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Geographical Distribution of Central American Freshwater Fishes

ROBERT RUSH MILLER

The distribution of freshwater fishes in Central America is reviewed. Major parts of the region, especially in Honduras and Nicaragua, have yet to be explored ichthyologically, and systematic revision of important groups, notably the cichlids, is long overdue. The continental area from the Isthmus of Tehuantepec to the Colombian border contains approximately 456 species, of which over 75% comprise the Cyprinodontidae, Poeciliidae, Cichlidae, and marine invaders (peripheral fishes); about one-third of the latter (57 species) have taken up more or less permanent residence in fresh water. There are 104 primary species in 10 families, 165 secondary forms in 6 families, and 187 peripheral species distributed among 30 families (nearly half of the latter are ariids, atherinids, gerrids, and gobies). Poeciliids and cichlids are particularly rich and diverse, together comprising 139 species. Characins are numerous only in the Panamanian region, into which they and five South American catfish families have recently penetrated. Except for gars, no North American family has reached beyond northern Guatemala. There are no non-ostariophysan primary fishes in the area.

Although our knowledge of the fish fauna approaches adequacy only in the Guatemalan and Panamanian regions, an attempt is made to delimit fish provinces. The best known, the Usumacinta assemblage of southeastern México and northern Guatemala, has been a strong center of evolution. The marked differences between the fishes of this area and those of the Isthmian province, in Costa Rica and Panamá, emphasize that Middle American fishes do not comprise a coherent faunal unit. Other provinces are the impoverished Chiapas-Nicaraguan and the San Juan, the latter notable chiefly for the cichlids of the Great Lakes of Nicaragua. The highlands of southeastern México, Guatemala, and Honduras comprise an ancient land mass with a meager fish fauna in which the primitive cyprinodontid genus *Profundulus* has evolved.

The Middle American fauna, from which most of Panamá should be excluded, is characterized by: (1) the adaptive radiation of the probably autochthonous Poeciliidae; (2) great diversification of the genus *Cichlasoma*, including the evolution of the derived genera *Petenia*, *Neotroplus*, and *Herotilapia*; (3) the likely origin and speciation of *Bramocharax*; (4) the occurrence of numerous freshwater species of marine origin, a development strongly influenced by (5) the paucity of primary freshwater fishes.

INTRODUCTION

MORE than half a century has elapsed since the last attempt was made by an ichthyologist (Regan, 1906–1908) to summarize knowledge of the distribution of freshwater fishes in Central America. Regan included all of México in his treatment but to do so in this paper would unduly complicate and handicap an understanding of the origin and dispersal of what may be appropriately called a Middle American fauna (Miller, 1959:195; Hubbs and Miller, 1960:101).

This fauna, in marked contrast to that of North America (including the Mexican Plateau and the coastal lowlands south to about the Tropic of Cancer), is dominated by the salt-tolerant cyprinodontoids (particularly the poeciliids) and cichlids, and by a diversity of invaders from the sea. These three groups comprise over 75% of the species known to occur in fresh water between the Isthmus of Tehuantepec and Colombia. Within that area there are no minnows, only two suckers, only one North American catfish, and no perches, darters, or sunfishes—which together comprise the bulk of the North American fauna. The abundant marine element, consisting of almost 40% of the species, include some 57 species that are more or less permanent residents of fresh water—a noteworthy feature of the Middle American fish fauna.

Chiefly in the southern part of Middle America, in Costa Rica and Panamá, there is also an abundance of characins and Neotropical catfish families representing, in greatly diluted form, a vanguard from the south of the great Amazonian fauna. One characin genus (*Astyanax*) has succeeded in crossing the whole length of the Middle American bridge to enter Texas, as has the South American cichlid genus *Cichlasoma*. The South American catfish genus *Rhamdia*, family Pimelodidae, has moved up the bridge to southern México (across the Isthmus of Tehuantepec), and a few other ostariophysans have progressed part way across Central America. No North American primary freshwater family has succeeded in moving southward beyond Guatemala, but the salt-tolerant Nearctic gars have managed to reach the Great Lakes basin of Nicaragua–Costa Rica.

AREA COVERED

Although the fishes of the southern termi-

nus of Central America represent a transition between the South and Middle American faunas, all the Panamanian region is arbitrarily included since the area of faunal break has not been clearly delimited. The northern boundary, however, has been determined by the nature of the fish fauna to include the Río Papaloapam on the Atlantic coast and the Río Tehuantepec on the Pacific versant—essentially the Isthmus of Tehuantepec geological province (Maldonado-Koerdell, 1964:Fig. 2).

The Río Coatzacoalcas—the large river just south of the Papaloapam that drains the northern slope of the Isthmus of Tehuantepec—harbors a fish fauna characteristic of the lowland tropical region extending eastward into the Usumacinta basin of Guatemala. The Papaloapam contains essentially the same fauna but with fewer species—including only one of northern origin (*Ictiobus bubalus*) that is not also found in the Coatzacoalcas. In striking contrast is the Río Pánuco, the major drainage next to the north of the Papaloapam, which harbors a fish fauna strongly transitional between tropical and temperate types (Darnell, 1962:351–359).

The Río Tehuantepec likewise marks the northern distributional limit for many of the Pacific tropical forms, including the four-eyed fishes of the family Anablepidae, the pimelodid catfishes, the Synbranchidae, and most of the cichlids.

DISTRIBUTIONAL AND SYSTEMATIC KNOWLEDGE

Although both our distributional and systematic knowledge of the fish fauna of Central America have increased greatly since Regan's work was published, there are still large gaps to be filled. Little is known of the life history and ecology of any of the species—a vacuum that must be filled before we can fully understand the fauna.

Only México and Guatemala have been comparatively well worked, and even in those areas recent collecting has uncovered major ichthyological finds. Most of western Honduras and a large part of northern Nicaragua have yet to be examined by ichthyologists, and even in such small countries as British Honduras and El Salvador exploratory work is needed. Lately a number of ichthyologists have worked in Costa Rica and in the adjoining Great Lakes basin of Nicaragua, and William A. Bussing is completing a doctoral program on Costa Rican fishes.

With the very recent establishment in Costa Rica of the Organization for Tropical Studies, we may anticipate that our knowledge of Costa Rican fishes will be rapidly advanced. Between 1961 and 1965, Horace G. Loftin collected in those areas of Panamá—chiefly east and west of the Canal Zone—that had previously been not at all or very little explored for freshwater fishes. I have examined just enough of his material to recognize that current concepts of distribution and classification of certain fishes occurring near the southern terminus of Central America will need to be considerably revised.

The area treated contains about 456 species of fishes known from fresh and brackish water. This includes 104 freshwater or primary species, 165 secondary species that may tolerate varying degrees of salinity, and some 187 peripheral species—including such kinds as sawfishes, tarpon, anchovies, ariid catfishes, atherinids, gerrids, gobies, and flatfishes. These 187 species are represented by 73 genera in 30 families, whereas the 165 secondary fishes include 34 genera in only 6 families and the 104 primary species are assigned to 43 genera in 10 families (or to 16, if the characins are split). It should be stressed that within some families classified as primary freshwater fishes (i.e., those regarded as strictly confined to fresh water) are species that may be more salt tolerant than are some fishes assigned to the secondary freshwater groups (see, e.g., Darnell, 1962:354; Schwartz, 1964; Marshall, 1965:333). As Middle American examples may be cited the ubiquitous *Astyanax fasciatus*, a primary fish that is known to tolerate brackish water, *Ictalurus furcatus*, a frequent invader of water of low salinity in México, and *Rhamdia wagneri*, the only member of the genus common to South and Middle America and believed capable of dispersing coastwise under favorable salinity conditions (Loftin, pers. comm.).

The major peripheral groups comprise only 5 families (Ariidae, Atherinidae, Gerriidae, Eleotridae, and Gobiidae) that contribute 85 species or nearly half of the total. Although some 31 of the 187 peripheral fishes have taken up permanent residence in fresh water, and about 26 additional species spend much of their lives inland from the sea, most members of this group occur only sporadically or temporarily in fresh water

(commonly in the early life-history stages) and need not concern us here.

The Middle American fish fauna is marked by great richness and diversity of the Poeciliidae and the Cichlidae, which together comprise 84% (139 species) of the secondary fishes and more than half of the combined primary and secondary groups. The Cyprinodontidae and the pimelodid catfishes of the genus *Rhamdia* are also numerous in Middle America, but the characins, while comprising an impressive total of 20 genera and 51 species, number fewer than 10 species north of Costa Rica. In general there is a dearth of primary fishes north of the Nicaraguan–Costa Rican boundary, the reasons for which are explored by Dr. Myers (1966).

The Gymnotidae, derived from a characin stock, are represented by 5 genera and species south of Nicaragua, but only 2 species of a single genus, *Gymnotus*, penetrate as far north as Guatemala.

Five South American catfish families—the Auchenipteridae, Ageneiosidae, Trichomycteridae, Callichthyidae, and Loricariidae—have managed to invade the southern part of the isthmus as far as Panamá or Costa Rica (Fig. 1); but only the loricariids—the largest and probably most specialized of existing catfish families—have numerous representatives there (15 species in 8 genera).

