

Cichlasoma loisellei, a new nandopsis group cichlid fish from Central America

William A. Bussing

Escuela de Biología & Centro de Investigación en Ciencias del Mar y Limnología (CIMAR), Universidad de Costa Rica

(Rec. 26-II, 1988 Acep. 21-II-1989)

Abstract: A fish formerly considered a southern variant of *Cichlasoma friedrichsthalii* is described as new. The species inhabits Atlantic versant drainages from the Río Negro, Honduras to coastal drainages of western Panama and Pacific-slope drainages of Nicaragua. Mature *Cichlasoma loisellei* are distinguished by the broad lateral stripe from the vertical-barred *C. friedrichsthalii*. The latter is known from Belize, Guatemala and southern Mexico.

The present report provides a name for a wide-ranging Central American cichlid that is not uncommon in museum collections and has become popular in the aquarium trade in the USA and Europe.

The species was first noted in the literature not as an undescribed form, but as *Cichlasoma friedrichsthalii* (Heckel) from Costa Rica (Meek, 1914). Considerable confusion has existed regarding the validity of the various large-mouthed cichlids commonly called "guapotes" because of the intrinsic meristic and proportional similarity of the species and the variety of color phases of each due to differences in sex, age, disposition and geographic locality. Regan's keys (1905; 1906-08) to the four commonly confused species [*Cichlasoma friedrichsthalii*, *motaguense* (Günther), *managuense* (Günther) and *dovii* (Günther)] were based on few specimens and hence are unreliable. Moya (1979) concluded that all aforementioned species are valid and provided a key for preserved material, but she did not recognize *C. loisellei* as distinct from *C. friedrichsthalii*. Regan (1905) created the subgenus *Parapetenia* to include species of *Cichlasoma* with enlarged jaws and slightly to strongly enlarged anterior canines. Kullander (1983) noted that *Nandopsis* Gill 1862 has priority over *Parapetenia* Regan, 1905 because the type species of each is the same.

MATERIAL AND METHODS

All measurements refer to standard length (SL) in millimeters. Body measurements in per mille of SL appear in Table 1. The last two dorsal and anal rays are counted as one only when their bases touch; when the base of the last ray is not touching the penultimate ray, each ray is counted separately. Other counts and measurements follow the standard procedures defined by Hubbs and Lagler (1958).

The type specimens and comparative materials are deposited in the Academy of Natural Sciences of Philadelphia (ANSP), Natural History Museum of Los Angeles County (LACM), Florida State Museum (UF and UF/FSU), Museum of Zoology of the University of Michigan (UMMZ), Museo de Zoología, Universidad de Costa Rica (UCR) and the National Museum of Natural History (USNM).

Cichlasoma loisellei, new species

Cichlasoma friedrichsthalii, (not Heckel) Meek, 1914, (Costa Rica); Caldwell, 1959 (Costa Rica); Miller, 1966 (in part; to Costa Rica); Bussing, 1967 (Costa Rica); Gilbert & Kelso, 1971 (Costa Rica); Martin, 1972 (in part; Honduras); Astorqui, 1972 (Nicaragua); Bussing, 1976 (San Juan drainage); Mayland, 1978, 1984 (in

