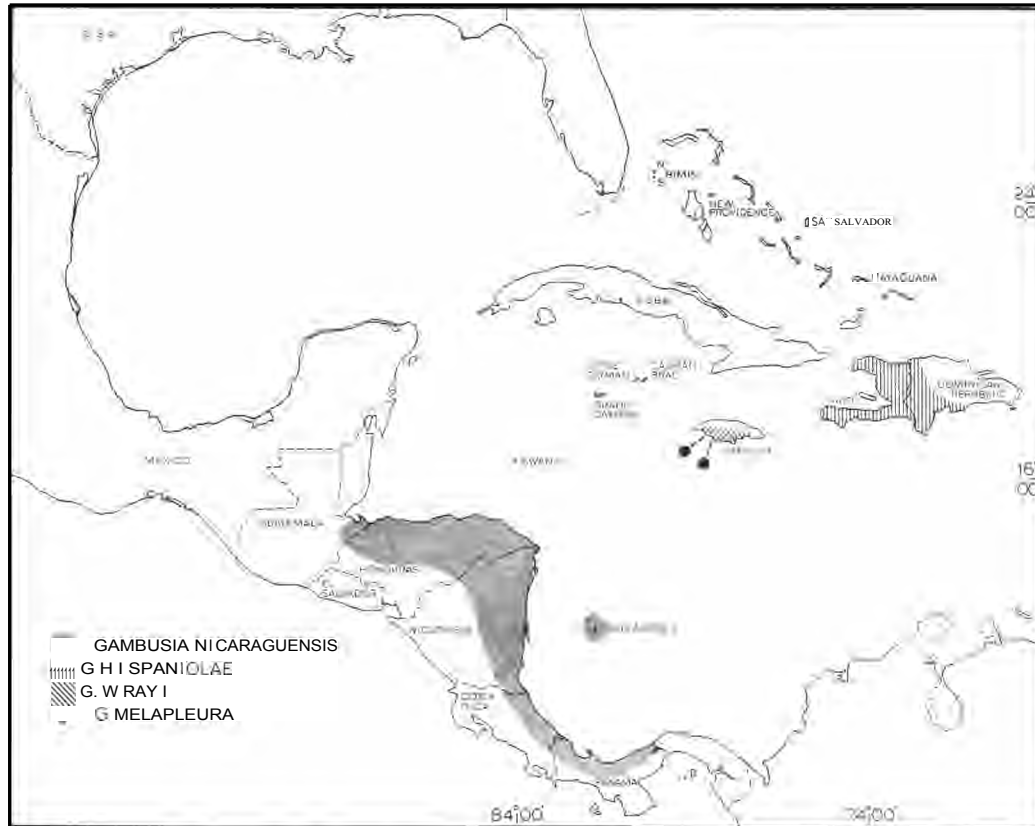


Figure 9. Distribution of the *Gambusia nicaraguensis* species group.



Table 1. Frequency distribution of dorsal rays, pectoral rays and branched caudal rays in the *Gambusia nicaraguensis* species group.

Species	N	Dorsal rays						Mean
		7	8	9	10	11	12	
<i>nicaraguensis</i>	158	100	57	1				7.4
<i>hispaniolae</i>	274		10	259	5			9.0
<i>wrayi</i>	587		28	533	26			9.0
<i>melapleura</i>	100				5	46	49	11.4

Species	N	Pectoral rays						Mean
		12	13	14	15	16	17	
<i>nicaraguensis</i>	165	2	145	18				13.2
<i>hispaniolae</i>	273		62	211				13.8
<i>wrayi</i>	587		67	503	17			13.9
<i>melapleura</i>	100				60	39	1	15.4

Species	N	Branched caudal rays										Mean
		11	12	13	14	15	16	17	18	19	20	
<i>nicaraguensis</i>	105	10	61	28	6							12.3
<i>hispaniolae</i>	273		45	104	124							13.3
<i>wrayi</i>	587		13	50	461	40	5					14.0
<i>melapleura</i>	100						41	23	33	2	1	17.0

**Table 2. Frequency distribution of lateral scales, gill rakers and ray 3 spines in the *Gambusia nicaraguensis* species group.**

Species	N	Lateral scales							Mean
		28	29	30	31	32	33		
<i>nicaraguensis</i>	159	1	46	110	2				29.7
<i>hispaniolae</i>	273			38	233	2			30.9
<i>wrayi</i>	584			6	203	367	8		31.6
<i>melapleura</i>	100			1	46	53			31.5

Species	N	Gill rakers								Mean
		11	12	13	14	15	16	17	18	
<i>nicaraguensis</i>	132	14	16	36	52	14				13.4
<i>hispaniolae</i>	271			1	23	144	92	10	1	15.3
<i>wrayi</i>	584		11	95	277	182	19			14.2
<i>melapleura</i>	100		2	12	53	25	8			14.2

Species	N	Ray 3 spines							Mean
		6	7	8	9	10	11	12	
<i>nicaraguensis</i>	57	1	14	9	15	15	3		8.7
<i>hispaniolae</i>	87				16	48	22	1	10.1
<i>wrayi</i>	232	3	39	112	67	10	1		8.2
<i>melapleura</i>	40		3	23	13	1			8.3

**Table 3. Frequency distribution of number of segments distal to elbow of ray 4a, segments distal to serrae of ray 4p and number of serrae of ray 4p in the *Gambusia nicaraguensis* species group.**

Species	N	Segments distal to elbow of ray 4a					Mean
		3	4	5	6	7	
<i>nicaraguensis</i>	59	8	13	21	13	4	4.9
<i>hispaniolae</i>	87		1	38	48		5.5
<i>wrayi</i>	232	28	163	41			4.1
<i>melapleura</i>	40	1	30	8	1		4.2

Species	N	Segments distal to serrae of ray 4p					Mean
		3	4	5	6	7	
<i>nicaraguensis</i>	58		5	32	17	4	5.3
<i>hispaniolae</i>	87		15	63	9		4.9
<i>wrayi</i>	230	28	148	54			4.1
<i>melapleura</i>	40		22	16	2		4.5

Species	N	Serrae of ray 4p					Mean
		3	4	5	6	7	
<i>nicaraguensis</i>	58		14	38	6		4.9
<i>hispaniolae</i>	87	1	36	44	6		4.6
<i>wrayi</i>	233	8	124	86	14	1	4.5
<i>melapleura</i>	40		21	15	4		4.6

Table 4. Frequency distribution of total vertebrae and number of caudal fin elements on hypural plate in the *Gambusia nicaraguensis* species group.

Species	N	Total vertebrae					Mean	
		30	31	32	33	34		35
<i>nicaraguensis</i>	47	11	35	1				30.8
<i>hispaniolae</i>	40		6	34				31.8
<i>wrayi</i>	50			11	38		1	32.8
<i>melapleura</i>	47		1	15	31			32.6

Species	N	Caudal fin elements on hypural plate						Mean	
		8	9	10	11	12	13		
<i>nicaraguensis</i>	45	45						8.0	
<i>hispaniolae</i>	40		1	39				9.0	
<i>wrayi</i>	50			44	6			9.1	
<i>melapleura</i>	47					34	12	1	11.3

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National Naval Medical Center  
Bethesda, Maryland 20014