The four-eyed fishes of the family Anablepidae show a curious discontinuous distribution, with one species (*Anableps dowi*) confined to the Pacific slope from the Río Tehuantepec basin of México to the Río Choluteca, Honduras, whereas the other species occur along the Atlantic slope of northern South America (Venezuela to the Amazon).

Our knowledge of the systematics of some of the important groups of Middle American freshwater fishes badly needs overhauling. This is especially true of the cichlids, the last revision of which appeared over 60 years ago (Regan, 1905). I am aware of at least 12 nominal species in México and Guatemala alone that belong in synonymy, and of 10 in the same area that represent undescribed species. It may be questioned seriously whether the widespread genus *Rhamdia* comprises 20 species, and certain characins need re-evaluation before relationships and distributions are well understood. Not infrequently, specific names are based solely on unique specimens which bear such revealing

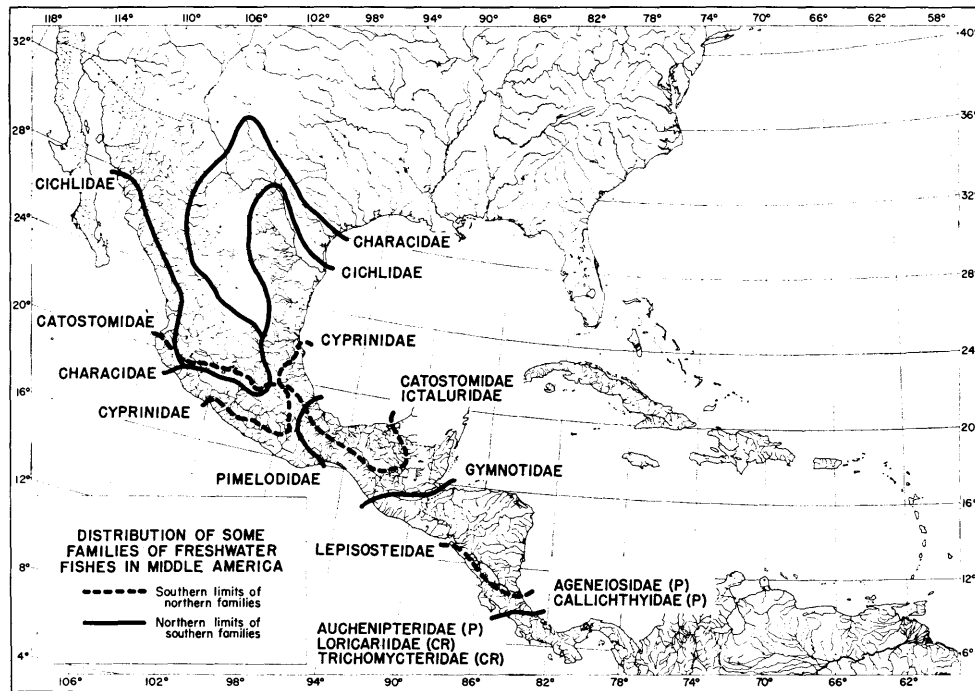


Fig. 1. Distributional limits of certain primary and secondary freshwater fishes in Middle America. A single characin (*Astyanax fasciatus*) and cichlid (*Cichlasoma cyanoguttatum*), representing the tropical families Characidae and Cichlidae, respectively, reach the U. S. The northern limit of the Neotropical Anablepidae (not shown) is the same as that for the Pimelodidae on the Pacific slope. Of 5 South American catfish families 3 range northward only to Panama (P), the other 2 to Costa Rica (CR). The Ictaluridae (like the Cyprinidae) also occur on the SW coast of México in the Río Balsas basin. The Nearctic sunfishes (Centrarchidae) and darters (Percidae) range southward into México only to the north of the Tropic of Cancer (just south of 24°); this is as far as non-ostariophysan families penetrate Middle America.

type localities as "Mexico" or simply "Central America." Proper assignment of names therefore often requires examination of type specimens and these are scattered among the world's museums. Fortunately the poeciliids have recently received a comprehensive review (Rosen and Bailey, 1963) that clears the way for intensive studies of this prolific and diversified group. (For a different interpretation of the limits and divisions of *Gambusia*, see Rivas, 1963.)

Ichthyologically the two best-known countries in Central America are Guatemala and Panamá and it is instructive to compare the composition of their primary and secondary fishes. Each country contains a comparable total number of species and families, 90 species in 11 families in Guatemala and 100 species in 12 families in Panamá. The major difference in composition of the primary

fishes occurs in the characins, of which there are only 6 species in 1 phyletic line in Guatemala but 36 species in 6 phyletic lines in Panamá. The two countries share only a single species of this group—the ubiquitous *Astyanax fasciatus* (which can disperse through brackish water)—although they do have four genera in common (*Astyanax*, *Brycon*, *Hyphessobrycon*, and *Roeboides*). The other notable difference is the occurrence of 5 South American catfish families in Panamá, comprising 20 species, none of which inhabits Guatemala. Gymnotids are also more diverse in Panamá, which has 5 genera, only 1 of which reaches Guatemala.

Among the secondary fishes, the situation is reversed: Guatemala has 70 species in 18 genera and 6 families, whereas Panamá has only 34 species in 15 genera assigned to 4 families. Here the major difference in com-

position is in the cichlids, of which there are 40 species in Guatemala but only 10 in Panamá. (These 10 are represented by 3 genera and 7 species that do not occur in Guatemala.) Although the number of poeciliids in these countries is similar—21 species in Guatemala and 17 in Panamá—only 3 are shared (*Gambusia nicaraguensis*, *Phallichthys amates*, and the ubiquitous *Poecilia mexicana*) and only 3 additional genera (*Alfaro*, *Brachyrhaphis*, and *Poeciliopsis*) have representatives in each area. Both Guatemala and Panamá have 6 species of cyprinodontids, with no species and only the genus *Rivulus* in common.

The major difference in cichlid development has both historical and ecological bases, the former discussed by Myers (1966). Cichlids occupy much the same ecological position in the tropics as do the temperate North American sunfishes. They are carnivorous, herbivorous, or omnivorous, inhabit springs, small creeks, and ponds to large rivers and lakes, from coastal lowlands (including mangrove-bordered lagoons) to mountain highlands, where they are scarce; many of the species are important food fishes. As a group they have been able to adapt to a large variety of habitats. Probably the two most important factors limiting their northward dispersal and altitudinal distribution have been temperature and competition. Their maximum flowering in Middle America occurs in the tropical lowland area of southeastern México and northern Guatemala—a region containing the most voluminous rivers of Middle America.

FISH PROVINCES

Most primary freshwater fishes usually can disperse overland only by physiographic changes of the land, lowering of sea level, or anastomosing of river systems during the high water of the rainy season. Consequently, their distributional patterns as a rule rather closely match those of the major hydrographic systems. The presence of a large and diverse drainage basin—such as the Mississippi in North America or the Amazon in South America—provides the focus for the evolution of a major fish fauna.

As here conceived, a fish province is a region that is characterized by groups of associated species that have similar geographic and ecologic ranges. Endemism is marked,

and some species and genera are autochthonous. There are very restricted species that live in association with widespread ones. Among the latter are those which, by virtue of particularly broad ecological tolerances, extend beyond the confines of a single province and are members of two or more such assemblages. Of the regions tentatively recognized below, only the Usumacinta Province seems firmly established. The number and precise delimitation of other provinces will require a greater knowledge of the fish fauna than is now available.

Usumacinta Province.—The broad hot lowlands of Tabasco in southeastern México receive the waters of the two largest river systems of Middle America: the Grijalva and the Usumacinta. Although widely separated in their upper courses, once they break out of the Chiapas-Guatemalan highlands they form and are joined by large, slowly-moving waters, of rather uniform flow. In their lower courses these rivers comingle in a maze of bifurcating channels and distributaries, oxbows, marshes, and swamps—providing a large area of productive, permanent fish habitats. The Usumacinta system is the major source of the best-marked fish province in Middle America. It includes the area from the Río Papaloapam of southeastern México eastward and southward to the Río Polochic of eastern Guatemala (Fig. 2). It is separable into two major divisions, the Usumacinta-Grijalva and the Papaloapam-Coatzacoalcos, and two lesser ones, the Yucatán Peninsula and the Polochic-Lake Izabal. Excluding the Pacific drainage, this province comprises approximately the northern half of Regan's (1906–08, map 2) provisional Guatemalan Province.