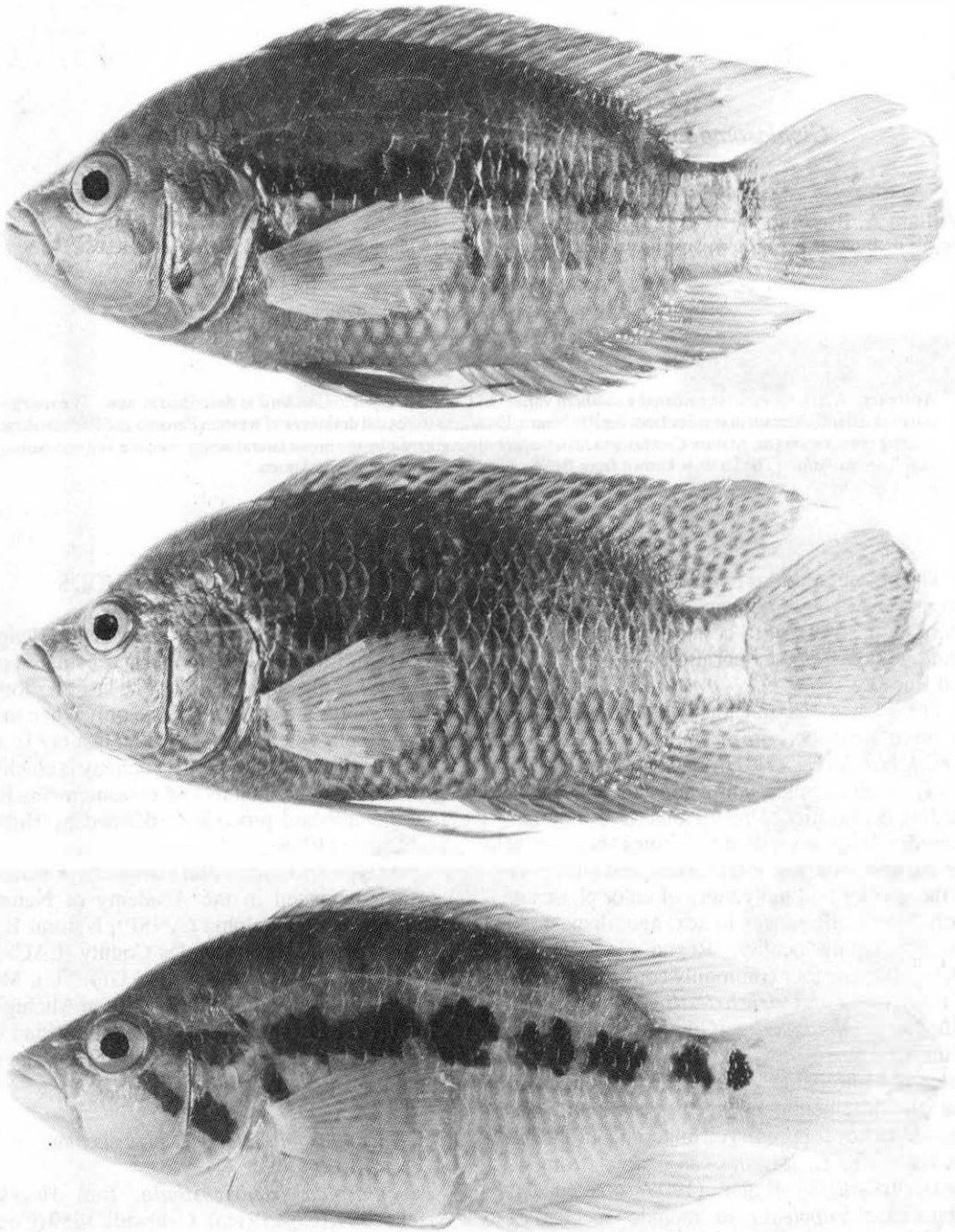


Fig. 1 *Cichlasoma loisellei*, new species. Above: Female paratype, 111 mm (UCR 1852-10) Río Tortugero drainage, Costa Rica. Middle: Male paratype, 145 m (UCR 1852-10) Río Tortugero drainage. Below: Female paratype, 106 mm (UCR 1590-1) Río Plátano drainage, Honduras.

part; to Costa Rica); Moya, 1979 (in part; Honduras to Panama; Fromm, 1981 (Panama); Villa, 1982 (Nicaragua); Stawikowski & Werner, 1985 (color plates, provenance unknown).

Cichlasoma "friedrichsthalii", Werner, 1983 (formerly called *C. managuense* in Germany; color plates).

Cichlasoma motaguense, (not Günther) Behre, 1928 (Panama); Hildebrand, 1938 (Panamá); Loiselle, 1980 (color plates; Nicaragua); Mayland, 1984 (color plate; Nicaragua).

Cichlasoma sp. B, Lofin, 1965 (Panama).

Cichlasoma sp., Bussing, 1987 (color plates; Costa Rica).

Holotype: LACM44405-1, adult male, 123.0 mm SL from Río San Miguel, a tributary of Río Matinaon road to Puerto Limón (elevation 12 m), Limón Province, Costa Rica. Original collection number UCR 1126-8, taken 30 Sep. 1977 by W. Bussing, Klaus Gocke and ichthyology students.

Paratypes: See Appendix.

Diagnosis: A rather large species of *Cichlasoma* belonging to the group of large-mouthed, canine-toothed "guapotes" of the *Nandopsis* section of *Cichlasoma*. The species is distinguished from lower Central American members of the section by the long maxillary reaching to the anterior margin of the eye, the well-developed canines, XVI-XVIII, 9-12 (modally XVIII, 10) dorsal-fin elements and VII-IX, 7-10 (modally IX, 9) anal-fin elements. *C. loisellei* usually has eight or nine anal-fin spines, whereas *C. dovii*, *managuense* and *motaguense* usually have six or seven spines. In addition *Cichlasoma managuense* has a lobe at the angle of the preopercle and highertotal gill-raker counts (14 or 15 vs. 10-13); *C. motaguense* and *C. dovii* both have more longitudinal scales (31-35 vs. 27-31 for *C. loisellei*). Mature *C. friedrichsthalii* differ in coloration, black vertical bars on the flanks extending nearly to the ventral midline and typically a round black blotch on midsides above the anal-fin origin; smaller blotches are often present on midsides overlapping the vertical bars. This contrasts with the broad black lateral band pattern of *C. loisellei* which in adult specimens shows little or no evidence of vertical bars; bars if present are usually confined to the dorsal half of the body.

Description: Body moderately deep, deepest in young. Dorsal profile of head straight in

young, becoming concave over eye with age. Nape slightly more pronounced in large males, but not as in *C. dovii*; dorsal and ventral profiles similar; moderately convex posterior to nape and isthmus. Caudal peduncle depth slightly greater than peduncle length.

Head deep; mouth turned upward, lower jaw projecting slightly in advance of premaxillaries; maxillary reaching nearly to vertical from anterior margin of eye. Fold of lower lip without frenum. Interorbital space convex, least bony width less than snout length. Horizontal orbit diameter greater than snout length in young, becoming less than snout length with age.