The Usumacinta Province contains well over 200 species in all categories, with 108 species, 29 genera, and 9 families of primary and secondary fishes. Two secondary groups, the cyprinodontoids and the cichlids, comprise approximately 90 species, including a number of endemic and evidently autochthonous genera and a host of endemic species. The province is also distinguished by the large number of marine derivatives (18 species in 11 genera and 9 families) that have taken up permanent residence in fresh water. Among these are the clupeid *Dorosoma anale*, the ariid catfish genus *Potamarius*, a half-beak (*Hyporhamphus mexicanus*), the atherinid genera *Archomenidia* and *Xenatherina*,

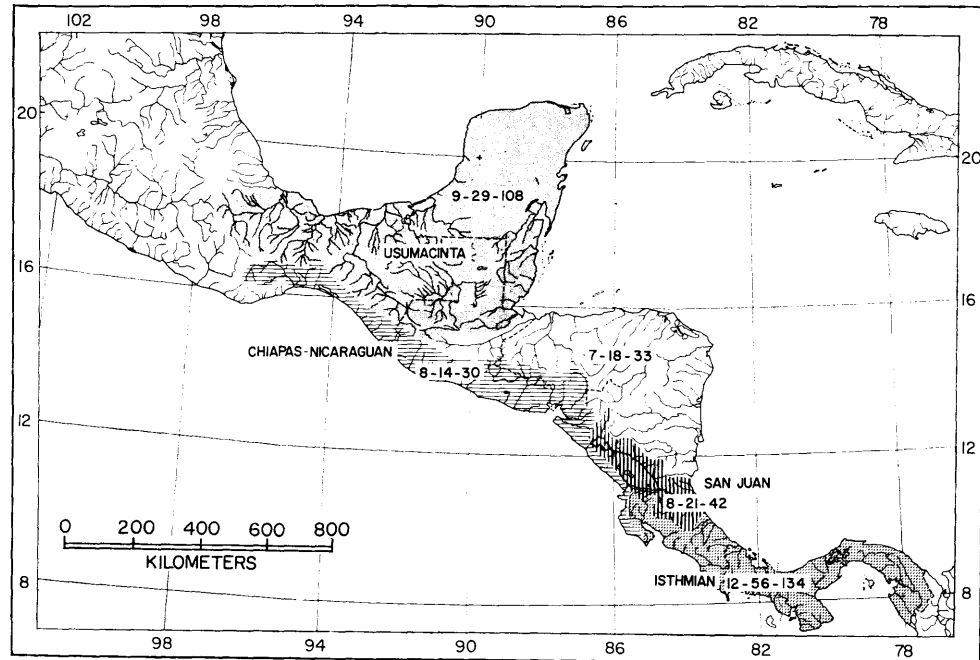


Fig. 2. Tentative arrangement of major fish provinces of Middle America, showing numbers of families, genera, and species of primary and secondary fishes in each area. Insufficient collecting between the Río Motagua (Guatemala) and the Río San Juan (Nicaragua) prevents the delimitation of a province (or provinces) in that region.

the gerrid *Diapterus mexicanus*, eleotrids of the genus *Leptophilypnus*, the toadfish *Batrachoids goldmani*, and the blind brotulid *Typhliasina pearsei*. There is also the blind *Furmastix infernalis*, of the secondary freshwater family Synbranchidae. These latter two cave-inhabiting species are restricted to the Yucatán Peninsula.

Among the poeciliids are no fewer than 4 genera belonging to 2 subfamilies and 3 tribes (*Priapella*, *Carlhubbsia*, *Xenodexia* and a recently discovered cnesterodontine) that are confined to and evidently evolved within the area. *Priapella*, with a species each in the Papaloapam, Coatzacoalcos, and Usumacinta basins, is the most widespread of these autochthonous genera (Fig. 3). Restricted to the province are 23 species in 9 genera that represent all the known tribes of the subfamily Poeciliinae. Included is the distinctive *Heterophallus* group of the tribe Gambusiini, containing a species each in the Coatzacoalcos, Grijalva, and Usumacinta basins. Of the 11 remaining species of poeciliids, 3 are mollies widely distributed both to the north and

south; 2 represent a widespread swordtail and platyfish belonging to a genus (*Xiphophorus*, Fig. 4) that likely originated to the north of the province in the Río Pánuco area; 2 are gambusias (*G. yucatana*, *G. nicaraguensis*), ranging, respectively, north and south of the province; 1 is the widely distributed, salt-tolerant *Belonesox belizanus* (from near Veracruz south to Costa Rica, Fig. 5); another the equally ubiquitous *Heterandria* (*Pseudoxiphophorus*) *bimaculata* (from Veracruz, México to Nicaragua); and 2 are species of *Poeciliopsis* that are more widespread on the Pacific coast of Middle America.

The cichlids are the most speciose group in the Usumacinta Province but are not as diversified as the poeciliids. There are about 44 species in 2 genera, constituting more than half (53%) of the cichlid fauna of Central America and nearly 60% of the species assignable to the genus *Cichlasoma*. One monotypic genus, *Petenia*, is confined to the province, and the distinctive *Thorichthys* division of *Cichlasoma* (Miller and Nelson, 1961; Rivas, 1962) has all but 1 of its 8 or 9

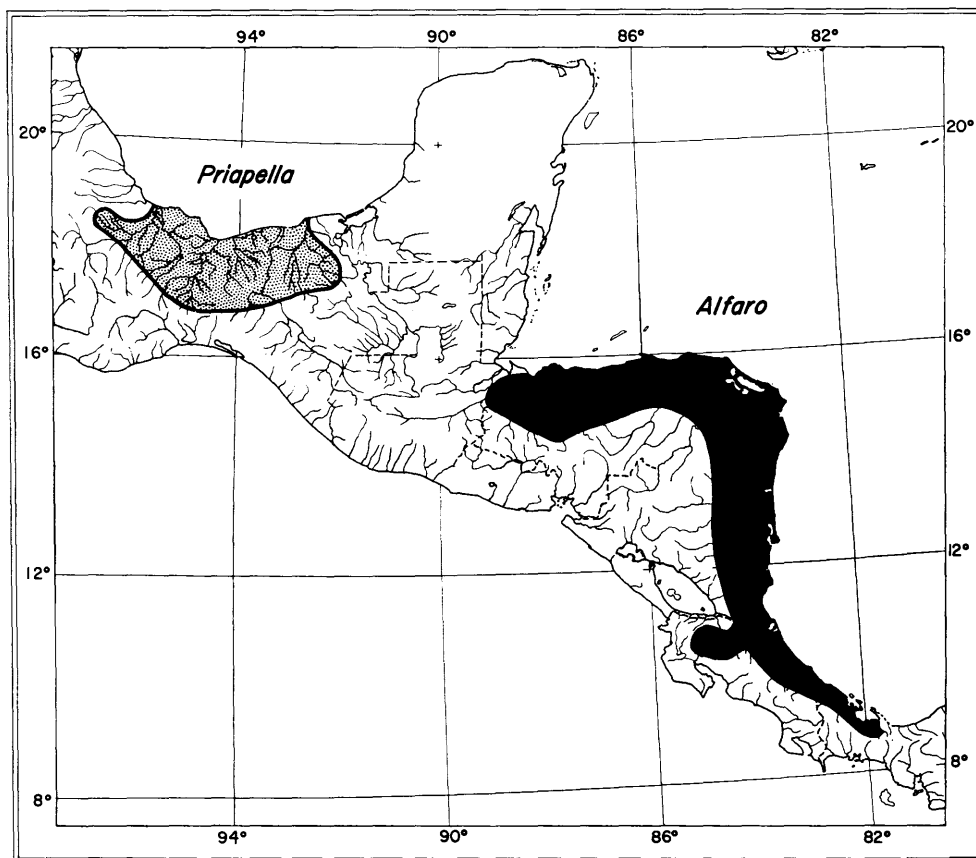


Fig. 3. Distribution of the poeciliid genera *Priapella* (3 species) and *Alfaro* (2 species), modified after Rosen and Bailey (1963). *Priapella* is an example of an autochthonous endemic in the Usulután Province. Except for a crossover in the Tilarán region of Costa Rica, *Alfaro* is restricted to the Caribbean slope; its known southern limit is near the faunal break between the Middle American and South American faunas.

species restricted to the area. Thirty-five of the 44 species are not known to range outside of the province.

Of the remaining 9 species of cichlids 2 (*Cichlasoma maculicauda* and *C. spilurum*) occur as far south as Panamá and it is noteworthy that one of these (*maculicauda*) is usually found near the coast and frequently in brackish water; 2 (*C. friedrichsthalii* and *C. urophthalmus*) range southward to Costa Rica and Nicaragua, and *urophthalmus* occurs in brackish water and on islands adjacent to the coast (e.g., Isla Mujeres, Quintana Roo); 2 others (*octofasciatum* and *robertsoni*) occur southward into northwestern Honduras and *octofasciatum* ranges north to the vicinity of Veracruz City; *Cichlasoma*

fenestratum is distributed northward to the Río Antigua, just north of Veracruz City; *C. guttulatum* is essentially a Pacific slope species, occurring in the province in the Río Coatzacoalcas basin; and *C. aureum* (of the *Thorichthys* group) ranges southward only to the Río Motagua of southeastern Guatemala and adjacent Honduras.

Characins are weakly represented, with only 5 species in 4 genera, but 1 genus (*Bramocharax*) is shared with Nicaragua and Costa Rica.

There are but 3 northern elements represented by 2 species of *Ictiobus*, 1 of *Ictalurus*, and a single gar, *Lepisosteus tropicus*, which also occurs along the Pacific slope of Central America and in the Great Lakes-San Juan

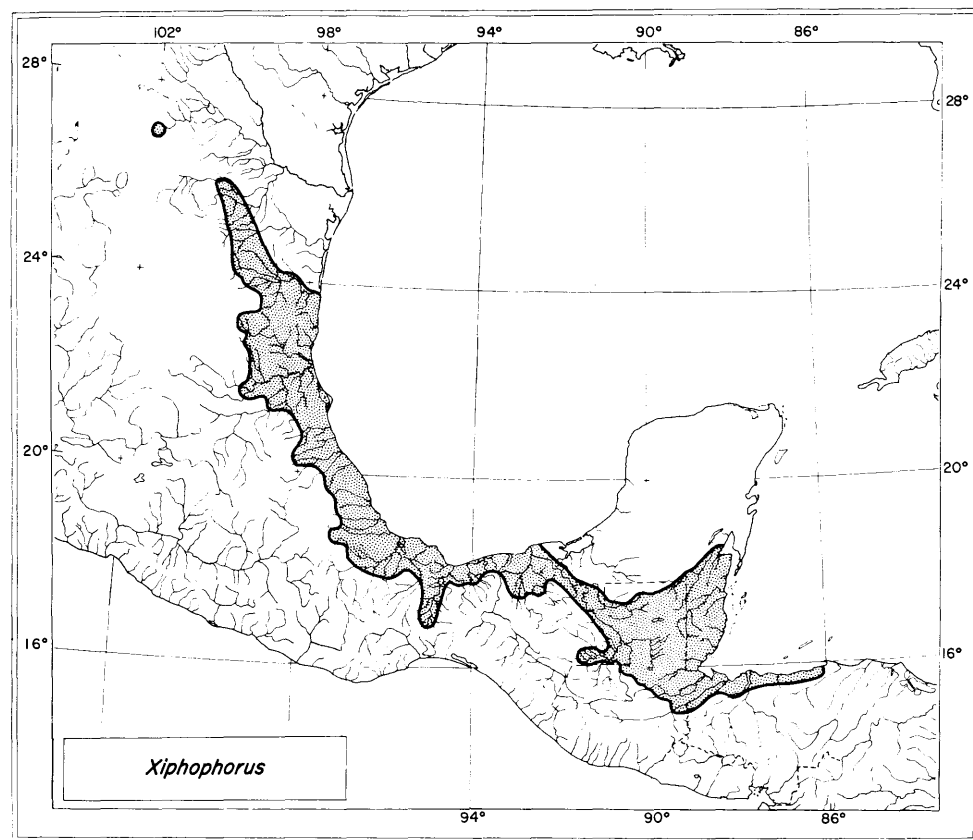


Fig. 4. Distribution of the platyfishes and swordtails, genus *Xiphophorus*, after Rosen and Bailey (1963). Of the 8 or 9 recognized species, 1 each is confined to the Río Papaloapam and Río Coatzacoalcos basins, 2 (*X. helleri* and *X. maculatus*) range westward and southward from the Río Coatzacoalcos, and the remainder occur north of the area treated herein.

basin of Nicaragua and northern Costa Rica.

The pimelodid catfishes have 7 species, all in the genus *Rhamdia*; 5 occur only within the province.

There is moderate to strong endemism within the subdivisions of the Usumacinta Province. This is most marked in the Usumacinta-Grijalva division, which contains the largest and most diversified catchment basin. It has 38 endemics out of a total of 67 species of primary and secondary freshwater fishes—or 57%. Five of the 10 strictly freshwater marine derivatives are confined to this division.

In the Papaloapam-Coatzacoalcos division are 45 species of primary and secondary fishes, of which 15 (33%) are endemic; again, 5 of 10 freshwater peripheral species are restricted to these basins. Within each of the

two river systems there are also endemics—e.g., among the poeciliids of the genera *Priapella*, *Xiphophorus*, and *Poeciliopsis*, in the cichlids, and in the atherinid genera *Archomenidia* and *Xenatherina*.

On the Yucatan Peninsula, endemism involves coastal forms in the families Cyprinodontidae, Atherinidae, and Brotulidae (5 species with 1 endemic genus, *Typhliasina*) as much as it does species whose nearest relatives inhabit the adjacent lowlands of southeastern México (4 species, with 1 endemic genus, *Furmastix*, in the Cyprinodontidae, Poeciliidae, Cichlidae, and Synbranchidae). The fauna is an impoverished one, largely because of the scarcity of surface waters, particularly rivers.

The Polochic-Izabal division has a total of 28 species of freshwater fishes with 6 en-

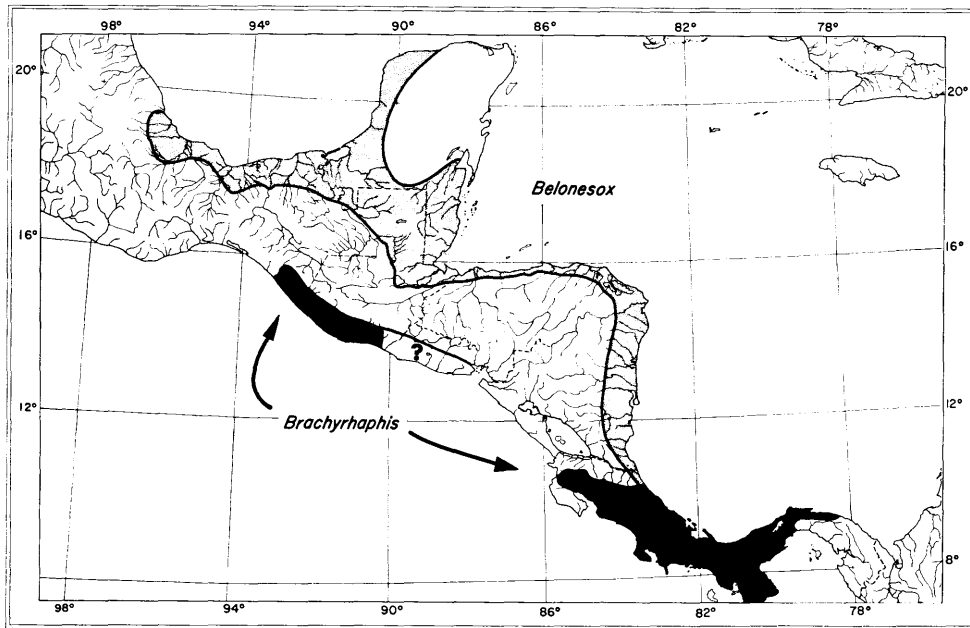


Fig. 5. Complementary distribution of the closely related poeciliid genera *Belonesox* and *Brachyrhaphis*, modified after Rosen and Bailey (1963). The large, predatory *Belonesox* is a monotypic genus not uncommon in brackish lagoons and may have originated in the Usumacinta Province. *Brachyrhaphis* is autochthonous in the Isthmian Province, where it is represented by at least 7 species; the disjunct *B. hartwegi*, described from Chiapas, México, has recently been collected by Rosen in Guatemala and may range as far to the southwest as the Gulf of Fonseca, Honduras.

demics belonging to the Poeciliidae and Cichlidae. Four of the 5 peripheral freshwater forms are confined to this drainage, including a representative each of the Ariidae, Atherinidae, Syngnathidae, and Eleotridae. The genera *Potamarius* and *Carlhubbsia* are shared with the Usumacinta-Grijalva drainage.

Chiapas-Nicaraguan Province.—Precise delineation of other fish provinces is not possible at this time but some tentative arrangements may be outlined. Extending along the Pacific slope from the basin of the Río Tehuantepec approximately to the Nicoya Peninsula of extreme western Costa Rica (Fig. 2) is an area that is essentially equivalent to the Pacific México-Nicaragua Biotic Province of Stuart (1964:356, Fig. 5), except that the northern part extends into his Tehuantepec Province. The fishes of this region are here referred to the Chiapas-Nicaraguan Province. The area receives much less rainfall than the Caribbean lowlands, has a narrower coastal plain, and its streams are few and of relatively small discharge; many are intermittent.

Not surprisingly, it is marked by an impoverished fauna, with only 8 families, 14 genera, and 30 species of primary and secondary fishes (see Hildebrand, 1925; Carr and Giovannoli, 1950).

Encompassed within the area is the known Central American range of *Anableps dowi*; also included is the Pacific distribution of the tropical gar, which very nearly matches that of the cuatro-ojos.

There are only 2 characins, *Astyanax fasciatus* and *Roeboides salvadoris*; the latter represents a genus absent from the Usumacinta Province. There is a single gymnotid, ranging from Guatemala to the Gulf of Fonseca. *Rhamdia* is represented by 4 species, of which 3 appear to be restricted to the area. There are only 2 cyprinodontids, the essentially highland genus *Profundulus* and the peculiar *Oxyzygonectes dowi*, a salt-tolerant species barely entering the province from the south. Poeciliids also are few, 8 species in 5 genera, of which 3 are confined to the province. The absence of *Gambusia*, so well represented in the Atlantic-Caribbean

lowlands of México, is noteworthy. Among the cichlids are 10 species of *Cichlasoma*, of which 7 are so far only known from this area. There are no distinctive freshwater derivatives of marine groups.