Jaw teeth conical, without posterior cusps, recurved and brown-tipped; round in cross section at all ages. Each jaw with one enlarged outer tooth row and a band of minute inner teeth. Anterior pair of teeth in upper jaw enlarged as canines; remaining teeth on each side (11-14) of outer row decreasing in size posteriorly. Anterior pair of teeth in lower jaw not enlarged, but following two or three on each side canine-like; remaining 11-12 teeth on each side decreasing in size posteriorly. Lower pharyngeal bone of a 127-mm specimen with a toothed area 1.5 times broader than long; six tooth rows anterior to posterior, the latter row containing 22 teeth. Teeth of median two rows, especially posteriorly, massive, compressed, with a shoulder, the major cusp curved; lateral and anterior teeth progressively smaller, all with brown tips and most with a low minor cusp.

Gill rakers short and expanded. One to three small rakers on upper limb; total rakers on first arch 10 (6), 11 (25), 12 (43), 13 (6); holotype 2 + 9/2 + 10.

Upper lateral line beginning above upper margin of gill opening, following curve of dorsal profile and terminating below first soft dorsal fin rays, pored scales 17 (9), 18 (30), 19 (27), 20 (10), 21 (4); holotype 19/20. Lower lateral line usually beginning below penultimate pored scale of upper lateral line and continuing to end of hypural complex, pored scales 8 (4), 9 (12), 10 (59), 11 (85), 12 (58), 13 (15), 14 (1); holotype 12/11. Scales in longitudinal series from upper margin of gill opening (*i.e.*, row below upper lateral line) to end of hypural complex 26 (3), 27 (4), 28 (62), 29 (82), 30 (80), 31 (10); holotype 29/30. Regan's longitudinal scale series 25 (2), 26 (1), 27 (6), 28 (25), 29 (29), 30 (9), 31 (5); holotype 31/31. Transverse scale rows between origin of dorsal fin and lateral line 3 (3), 4 (77); holotype 4/4.

Transverse scale rows between origin of anal fin and lateral line 8 (1), 9 (133), 10 (117), 11 (4); holotype 9/9. Scale rows around caudal peduncle of holotype approximately 17. Horizontal scale rows on cheek of holotype about 6/6.

Origin of dorsal fin over posterior margin of opercle, dorsal spines XV (1), XVI (5), XVII (69), XVIII (78); dorsal soft rays 9 (8), 10 (48), 11 (15), 12 (9); holotype XVII, 11. Dorsal-fin spines progressively longer posteriorly (Table 1). Extreme posterior tip of dorsal and anal soft-pointed in large specimens, filamentous in males. Anal-fin spines 7 (6), 8 (34), 9 (40); anal soft rays 7 (2), 8 (33), 9 (42), 10 (3); holotype IX, 8. Pectoral-fin rays (excluding minute splint on upper ray) 13 (4), 14 (76); holotype 14/14. Pelvic-fin rays I,5; holotype I,5. Caudal fin rounded, principal rays (branched rays plus two) 16, rarely 17; holotype 16.

Color in life: The ground color above is golden brown to gray turning to silvery below, the sides and belly becoming golden or yellowish during the breeding period. A series of large black quadrangles, becoming irregular anteriorly, form a prominent discontinuous band from eye to base of caudal fin. Two other conspicuous black markings form a broken band from eye to lower opercle; another black marking is mostly hidden in the pectoral axil. Up to eight dark vertical bars are apparent on fry and may appear at times as diffuse markings on older juveniles (<80 mm SL) and occasionally on the upper flanks of adults. The pectoral fins are transparent, the pelvics dusky with darker leading edges. Excellent color plates of *C. loisellei* were published in Bussing (1987: 221,223), as *C. motaguense* in Loiselle (1980: 46) and as "alten *managuense*" in Werner (1983: 399); color plates of *C. friedrichsthalii* appear in Loiselle (1980: 46) and Mayland (1984: 182).

Sexual dichromatism is first evident at about 100 mm SL: dark spotting is present on the interradiated membranes of soft dorsal rays and base of caudal rays in young and as the male matures this extends to cover the entire dorsal and caudal fins and the soft anal rays (dark streaks appear between anal spines); developing females lose the spotting or retain a few diffuse spots on the soft dorsal. A spotted pattern formed by a square spot on each scale and a vermicular pattern on the head appears first on the lower flanks and head and later the dorsum of large males. The la-

teral stripe on mature females is set off further by a contrasting iridescent yellow border paler than the yellow or golden ground color of the flanks. Loiselle (pers. comm.) noted that the characteristic golden yellow body and fin coloration is particularly pronounced in ripe females and it pales considerably in parental individuals of both sexes.

Sexual dimorphism: In addition to dichromatism, males also exhibit longer pelvic-fin filaments than females. The male urogenital papilla is conical with a bifid, somewhat ragged tip and a terminal opening. The female papilla is stouter with a large ventral aperture bordered by crenulate folds revealing several small internal papillae in larger females. The largest specimens in most collections were males. A 191-mm SL male specimen from the Sixaola drainage was the largest collected; a large female from Tortuguero measured 130 mm SL. Loiselle (pers. comm.) reported ripe females with distended ovipositors at 80 mm SL from the Río Cocolis in the Sixaola drainage.