The Caribbean fish fauna of Honduras and Nicaragua is still too poorly known to yield adequate interpretations of distributions in the region between the Río Motagua, southeastern Guatemala, and the Río San Juan, Nicaragua. Regan (1906-08) simply placed the fishes of this area (as he did of my Chiapas-Nicaraguan Province) in his Guatemala Province.

San Juan Province.—Regan (1906-08) tentatively recognized lakes Managua and Nicaragua and their outlet, the Río San Juan, as comprising a region characterized by the peculiar cichlid fauna found in the Nicaraguan lakes (Meek, 1907). Regan called this the San Juan Province. That it spills southward into Costa Rica is indicated by recent collecting near Tortuguero (Caldwell, et al., 1959).

The cichlids, though perhaps not quite so speciose as Regan and Meek believed, are nevertheless numerous and diversified. They comprise about 16 species in 3 genera, 1 of which—the monotypic *Herotilapia*—evidently evolved in the area. The genus *Neetroplus*, which may also be autochthonous, is represented by one species nearly restricted to the region and by another apparently limited to Panamá. Nine of the 14 species of *Cichlasoma* appear to be confined to the province; some are highly specialized, with thick, fleshy lips and blunt teeth; others exhibit rubrism (Meek, 1907). (Possibly the excessive lip development is sex-limited in one species.)

Also characteristic of this province is the genus *Bramocharax*, with 2 species ranging into Costa Rica; but we now know of an additional species of this genus in the Usumacinta basin of Guatemala, and others may be discovered in the poorly known intervening region.

Other characins in the Nicaraguan area include 7 species in 6 genera, of which *Bryconamericus* and *Rhoadsia* have species that either range south of Nicaragua or their relatives are southern only. Possibly 4 species of characins are confined to the province.

Poeciliids are not numerous, 9 species in 6 genera, none of which is distinctive of the region. Most of the species are wide-ranging, although the recently described *Phallichthys*

tico (Bussing, 1963) is presently known only from the San Juan drainage in Costa Rica; 1 species is possibly restricted to the Great Lakes basin (a *Poeciliopsis*).

The clupeid genus *Dorosoma* reaches its southern limit in the Nicaraguan lakes, where it is represented by the endemic species *D. chavesi*. A shark, two sawfishes (*P. pectinatus* rare), and the tarpon also occur in Lake Nicaragua. One atherinid (*Melaniris sardina*) is restricted to the Great Lakes. As previously mentioned, this province marks the southern limit of the gars.

Isthmian Province.—The well-watered tropical lowlands lying south and east of Nicaragua include an area with a distinctive biota that has been called the Costa Rica-Panamá Biotic Province (Stuart, 1964:355, Fig. 5). This is essentially equivalent to the Isthmus of Costa Rica-Panamá Geological Province (Maldonado-Koerdell, 1964:Fig. 2). Its fish fauna is here designated as the Isthmian Province, following the terminology of Regan (1906-08). When more data become available the boundaries of the province will need revision since it now includes all of Panamá, of which the central and eastern (especially) parts contain fishes with predominantly South American relationships.

The Isthmian Province comprises both a rich and diversified fish fauna, of which the primary and secondary groups are represented by 136 species, 55 genera, and 12 families (or 17 if one splits the Characidae). This is more than twice the number of genera and 30% more species than are found in the Usumacinta Province. Unlike the latter, however, the diversity and abundance of species in the Isthmian area are largely due to penetration of South American fishes, especially among the catfishes, characins, gymnotids and, to a lesser extent, the cichlids. These 4 groups comprise 109 species, 44 genera, and 10 families—of which 53 species, 33 genera, and 5 families (all catfishes) reach their northern limit in the Panamanian section of the province. The characins, gymnotids, and catfishes together make up 60% of the total fauna, and more than 60% of the species in these 3 groups are either restricted to Panamá (east of Bocas del Toro and Chiriquí provinces) or range southward and eastward into South America.

Unlike the characins, gymnotids, and cat-

fishes (except *Rhamdia*), the poeciliids show that the area has been a center of noteworthy diversification at various taxonomic levels. There are 9 genera and 25 species, of which 2 genera, 1 subgenus, and 18 species are restricted to the province.

The genus *Brachyrhaphis* (Fig. 5), closely allied to *Gambusia* (of which there is only 1 species in the Isthmian region), evidently evolved in the area, for all but 1 of its approximately 9 species are known only from Costa Rica and Panamá. Some, like *B. cascajalensis*, are generally distributed, but most are restricted to either Costa Rica or Panamá, and often to either the Pacific or Caribbean slopes. The genus is evidently more speciose than currently recognized.

Neoheterandria also appears to have originated in the Isthmian region, to which 3 of its 4 species are confined (the fourth inhabits the Caribbean drainage of Colombia). Two of the species occur only in Panamá and 1 (*N. umbratilis*) is found on the Caribbean slope of Costa Rica and adjacent Nicaragua (San Juan basin).

The subgenus *Aulophallus* of the genus *Poeciliopsis* is represented by 3 species on the Pacific slope (*P. elongata*, *P. retropinna*, and *P. sp.*), all of rather restricted distribution.

The genus *Priapichthys*, distributed from Costa Rica to Ecuador, has 3 of its 8 species in the Isthmian region; it may have originated there.

Cyprinodontids are represented by the essentially South American genus *Rivulus* with 6 species in the assemblage—4 confined to Panamá, 1 in both Costa Rica and Panamá, and 1 occurring in Costa Rica and Nicaragua. The genus *Oxyzygonectes* is nearly restricted to the province.

Nineteen of the 24 species of cichlids belong to the genus *Cichlasoma*. Of these, 10 occur only on either the Pacific or Caribbean slopes of Costa Rica, including 3 that spill over into the adjacent San Juan basin of Nicaragua; 2 are confined to Panamá; 3 are generally distributed in both countries; and the remainder occur either to the north (4) or the south (1). This again indicates greater differentiation of *Cichlasoma* as one moves up Central America from Panamá.

Freshwater fishes of marine origin number far fewer than in the Usumacinta assemblage: 8 species in 7 genera and 6 families

(versus 18 species in 11 genera and 9 families). (In each case, *Agonostomus*, *Joturus*, and *Sicydium* were not included.) Most of these species, including the more distinctive ones, are confined to Pacific streams: a pipefish (*Syngnathus elcapitanensis*) in both countries; the goby *Guavina micropus* in central Panamá; 2 eleotrids (*Hemieleotris latifasciatus* and *Leptophilypnus panamensis*); and *Gobiesox potamius* in Costa Rica. On the Caribbean slope are the atherinid *Melaniris chagresi* (both countries) and *Gobiesox nudus*, which also occurs in the West Indies and southward to Venezuela.

The region where most typically South American fishes stop and southern Central American ones appear has been investigated by Horace Loftin. He informed me that the transition is approximated by the eastern boundaries in western Panamá of the provinces of Bocas del Toro (near Valiente Peninsula) on the Caribbean and Chiriquí (Río Tabasara) on the Pacific. The southern limit of the genus *Alfaro* is very close to the proposed faunal break on the Caribbean slope; that boundary also forms the western margin of the Colón-Darién Biotic Province of Ryan (1963:32), as based on mammal distribution. The ranges of approximately 12 of the 44 characins, 4 of the 7 species of *Rhamdia*, 3 of the 6 kinds of *Rivulus*, 11 of the 26 poeciliids, and 6 of the 24 cichlids are essentially restricted to the Costa Rican division as just delimited. A careful analysis of the nature and breadth of the transition zone must await the completion of studies now in progress.

A noteworthy aspect of the distributional patterns for freshwater fishes in Panamá is that many of the species of the opposite slopes of central Panamá are identical or have their closest relatives in the two regions. Also noteworthy is the great similarity of the faunas of the Pacific slope of Panamá (east of the Azuero Peninsula) and that of the Caribbean slope of Colombia—particularly the likeness of the fishes of the Río Tuira and Río Atrato (Hildebrand, 1938).

Chiapas-Guatemalan Highlands.—Fishes are rare in the highlands of Central America much above 1500 m. For example, in Panamá Hildebrand found that streams over this elevation were fishless. Probably in this region, to which no north or south temperate fish

has gained access, temperature provides an effective barrier to the tropical fauna. This idea gains support by the successful introduction of North American trout into these highland Panamanian waters. Farther north in Central America, waters between 1200 and 2500 m are abundantly and chiefly supplied with representatives of the primitive cyprinodontid genus *Profundulus* (Miller, 1955). At the higher elevations, generally above 1500 m, this is the only native fish. The area occupied comprises part of an ancient land mass (West, 1964:38) extending from the highlands of Chiapas, México, eastward across Guatemala into Honduras and beyond. The river systems in this mountainous area are often precipitous and subject to wide fluctuations in flow—thus requiring special adaptations for aquatic organisms. Again, no truly northern (Nearctic) fishes have succeeded in gaining natural access to this highland. Distributional and speciational considerations indicate that *Profundulus* evolved within and spread outward from this land mass.

COMMENTS ON DISTRIBUTIONAL LIST

The list that follows forms the basis for the preceding analysis. It is derived from my own manuscript check lists of the fishes of México and Guatemala, the literature, and lists or information supplied by others, as often indicated by placing these individuals' names in parentheses at the ends of the range statements (see also acknowledgments). Treated first are the primary freshwater fishes, followed by the secondary and peripheral groups. Many brackish-water species are included; subspecies are not included. It is emphasized that the list is preliminary, since I recognize that those currently working on Central American fishes will see a need for both additions and deletions. For some species, documentation is given from the literature—of which all important references are cited at the end of the paper. An attempt is made to list the fishes in phylogenetic sequence. Species believed to be new are included since these were considered in the distributional analysis. A number of cichlids reported by Behre (1928) from Panamá (and accepted by Hildebrand, 1938) are not considered because they represent known or suspected misidentifications.

PRELIMINARY DISTRIBUTIONAL LIST OF THE FRESHWATER FISHES OF CENTRAL AMERICA From the Isthmus of Tehuantepec (Río Papaloapam and Río Tehuantepec) to the Panamá-Colombia border.

I. PRIMARY FISHES

CHARACIDAE

CURIMATINAE

Curimata magdalenae Steindachner

Pacific slope of Costa Rica (Bussing) to eastern Panamá (Río Tuira) and Atlantic slope of Colombia (Atrato and Magdalena basins) to Venezuela (Maracaibo basin).

PARODONTINAE

Apareiodon dariensis (Meek and Hildebrand)

Known only from the Río Tuira basin, Pacific slope of eastern Panamá.

Apareiodon compressus Breder

Known from the type only; in the Río Tuira basin, Pacific slope of eastern Panamá.

CHARACINAE

Characidium marshi Breder

Known only from the Río Tuira basin, Pacific slope of eastern Panamá.

Phenagoniates macrolepis (Meek and Hildebrand)

Pacific slope of eastern Panamá (Río Tuira) and the Atlantic slope of Colombia (Río Atrato) to the Maracaibo drainage of Venezuela.

Compsura gorgonae (Evermann and Goldsborough)

Both slopes of central Panamá and the Río Tuira of eastern Panamá, westward on the Pacific slope to southern Puntarenas Province, Costa Rica (Bussing).

Pseudocheirodon affinis Meek and Hildebrand

Both slopes of central Panamá and the Río Tuira on the Pacific slope of eastern Panamá.

Pseudocheirodon sp.

Pacific slope of Costa Rica (Bussing).

Astyanax fasciatus (Cuvier)

Atlantic slope from Argentina to the Río Nueces, southern Texas, Pacific slope from Colombia to the Río Armería basin, Jalisco, México.

Astyanax nasutus Meek

Great Lakes of Nicaragua (Rivas).

- Astyanax ruberrimus* Eigenmann
Both slopes of Panamá and Colombia.
- Astyanax kompi* Hildebrand
Crater lakes at Volcán, Pacific slope of extreme western Panamá.
- Astyanax albeolus* Eigenmann
Pacific slope of Costa Rica and Panamá (Loftin).
- Astyanax regani* Meek
Pacific slope of Costa Rica.
- Bramocharax bransfordi* Gill
Atlantic slope of Nicaragua and Costa Rica.
- Bramocharax elongatus* Meek
Atlantic slope of Nicaragua and Costa Rica (Bussing).
- Bramocharax* sp.
Río Usumacinta basin, Petén, Guatemala; perhaps the same as one of the above (Rosen).
- Creagrutus affinis* Steindachner
Pacific slope of Panamá (Río Tuira) and Colombia (Río San Juan), and Atlantic slope of Colombia (Río Atrato, Río Cauca).
- Creagrutus notropoides* Meek and Hildebrand
Known only from the upper Río Chagres basin, Atlantic slope of Panamá.
- Brycon argenteus* Meek and Hildebrand
Pacific and Atlantic (San Blas coast) slopes of Panamá (Loftin).
- Brycon guatemalensis* Regan
Atlantic slope from the Río Grijalva, Tabasco and Chiapas, México southward to eastern Panamá.
- Brycon petrosus* Meek and Hildebrand
Atlantic and Pacific slopes of Panamá (Loftin).
- Brycon obscurus* Hildebrand
Known only from El Valle, Pacific slope of western Panamá.
- Brycon striatulus* (Kner and Steindachner)
Pacific slope of central and eastern Panamá. Atlantic and Pacific slopes of Costa Rica (Bussing).
- Brycon chagrensis* (Kner and Steindachner)
Atlantic slope of central Panamá (Loftin).
- Brycon behreae* Hildebrand
Pacific slope of western Panamá.
- Hyphessobrycon panamensis* Durbin
Atlantic slope of Panamá to the Río Magdalena basin, Colombia.
- Hyphessobrycon compressus* (Meek)
Atlantic slope from the Río Papaloapam, México to the Río Polochic, Guatemala.
- Hyphessobrycon milleri* Durbin
Atlantic slope from the Río Sarstún (?), British Honduras to the Río Motagua, Guatemala.
- Hyphessobrycon tortuguerae* Böhlke
Atlantic slope of Costa Rica and Nicaragua (including Lake Managua; Astorqui).
- Hyphessobrycon* sp.
Pacific slope of Costa Rica (Bussing, Rivas).
- Bryconamericus emperador* (Eigenmann and Ogle)
Both slopes of central Panamá and the Río Tuira basin; Pacific slope of Panamá; Pacific slope of Costa Rica.
- Bryconamericus zeteki* Hildebrand
El Valle, Pacific slope of Panamá.
- Bryconamericus cascajalensis* Meek and Hildebrand
Known only from the Atlantic slope of Panamá, in the Río Cascajal, Portobelo, east of Colón.
- Bryconamericus ricæ* Eigenmann
Atlantic slope of Nicaragua (Lake Nicaragua; Astorqui), Costa Rica, and western Panamá (perhaps the same as *B. scleroparius*).
- Bryconamericus scleroparius* (Regan)
Atlantic slope of Costa Rica (Bussing).
- Hemibrycon dariensis* Meek and Hildebrand
Pacific slope of Panamá (Loftin).
- Rhoadsia eigenmanni* (Meek)
Lake Nicaragua (Rivas) to Atlantic slope of Costa Rica (Böhlke, 1958:178; Bussing).
- Roeboides guatemalensis* (Günther)
Atlantic slope from the Río Chagres, Panamá north to Lake Nicaragua.
- Roeboides occidentalis* Meek and Hildebrand
Pacific and Atlantic (San Blas coast) slopes of Panamá (Loftin).
- Roeboides salvadoris* Hildebrand
Pacific slope from the Río Tehuantepec, Chiapas, México, to both slopes of Costa Rica (Rivas); also in far western Panamá (Loftin).
- Gephyrocharax atricaudatus* Meek and Hildebrand
Río Chagres on Atlantic slope and Canal Zone to Río Tuira on Pacific slope, Panamá.
- Gephyrocharax intermedius* Meek and Hildebrand
Pacific slope of Panamá (Río Chame to Río Chiriquí) and Costa Rica (Bussing).
- Gephyrocharax whaleri* Hildebrand
Pacific slope of Panamá.

LEBIASINAE

Piabucina festae Boulenger

Pacific slope of eastern Panamá (Río Tuira) and Colombia (Río San Juan) and the Atlantic slope of eastern Panamá (Loftin) and Colombia (Río Atrato).

Piabucina panamensis Gill

Both slopes of Panamá excluding the Río Tuira basin; Pacific slope of Costa Rica (Bussing).

Piabucina sp.

Pacific slope of Costa Rica (Bussing).

GASTROPELECINAE

Gasteropelecus maculatus Steindachner

Pacific slope of Panamá from the Río Chorrera eastward; also on the Pacific (Río San Juan) and Atlantic (Río Magdalena) slopes of Colombia to Venezuela (Maracaibo basin).

CTENOLUCINAE

Ctenolucius beani (Fowler)

Pacific slope of central and eastern Panamá, southward to the Río San Juan, Colombia; also from the Río Atrato basin, Atlantic slope of Colombia.

ERYTHRININAE

Hoplias microlepis (Günther)

Both slopes of Panamá and Pacific slope of Costa Rica (Bussing).

Hoplias malabaricus (Bloch)

Pacific slope of eastern Panamá, from the Río Bayano and Tuira basins, southward to southern Colombia; also from the San Blas coast on the Atlantic slope of Panamá (Loftin) and the Río Atrato basin in Colombia to Buenos Aires, Argentina.

GYMNOTIDAE

Gymnotus carapo Linnaeus?

Both slopes of Costa Rica and Nicaragua (Myers) and the Atlantic slope of extreme western Panamá (Behre, 1928:310); northern limit of range of this South American species very uncertain.

Gymnotus cylindricus LaMonte

Atlantic slope from Río Motagua, Guatemala to northwestern Honduras.

Gymnotus sp.

Pacific slope of Guatemala southward at least to tributaries of the Gulf of Fonseca, Nicaragua (Carr and Giovannoli, 1950: 11-12, as *G. carapo*).