Etymology: The species is named for Dr. Paul V. Loiselle, long-time cichlid specialist, who has dedicated himself to the study of all aspects of cichlid biology involving African as well as Neotropical species. Loiselle some time ago christened this fish the "guapote amarillo" (yellow guapote).

Ecological aspects: Although *C. loisellei* is sympatric with two other *Nandopsis*, *C. dovii* and *C. managuense*, it maintains separate territories, choosing the sluggish water of streams, backwaters and swamps. *C. dovii* is often found in moderately swift waters, whereas *C. managuense*, although occasionally found in streams, is basically lacustrine, being the dominant guapote in Lake Nicaragua as well as in other lakes where introduced. The guapote amarillo is somewhat less piscivorous than other guapotes, preferring aquatic and terrestrial insects, and only occasionally taking fish.

Distribution: *C. loisellei* is known from suitable lowland habitats on the Atlantic versant from the Río Negro in eastern Honduras (Martin, 1972) as far south as the coastal drainages of Laguna de Chiriquí in western Panama (Loftin, 1965). On the Pacific slope it is found in the Río

Tamarindodrainage (Villa, 1982). In recent years the species has been introduced, probably inadvertently with the larger guapote *C. dovii*, to ponds on the Pacific versant of Costa Rica at San Isidro de El General in the south and Monteverde in the north. Other probable introductions to the Pacific slope include the Río Coto Colorado in extreme southeastern Costa Rica (Loiselle, pers. comm.) and the headwaters of the neighboring Río Chiriquí Viejo in Panama (as *C. friedrichsthalii*; Fromm, 1981). Some guapote populations of the Atlantic slope of western Honduras and the Río Choluteca, Pacific slope, were not assigned to species and are discussed below.

REMARKS

C. loisellei possesses considerable intraspecific meristic variation which overlaps the parameters of material of *C. friedrichsthalii* from the Petén, Guatemala (Table 2). Nevertheless, the courting and parental coloration of the Belizian and Petén populations is strikingly and consistently different from that of the form inhabiting Costa Rica (Loiselle, pers. comm.). On the basis of preserved material it is evident that specimens from Nicaragua and eastern Honduras share the same color pattern with Costa Rican fishes and are therefore considered conspecific.

Trewavas (1983) in her study of tilapiine cichlids stated "...Where territorial coloration is distinctive it has been regarded as indicative of a degree of reproductive isolation and the respective populations have been treated as species." She cites the example of *Oreochromis mossambicus* and *O. mortimeri*, of the Lower and Middle Zambezi respectively, in which only the black body and fins and white lower head of male *O. mossambicus* serve to distinguish it. Likewise coloration is almost the only distinction between *O. mossambicus* and *O. spilurus*, two allopatric species. Trewavas is influenced by coloration to the degree that "When this is similar in two populations I have allowed it to over-ride meristic differences." Likewise, I feel the distinctive meristics of *C. loisellei* from the Sixaola drainage reflects its relative isolation from populations just to the north, but because of its similar color pattern the population does not merit taxonomic recognition.

Some guapotes collected in Lago de Yojoa (UMMZ 188132 and 188276) and lower portions

of the Río Ulúa drainage (UMMZ 173170) appear to be *C. friedrichsthalii* on the basis of the color pattern of large specimens and others (numerous collections at LACM) appear to be intergrades with *C. motaguense* and thus require further study. Species identification of other *Nandopsis*, mainly small individuals, from the Ulua-Chamelecón region and the Río Choluteca drainage on the Pacific slope is uncertain and consequently the material is not included here as type specimens. *C. motaguense* is also present in the Ulúa drainage (Martin, 1972) and just to the north in the Río Motagua drainage (UMMZ 190579, 190722, 193883, 197293, 197373). R.R. Miller (pers. comm.) has also identified *C. managuense* (UMMZ 197323 and 197347) from the Motagua and considers its presence an introduction by human agency; the spotty distribution in Honduras (Martin, 1972) of this species of aquacultural importance could also be attributed to human activity. Neither *C. loisellei* nor *C. friedrichsthalii* have been collected in the Río Motagua drainage and R.R. Miller (pers. comm.) considers their presence unlikely. Since Miller (1907) considered *Heros motaguensis* and *H. managuensis* synonyms of *Heros friedrichsthalii* his report of the latter in the Río Motagua is subject to doubt, as is Fowler's (1936) brief color description of *C. friedrichsthalii* from the Motagua.

It is not surprising to find the zone of concurrence of *C. loisellei* and *friedrichsthalii* located in a region which represents a significant ichthyofaunal discontinuity (Bussing, 1976:157). Several other cognate species replace one another in this region which in the past was submerged by the Chapayalseaway and persisted until Pliocene times as the Amatique Basin (*op. cit.*, 163).