Sternopygus dariensis Meek and Hildebrand

Known only from the Pacific slope of Panamá (Loftin).

Hypopomus occidentalis Regan

Both slopes of Panamá and Colombia to the Maracaibo basin, Venezuela.

Eigenmannia virescens (Valenciennes)

Pacific slope of Panamá to the Río Magdalena (Atlantic slope) of Colombia, thence southward to Buenos Aires.

Apteronotus rostratus (Meek and Hildebrand)

Pacific slope of eastern Panamá and Atlantic slope of Colombia (Río Magdalena).

CATOSTOMIDAE

Ictiobus bubalus (Rafinesque)

Eastern United States, west of the Appalachians, southward to the Río Papaloapam, Veracruz, México.

Ictiobus meridionalis (Günther)

Atlantic slope of southern México and Guatemala from the Río Papaloapam to the Río Usumacinta.

ICTALURIDAE

Ictalurus meridionalis (Günther)

Atlantic slope from Río Papaloapam, southern México, to Río Usumacinta, northern Guatemala, and Belize River, British Honduras (very close to and perhaps the same as *I. furcatus*) (Lesueur).

AUCHENIPTERIDAE

Trachycorystes amblops (Meek and Hildebrand)

Pacific slope of Panamá.

AGENEIOSIDAE

Ageneiosus caucanus Steindachner

Pacific slope of Panamá (Río Tuira basin), Río Atrato and Río Magdalena basins, Colombia, and Venezuela (Caracas; identity uncertain).

PIMELODIDAE

Imparales sp.

Atlantic slope (Río Chagres) and Pacific slope (Río Santa María) of Panamá (Loftin). (*Imparales* Schultz, 1944b.)

Rhamdia wagneri (Günther)

Both slopes of Costa Rica and Panamá southward to Colombia.

Rhamdia brachypterus (Cope)

Mountain streams of south-central Veracruz, México (Orizaba, Motzorongo-Río Blanco, Río Papaloapam); "probably not distinct

- from" *R. guatemalensis* (Regan, 1906–08: 128).
- Rhamdia heteracantha* Regan
Atlantic slope of Costa Rica.
- Rhamdia rogersi* Regan
Both slopes of Costa Rica and Panamá.
- Rhamdia cabreræ* Meek
Pacific drainage of Guatemala (and El Salvador?).
- Rhamdia hypselura* (Günther)
Pacific slope of southern México.
- Rhamdia guatemalensis* (Günther)
Both slopes of Middle America, from near Veracruz City and Río Tehuantepec, México, southward to Costa Rica (includes *R. godmani* (Günther), but Behre's, 1928, record of *godmani* from western Panamá represents a different species; specimens examined at UMMZ).
- Rhamdia salvini* (Günther)
Río San Geronimo, Atlantic drainage of Guatemala.
- Rhamdia polycaulus* (Günther)
Río San Geronimo, Atlantic drainage of Guatemala.
- Rhamdia managuensis* (Günther)
Great Lakes of Nicaragua.
- Rhamdia microptera* (Günther)
Río San Geronimo, Atlantic drainage of Guatemala.
- Rhamdia motaguensis* (Günther)
Atlantic slope of British Honduras (Stann Creek) and Guatemala (Río Polochic, Río Motagua) to Honduras.
- Rhamdia alfaroi* Fowler
Escobal, on Pacific slope of Costa Rica.
- Rhamdia nasuta* Meek
Pacific slope of Costa Rica.
- Rhamdia laticauda* (Heckel)
"México."
- Rhamdia nicaraguensis* (Günther)?
Great Lakes, Río Prinzapolca, and Río Huahuashan, Nicaragua (Astorqui).
- Rhamdia barbata* Meek
Great Lakes of Nicaragua.
- Rhamdia brachycephala* Regan
Pacific slope of Guatemala to Honduras (?).
- Rhamdia underwoodi* Regan
Atlantic and Pacific slopes of Costa Rica and Panamá.
- Rhamdia* sp.
Río Usumacinta basin, Guatemala and Belize River, British Honduras.
- Pimelodus clarias* (Bloch)
Río Tuira basin, Pacific slope of eastern Panamá, southward on Atlantic slope to Río de La Plata (Uruguay-Argentina).
- Pimelodella chagresi* (Steindachner)
Pacific slope of Costa Rica (Bussing) and both slopes of Panamá southward to the Atrato and Magdalena basins (Atlantic slope) of Colombia and the Maracaibo basin, Venezuela.

TRICHOMYCTERIDAE

- Pygidium striatum* Meek and Hildebrand
Pacific slope of Costa Rica near Panamanian border (Bussing) to eastern Panamá (Río Tuira). Atlantic slope of Panamá (Loftin), and both slopes of Colombia.
- Pygidium septentrionale* Behre
Pacific slope of western Panamá (Río Chiriquí del Tiro).

CALlichthyidae

- Hoplosternum thoracatum* (Valenciennes)
Pacific slope of central Panamá to the Atlantic drainage of Colombia, southward to the Orinoco and upper Paraguay.

Loricariidae

- Astroblepus longifilis* (Steindachner)
Pacific slope of eastern Panamá (Río Tuira basin) to Perú. (I follow Gosline, 1947, in regarding *Astroblepus* as a loricariid.)
- Hypostomus plecostomus* (Linnaeus)
Pacific slope of Costa Rica (Hildebrand, 1938:238) and both slopes of Panamá, southward to Uruguay.
- Chaetostoma fischeri* Steindachner
Both slopes of central Panamá and the Pacific slope of eastern Panamá; both slopes of Colombia, southward into Ecuador.
- Ancistrus chagresi* Eigenmann and Eigenmann
Both slopes of central Panamá.
- Ancistrus spinosus* Meek and Hildebrand
Pacific slope of central and eastern Panamá (Río Bayano, Río Tuira).
- Lasiancistrus planiceps* (Meek and Hildebrand)
Pacific slope of eastern Panamá (Río Tuira basin).
- Leptoancistrus canensis* (Meek and Hildebrand)
Pacific slope of Panamá east of the Canal Zone and the Atlantic slope (San Blas) of Panamá (Loftin).

- Loricaria uracantha* Kner and Steindachner
Atlantic and Pacific slopes of Panamá (Loftin) to Venezuela (Schultz, 1944a:325).
- Loricaria latiura* Eigenmann and Vance
Pacific slope of Panamá (Río Tuira) and Atlantic slope of Colombia (Río Atrato).
- Loricaria variegata* Steindachner
Pacific slope of Panamá (Río Bayano, Río Tuira) and Atlantic slope of Colombia (Río Atrato, Río Magdalena) to Venezuela.
- Loricaria capetensis* Meek and Hildebrand
Known only from the Río Tuira basin, eastern Panamá.
- Loricaria filamentosa* Steindachner
Pacific slope (Río Tuira) of eastern Panamá; Atlantic slope of Colombia to the Maracaibo basin, Venezuela (Schultz, 1944a:328).
- Loricaria altipinnis* Breder
Known only from the Río Chucunaque (Río Tuira basin) and confluents, Pacific slope of eastern Panamá.
- Sturisoma panamense* (Eigenmann and Eigenmann)
Pacific slope of central to eastern Panamá (Loftin) through both slopes of Colombia to western Ecuador.
- Sturisoma citurense* (Meek and Hildebrand)
Pacific slope of Panamá (Río Bavano, Río Tuira).

II. SECONDARY FISHES

LEPISOSTEIDAE

- Lepisosteus tropicus* (Gill)
Atlantic slope of Middle America in Lake Nicaragua, Río San Juan and tributaries (Nicaragua, Costa Rica), and the Río Usumacinta to Río Coatzacoalcos basins of Guatemala and southeastern México; Pacific slope from southern Chiapas, México southward to the Gulf of Fonseca, Nicaragua (Río Negro).

CYPRINODONTIDAE

- Profundulus guatemalensis* (Günther)
Both slopes of Guatemala southward to El Salvador and Honduras (Río Lempa basin).
- Profundulus punctatus* (Günther)
Both slopes of Middle America from southern México (Río Aguacatillo near Acaapulco, Río Coatzacoalcos) southward to El Salvador.
- Profundulus hildebrandi* Miller
Known only from the vicinity of San

- Cristóbal de las Casas, Chiapas, México.
- Profundulus labialis* (Günther)
Atlantic slope of southern México (Chiapas) into central Guatemala (both slopes).
- Profundulus candalarius* Hubbs
Atlantic (or interior) drainage of extreme northwestern Guatemala and adjacent Chiapas, México (Río Grande de Comitán, headwaters Río Grande de Chiapa).
- Fundulus grandissimus* Hubbs
Confined to the Yucatán Peninsula, México.
- Fundulus persimilis* Miller
Known only from Río Lagartos, outer tip of Yucatán Peninsula.
- Oxyzygonectes dowi* (Günther)
Pacific slope from Poneloya, Nicaragua (Rivas) to Los Santos Province, western Panamá (Loftin).
- Rivulus myersi* Hubbs
Vicinity of Progreso, Yucatán, México.
- Rivulus isthmensis* Garman
Both slopes of Costa Rica and Nicaragua (includes *R. flabellicauda* Regan).
- Rivulus volcanus* Hildebrand
Crater lakes near Volcán on Pacific slope of extreme western Panamá.
- Rivulus hildebrandi* Myers
Pacific slope of Costa Rica (Bussing) and western Panamá (Chiriquí Province).
- Rivulus tenuis* (Meek)
Lowland Atlantic streams of Veracruz (near Veracruz City), México southward into Honduras (includes *R. hendrichsi* Alvarez and Carranza).
- Rivulus brunneus* Meek and Hildebrand
Atlantic slope of the Canal Zone.
- Rivulus montium* Hildebrand
Río Chagres basin, Atlantic slope of Panamá.
- Rivulus godmani* Regan
Río Motagua basin, Atlantic slope of Guatemala.
- Rivulus* sp.
Río Papaloapam and Río Coatzacoalcos basins, Veracruz and Oaxaca, México.
- Rivulus chucunaque* Breder
Río Chucunaque basin (Pacific slope), Darién, Panamá.
- Cyprinodon variegatus* Lacépède
The subspecies *C. v. artifrons* is confined to fresh and brackish waters of the Yucatán Peninsula.