The true *C. friedrichsthalii* certainly occurs in Belize (Loiselle, 1980); the southernmost record being the specimens that R.R. Miller (pers. comm.) identified from Hector Creek in the Sibún River drainage south of Belize City (UMMZ 202902). Thus, for the moment the status of the *Nandopsis* which inhabit the rivers between central Belize and western Honduras is uncertain.

There has been some uncertainty regarding the precise type locality of *C. friedrichsthalii*. Günther (1868:382) reported that after Heckel described *Heros friedrichsthalii* from "Central-Amerika", most of Baron von Friedrichsthal's Central American material remained unpub-

lished until Steindachner (1864) determined four other species, all known from Lake Petén, Guatemala. Thus, Günther, and later Regan (1905; 1906-08), cited Lake Petén as the type locality, which seems the most plausible conclusion. Hubbs (1935) identified specimens of *C. friedrichsthalii* from Central Petén, Guatemala and commented on their similarities with *C. motaguense* and *C. multifasciatum* Regan, although he considered *C. managuense* distinct. He also mentioned that Jordan and Evermann (1898) restricted the type locality of *C. friedrichsthalii* without warrant to Río San Juan, outlet of Lake Nicaragua.

Heckel's (1840) color description of *H. friedrichsthalii* provides further evidence that his specimen was from northern Central America. He described a fish with six wide blackish vertical bars, four of which split into two above the lateral line. This rules out the possibility that *friedrichsthalii* could be applied to the form herein described as *C. loisellei* from southern Central America. Incidentally, the spotted vertical fins also indicate the specimen was a mature male although the size was not mentioned by Heckel.

RESUMEN

Se describe como nueva una mojarra anteriormente considerada como la raza surcña de *Cichlasoma friedrichsthalii*. Ejemplares maduros de *C. loisellei* se distinguen por su coloración -una franja lateral ancha de color negro, mientras que la verdadera *C. friedrichsthalii* presenta 10 a 12 barras negras verticales en los costados. La nueva especie habita entre el río Negro, Honduras y Panamá occidental. Se confirma que *C. friedrichsthalii*, descrita por Heckel como procedente de "Central Amerika", en realidad proviene del Petén, Guatemala y habita entre el sur de México y Belice.

ACKNOWLEDGMENTS

I appreciate the comments of those persons familiar with live guapotes, especially Dr. Paul V. Loiselle and Mr. Uwe Werner, for their concern in putting things in order. I am grateful to the staffs of ANSP, UF, LACM and USNM for facilities provided, to Dr. David Greenfield for sending color transparencies of Belice specimens and to collectors too numerous to mention who

contributed the study material used here. Special thanks go to Dr. R.R. Miller who through copious correspondence, exchange of UMMZ specimens and a review of an earlier manuscript version, contributed valuable opinions and information.

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Paratypes: Abbreviations are spelled out when used for the first time. The elevation of each locality is given in meters (m) and distances are expressed in kilometers (km). Collections are listed by principal drainage basins beginning in Honduras and proceeding southeastward to Panama: following the collection date is the number of specimens in parentheses and size range in millimeters standard length.

HONDURAS (Atlantic versant)

Independent drainages between Río Negro and Río Aguan: LACM 31008-12: Stream 48 km E of Trujillo, 16 Aug. 1969 (22) 10-168 mm. LACM 31009-14: *ibid.* (3) 20-62 mm.

Río Negro Basin: UCR 1614: Tributary of Río Paulaya, Mar. 1983 (2) 71.5-78.2 mm. UCR 1615: *ibid.* (5) 31-62 mm.

Río Platano Basin: UCR 1421-5: Shores and backwaters, Río Platano, 7 Dec. 1981 (3) 60-115 mm. UCR 1419-3: *ibid.* 5 Dec. 1981 (3) 71-132 mm. UCR 1415-12: *ibid.* 16 Dec. 1981 (12) 35-127 mm. UCR 1593-1: *ibid.* 23 Jan. 1983 (2) 59-79 mm. UCR 1603-1: *ibid.* 20 Jan. 1983 (3) 41-119 mm. UCR 1590-1: Quebrada Baltituk, 21 Jan. 1983 (6) 42-146 mm. UCR 1591-1: Quebrada Sulwala, 20 Jan. 1983 (3) 36-112 mm. UCR 1633-1: Crique "Bullit", 10 Apr. 1983 (16) 31-84 mm. UCR 1599-1: Laguna Tingnitara, 17 Jan. 1983 (1) 80 mm. UCR 1605-1: Canal near Laguna Tingnitara, Jan. 1983 (1) 61 mm. UCR 1607-1: Laguna Irans, 19 Feb. 1983 (1) 90 mm.

Río Patuca Basin: LACM 32327-1: Río Ribra, 27 Feb. 1969 (17) 43-165 mm. UCR 516-5: Río Ribra (35 m) 14 Mar. 1970 (9) 46-116 mm.

Río Coco Basin: LACM 32459-3: Quebrada de Aeropuerto, 15 Mar. 1970 (2) 37-38 mm.

NICARAGUA (Atlantic versant)

Lake Nicaragua Basin: USNM 44176: San Carlos (31 m) 26 Feb. 1892 (1) 107 mm. UCR 24-7: Isletas de Granada (31 m) 6-10 Apr. 1966 (1) 116 mm.

Río San Juan Basin: UCR 1054-4: Río Poco Sol (35 m) 6 Jan. 1977 (18) 23-106 mm. UCR 1052-2: Caño Santa Rosa (40 m) 5 Jan. 1977 (38) 16-157 mm. UMMZ 203898 (ex UCR 1052-2) (8) 58-88 mm. UCR 1003-3: Río Sábalo (40 m) 2 Aug. 1976 (2) 20-35 mm. UCR 1062-5: Quebrada La Tigra (20 m) 8 Jan. 1977 (7) 19-68 mm. USNM 39920: 20 miles upriver Río San Juan (<20 m) 20 Dec. 1888 (1) 117 mm. USNM 44182: Greytown (= San Juan del Norte) 2 Apr. 1892 (3) 35-40 mm.

NICARAGUA (Pacific versant)

Río Tamarindo Basin: UCR 464-3: Tributary of Río Tamarindo (50 m) 14 Oct. 1967 (1) 73 mm. UCR 477-2: Río Tamarindo (50) 18 May 1970 (1) 116 mm.

COSTA RICA

Lake Nicaragua Basin: UCR 122-13: Río Sapoá (40 m) 19 Jan. 1967 (2) 38-44 mm. UCR 124-8: Río Las Vueltas (60 m) 20 Jan. 1967 (4) 66-86 mm. UCR 248-9: Río Muerto at Upala (50 m) 26 Apr. 1968 (35) 23-96 mm.

Río San Juan Basin: UCR 264-4: Tributary of Río Platanar (70 m) 1 Sep. 1968 (27) 42-171 mm. UCR 1063-3: Caño El Jardín (50 m) 8 Jan. 1977 (28) 32-122 mm. UCR 769-9: Río Puerto Viejo (35 m) 17 Apr. 1973 (1) 71 mm. LACM 9198-1: *ibid.* 21 Nov. 1962 (6) 22-59 mm. LACM 9191-9: *ibid.* 29 Sep. 1962 (1) 21 mm. LACM 9192-6: *ibid.* 29 Sep. 1962 (1) 72 mm. LACM 9182-6: *ibid.* 17 Jul. 1962 (1) 21 mm. LACM 9159-9: *ibid.* 17 Apr. 1962 (1) 47 mm. LACM 9230-5: *ibid.* 5 Dec. 1962 (3) 34-84 mm. LACM 9155-5: *ibid.* 9 Abr. 1962 (10) 27-104 mm. LACM 9165-1: *ibid.* 11 May 1962 (12) 19-85 mm. UCR 1074-7: Río Colorado (5 m) 10 Oct. 1976 (1) 35 mm.

Río Tortuguero Basin: UF 11050: Tortuguero Lagoon, 11-13 Aug. 1963 (16) 23-98 mm. UF 11059: *ibid.* 12 Aug. 1963 (1) 30 mm. UF 11077: *ibid.* 14 Aug. 1963 (7) 87-128 mm. UF 11112: *ibid.* 18 Aug. 1963 (8) 59-128 mm. UF 11133: *ibid.* (3) 41-74 mm. UF 11189: *ibid.* 25 Aug. 1963 (3) 53-79 mm. UF 5798: *ibid.* 13 July 1956 (3) 21-64 mm. UF 7166: *ibid.* 30 Jul 1958 (1) 96 mm. UF 5816: *ibid.* 2 Sep. 1956 (2) 144-153 mm. UF 7128: *ibid.* 2 Aug. 1958 (3) 28-117 mm. UF/FSU 17665: *ibid.* 16 Aug. 1969 (1) 90 mm. UF/FSU 17615: *ibid.* 13 Aug. 1969 (2) 28-95 mm. UCR 1757-6: *ibid.* 2 Mar. 1985 (1) 58 mm. UCR 1763-3: *ibid.* 13 Mar. 1985 (4) 41-91 mm. UCR 1772-4: *ibid.* 30 Mar. 1985 (1) 53 mm. UCR 1784-8: *ibid.* 5 Apr. 1985 (3) 58-74 mm. UCR 1786-2: *ibid.* 18 Apr. 1985 (3) 27-41 mm. UCR 1790-4: *ibid.* 5 Jun. 1985 (2) 25-39 mm. UF 11031: Tributary to Tortuguero Lagoon, 10 Aug. 1963 (6) 95-175 mm. UF 11090: *ibid.* 17 Aug. 1963 (4) 60-112 mm. UF 11152: *ibid.* 22 Aug. 1963 (11) 19-135 mm. UF 11170: *ibid.* 29 Aug. 1963 (1) 19 mm. UF 11226: *ibid.* 17 Aug. 1963 (20) 40-160 mm. UF 11248: *ibid.* 26 Aug. 1963 (3) 54-96 mm. UF 16394: *ibid.* 26 Aug. 1963 (5) 20-23 mm. UF 5840: *ibid.* 10 Aug. 1957 (1) 107 mm. UF 5815: *ibid.* 9 Sep. 1956 (2) 124-158 mm. UF/FSU 17699: *ibid.* 18 Aug. 1969 (13) 73-147 mm. UF/FSU 17710: *ibid.* 18 Aug. 1969 (11) 34-141 mm. UF/FSU 17680: *ibid.* 17 Aug. 1969 (28) 20-52 mm. UF/FSU 17731: *ibid.* 18 Aug. 1969 (2) 90-65 mm. UCR 1860-1: *ibid.* 17 Apr. 1987 (1) 146 mm. UCR 1765-1: *ibid.* 19 Mar. 1985 (4) 94-135 mm. UCR 1771-5: *ibid.* 26 Mar. 1985 (5) 23-73 mm. UCR 1785-1: *ibid.* 17 Apr. 1985 (3) 95-101 mm. UCR 1809-3: *ibid.* 18 Jun. 1985 (3) 39-90 mm. UCR 1810-5: *ibid.* 21 Jun. 1985 (2) 54-78 mm. UCR 1852-10: *ibid.* 13 Mar. 1985 (3) 111-148 mm.

Río Parismina Basin: UCR 1787-3: Laguna Jalova N of Parismina rivermouth, 2 May 1985 (1) 106 mm. UCR 1805-7: *ibid.* 5 Jun. 1985 (6) 15-105 mm. UCR 1807-2: *ibid.* 6-8 Jun. 1985 (1) 57 mm. UCR 1855-2: *ibid.* 18 Mar. 1985 (1) 129 mm.

Río Matina Basin: UCR 1014-19: Río Escondido (12 m) 17 Sep. 1976 (19) 28-75 mm. UCR 804-4: Canal nearmouth of Río Maína (2 m) 12 Apr. 1974 (23) 22-102 mm. UCR 1126-8: Type locality, Río San Miguel (12 m) 30 Sep. 1977 (14) 25-124 mm. UCR 1294-3: Río Cuba (12 m) 5 Oct. 1979 (65) 20-141 mm. UCR 1351-5: Río Cuba (12 m) 25 Sep. 1981 (77) 23-151 mm.

Río Moin Basin: UCR 214-4: Quebrada Chocalate (15 m) 20 Oct. 1967 (1) 109 mm. ANSP 140659: Stream 7 km W of Limón, 20 Feb. 1978 (2) 46-67 mm.

Río Gandoca Basin: UCR 1838-6: Tributary of Río Gandoca (<5 m) 18 Mar. 1986 (1) 39 mm.

Río Sixaola Basin: UCR 1141-7: Tributary of Quebrada Blei (60 m) 13 Nov. 1977 (2) 64-91 mm. UCR 1142-8: *ibid.* (2) 47-60 mm. UCR 1143-2: *ibid.* (5) 21-104 mm. UCR 1298-3: *ibid.* 6 Oct. 1979 (5) 41-72 mm. UCR 1298-3: *ibid.* 6 Oct. 1979 (5) 41-72 mm. UCR 1144-3: Río Cocolis (40

m) 13 Nov. 1977 (24) 20-128 mm. UCR 1299-14: *ibid.* 6 Oct. 1979 (104) 21-154 mm. UCR 1532-6: Laguna Don (15 m) 8 Oct. 1983 (4) 37-48 mm. UCR 279-4: Stream nearmouth of Río Sixaola (10 m) 3 Oct. 1968 (3) 35-107 mm. UCR 281-6: Swamp near mouth of Río Sixaola (1 m) 3 Oct. 1968 (6) 77-191 mm. UCR 282-1: *ibid.* (27) 18-171 mm. UMMZ 203897 (ex UCR 282-1) (8) 37-58 mm.

PANAMA

Río Sixaola Basin: USNM 292828: Tributary of Río Sixaola (25 m) 2 Sep. 1962 (14) 25-122 mm.

Río San San Basin: ANSP 104384: Río San San (5 m) 2 Sep. 1962 (20) 12-72 mm.

Río Changuinola Basin: UF 19745: Río Changuinola 20 Apr. 1965 (9) 38-70 mm. UF 19754: *ibid.* 20 Apr. 1965 (4) 35-72 mm. UF 19760: *ibid.* 21 Apr. 1965 (22) 16-116 mm.

Almirante Bay drainages: USNM 292827: Nigua Creek (5 m) 1 Sep. 1962 (7) 27-85 mm. UF 19720: Stream entering Almirante Bay, 17 Apr. 1965 (11) 33-176 mm. UF 19729: *ibid.* 18 Apr. 1965 (18) 21-142 mm. UF 19734: *ibid.* 18 Apr. 1965 (4) 20-66 mm.

Laguna de Chiriquí drainages: USNM 292826: Río Guanimo at Chiriquicito (55 m) 18 Apr. 1963 (1) 38 mm.

COMPARATIVE MATERIAL OF *C. FRIEDRICHI* ST. HALI

MEXICO

Laguna de Términos drainages: UCR 1826-1: Small lake 16 km NW Escárcega, 9 Nov. 1979 (1) 72 mm.

Río Tulija drainage: UMMZ 209357: Stream 16 km E Palenque, 16 Jul. 1981 (2) 69-109 mm.

GUATEMALA

Petén Basin: UCR 1170-1 (ex UMMZ 1438847): Arroyo de Pueblo Nuevo, 9 Feb. 1935 (8) 32-117 mm. UCR 1171-1 (ex UMMZ 143857): Outlet of Laguna de Petenxil, 20 Feb. 1935 (15) 23-89 mm. UCR 1172-1 (ex UMMZ 143866): Tributary of Laguna de Petenxil, 28 Feb. 1935 (10) 32-88 mm.

Río Usumacinta drainage: LACM 37765-3: Río Ixcán, (1) 97 mm. UMMZ 143868: Arroyo Subín, near La Libertad, 29 May 1935 (11) 28-110 mm. UMMZ 143862: Río San Pedro at El Paso de Caballo, 29 May 1935. UMMZ 143872: Río de la Pasión (=R. Chajmayic) at Ceiba, Alta Veera Paz, 13 Apr. 1935 (4) 86-106 mm. UMMZ 143877: Arroyo Subín tributary of R. de la Pasión, 29 May 1935 (19) 55-157 mm. UMMZ 187965: Río Chajmayic 5 km NE Sebol, 9 Mar. 1968 (11) 28-123 mm. UMMZ 188004: Arroyo Negro, tributary of R. Xachbál near Ixcán, 21 Mar. 1968 (16) 42-110 mm.

BELIZE

Río Hondo drainage: UMMZ 202916: Charco 7 km N Corral (Chetumal), 28 Mar. 1949 (4) 39-96 mm. UMMZ 187182: Cenote Creek, 14 km SE Río Hondo, 14 Mar. 1954 (3) 24-95 mm.

Río Sibún drainage: UMMZ 202902: Hector Creek, 23 Mar. 1949 (1) 74 mm. UMMZ 202897: Quarry Creek, 5 km from Belize, 24 Mar. 1949 (2) 61-79 mm.

TABLE 1

Proportional measurements in per mille of standard length of the holotype and 69 paratypes of Cichlasoma loisellei. Paratypes are from UCR 248-9, 264-4, 282-1, 516-5, 1052-2 and LACM 32327-1

	HOLOTYPE	34 PARATYPES	35 PARATYPES
SL	123.0 mm	25.0-79.0 mm	82.0-174.0 mm
Head length	404	367-493	352-431
Orbit diameter	86	102-62	84-110
Snout length	134	100-162	110-139
Upper jaw length	146	117-202	127-167
Bony interorbital	109	95-152	101-121
Postorbital distance	201	125-264	168-221
Suborbital distance	65	24-62	46-66
Greatest body depth	435	368-512	399-443
Depth caudal peduncle	149	123-181	141-170
Length caudal peduncle	118	121-161	121-154
Predorsal distance	395	363-480	368-429
Preanal distance	650	585-689	598-673
Prepectoral distance	385	342-497	336-418
Prepelvic distance	420	382-483	385-467
Length D fin base	606	518-645	545-616
Length A fin base	331	282-388	279-339
Length 1st D spine	45	41-119	23-78
Length 6th D spine	97	104-206	74-151
Length last D spine	135	110-245	123-174
Length pectoral fin	270	270-433	280-424
Length pelvic fin	413	255-347	245-303

TABLE 2.

Selected meristic features of Cichlasoma friedrichsthalii from Petén and C. loisellei from four parts of its range

	15	16	17	18	19	N	x		
DORSAL FIN SPINES									
<i>fried.</i> - Petén			3	27	3	33	18.0		
<i>lois.</i> - Honduras			10	25		35	17.7		
<i>lois.</i> - Nicaragua			8	36		44	17.8		
<i>lois.</i> - Matina, C.R.			15	15		30	17.5		
<i>lois.</i> - Sixaola, C.R.	1	5	36	2		44	16.9		
LOWER L.LINE	8	9	10	11	12	13	14	N	x
<i>fried.</i> - Petén			8	25	25	5		63	11.4
<i>lois.</i> - Honduras		7	11	10	5	2		35	10.5
<i>lois.</i> - Nicaragua	4	4	34	41	4			87	10.4
<i>lois.</i> - Matina, C.R.		1	13	13	3			30	10.6
<i>lois.</i> - Sixaola, C.R.			11	21	46	13	1	82	11.9
LONG. SCALES	26	27	28	29	30	31		N	x
<i>fried.</i> - Petén			4	20	31	1		56	29.5
<i>lois.</i> - Honduras			2	13	15	3		33	29.6
<i>lois.</i> - Nicaragua	3	4	52	30	1			90	28.2
<i>lois.</i> - Matina, C.R.			7	19	4			30	29.9
<i>lois.</i> - Sixaola, C.R.			1	20	60	7		87	30.2
SCALES BELOW LATERAL LINE	8	9	10	11		N	x		
<i>fried.</i> - Petén			5	51		9	65		10.1
<i>lois.</i> - Honduras				25	16	4	45		9.5
<i>lois.</i> - Nicaragua		1	88	1			90		9.0
<i>lois.</i> - Matina, C.R.			16	14			30		9.5
<i>lois.</i> - Sixaola, C.R.			4	86			90		10.0