Cyprinodon beltrani Alvarez

Known only from Laguna de Chichankanab, Quintana Roo, México.

Floridichthys carpio (Günther)

Two subspecies (*F. c. barbouri* and *F. c. polyommus*) are confined to the Yucatán Peninsula.

Garmanella pulchra Hubbs

Yucatán Peninsula to Corozal, British Honduras.

ANABLEPIDAE

Anableps dowi Gill

Pacific drainage from the Río Tehuantepec, Oaxaca, México to the Gulf of Fonseca drainage of Nicaragua (Astorqui).

POECILIIDAE¹*Alfaro cultratus* (Regan)

Atlantic drainage of western Panamá and Costa Rica to Zalaya, Nicaragua (including tributaries of L. Nicaragua; Astorqui); Pacific drainage in Tilarán region, Costa Rica (Bussing).

Alfaro huberi (Fowler)

Atlantic drainage from southeastern Guatemala to Nicaragua (Río Prinzapolca).

Poecilia caucana (Steindachner)

Pacific drainage of Darién, Panamá to Río Cauca, Colombia and Lake Maracaibo, Venezuela.

Poecilia mexicana Steindachner

Atlantic slope from the Río San Juan (in Río Grande basin), Nuevo León, México and Pacific slope from the Río del Fuerte basin, Sonora, México southward to the Caribbean slope of Colombia, the Pacific slope of eastern Panamá (Río Tuira), and the Netherlands and Colombian West Indies. (See detailed description by Hubbs, 1953, of a Panamanian population; listed as *Mollienesia sphenops gilli*.)

Poecilia sphenops Valenciennes

Atlantic slope of Middle America from lagoon about 30 airline miles N of Veracruz City, México southward to Costa Rica; Pacific slope from Aguililla, Michoacán, México southward to Costa Rica.

Poecilia sulphuraria (Alvarez)

Baños del Azufre, 4 miles W of Teapa, Tabasco, México.

Poecilia latipinna (Lesueur)

Coastal waters of the Atlantic slope from South Carolina to Campeche (near Champotón), México.

Poecilia petenensis (Günther)

Lake Petén and the Río Usumacinta basin, Guatemala.

Poecilia velifera Regan

Northern part of the Yucatán Peninsula, including Isla Mujeres. Probably confined naturally to coastal waters of the outer part of the peninsula (Hubbs, 1936:248).

Priapella bonita (Meek)

Upper part of the Río Papaloapam basin, Atlantic slope of Veracruz, México.

Priapella intermedia Alvarez and Carranza

Upper part of the Río Coatzacoalcos basin, Atlantic slope of Oaxaca, México.

Priapella compressa Alvarez

Palenque (Río Usumacinta basin) to Río Teapa Grijalva basin), Chiapas, México.

Xiphophorus maculatus (Günther)

Atlantic slope from the Río Jamapa basin just south of Veracruz City, México southward to northern British Honduras.

Xiphophorus milleri Rosen

Lake Catemaco basin in Río Papaloapam system, Veracruz, México.

Xiphophorus clemenciae Alvarez

Río Coatzacoalcos basin on Atlantic slope of Oaxaca, México.

Xiphophorus helleri Heckel

Atlantic slope from Río Nautla, Veracruz, México southward to northern Honduras. Genus and species (Cnesterodontini) Rosen; Río Usumacinta basin in Petén, Guatemala (two distinct species).

Brachyrhaphis terrabensis (Regan)

Pacific slope of Costa Rica and extreme western Panamá, at high elevations.

Brachyrhaphis hartwegi Rosen and Bailey

Pacific drainage of Chiapas, México, and Guatemala (Rosen).

Brachyrhaphis rhabdophora (Regan)

Both slopes of Costa Rica.

Brachyrhaphis episcopi (Steindachner)

Both slopes of central Panamá.

Brachyrhaphis punctifer (Hubbs)

Atlantic slope of western Panamá (Río Cricamola and vicinity).

Brachyrhaphis cascajalensis (Meek and Hildebrand)

¹ Not including an unidentified genus and species from Laguna Ocotál, México, known only from females (Miller, 1957:240). *P. formosa* (Girard), said to range southward to the Río Papaloapam (Rosen and Bailey, 1963:54), is also excluded as I know of no records south of the Río Pánuco system or the coastal Laguna de Tampamachoco near Tuxpan, northern Veracruz (specimens kindly loaned by R. M. Darnell).

- Atlantic slope of Costa Rica to San Blas Province, Panamá.
- Brachyrhaphis parismina* (Meek)
Atlantic slope of Costa Rica.
- Brachyrhaphis* sp.
Chiriquí Province on Pacific slope of western Panamá (Loftin).
- Brachyrhaphis* sp.
Atlantic slope of Costa Rica (Bussing).
- Gambusia nicaraguensis* Günther
Atlantic slope from Lake Izabal, Guatemala southward to the Río Chagres basin, Panamá (where possibly introduced; not taken by Loftin in his survey, 1961-1965).
- Gambusia yucatanensis* Regan
Atlantic slope from lower part of Río Coatzacoalcos, Veracruz, México southward to northern British Honduras including Yucatán Peninsula.
- Gambusia sexradiata* Hubbs
Atlantic slope from Río Nautla, northern Veracruz, México southward to northern Guatemala (Usumacinta basin) and northern British Honduras (Belize River drainage, uncatalogued material at UMMZ); absent from most of the Yucatán Peninsula.
- Gambusia* sp.
Vicinity of Teapa, Tabasco, México.
- Gambusia luma* Rosen and Bailey
Atlantic slope of British Honduras and Guatemala (Belize River to Puerto Barrios).
- Heterophallus rachowi* Regan
Known only from the Río Coatzacoalcos basin, Veracruz, México.
- Heterophallus echeagarayi* (Alvarez)
Known only from Palenque, Chiapas, México.
- Heterophallus* sp.
Río Teapa, Teapa, Tabasco, México.
- Belonesox belizanus* Kner
Atlantic slope of Middle America from Laguna San Julián, northwest of Veracruz (Suttkus), México, southward into Costa Rica (Caldwell, *et al.*, 1959:17).
- Carlhubbsia stuarti* Rosen and Bailey
Basin of the Río Polochic and Lake Izabal. Atlantic slope of eastern Guatemala.
- Carlhubbsia kidderi* (Hubbs)
Atlantic slope from the Río San Pedro Martir and Río de la Pasión (Usumacinta basin), Petén, and Alta Vera Paz, Guatemala, northward to the Río Champotón, Campeche and eastward to the Río Grijalva basin, Tabasco, México.
- Priapichthys annectens* (Regan)
Atlantic and Pacific slopes of Costa Rica.
- Priapichthys panamensis* Meek and Hildebrand
Pacific slope from Río San Juan, Nicaragua (Rivas) to Panamá in provinces of Veraguas, Coclé, and Panamá (Loftin).
- Priapichthys darienensis* (Meek and Hildebrand)
Pacific slope of central and eastern Panamá (Loftin) including Isla San José (Hildebrand, 1946).
- Neoheterandria tridentiger* (Garman)
Both slopes of central Panamá and Isla Taboga.
- Neoheterandria cana* (Meek and Hildebrand)
Río Satigante at Cana, tributary of Río Tuira, in Darién Province, Pacific slope of extreme eastern Panamá (same as *N. tridentiger*?).
- Neoheterandria umbratilis* (Meek)
Atlantic slope of Costa Rica; Lake Nicaragua (Rivas, 1965; Astorqui).
- Heterandria bimaculata* (Heckel)
Atlantic slope of Middle America from a stream 20 miles north of San José Cardel (UMMZ 184512), northwest of Veracruz City, México southward to northeastern Nicaragua (Río Prinzapolca).
- Heterandria* sp.
Headwaters of Río Lempa, Pacific slope of Guatemala and El Salvador.
- Poeciliopsis turrubarensis* (Meek)
Pacific slope from near Nuxco (60 miles NW of Acapulco), Guerrero, México southward to Río Dagua, Colombia; entering the sea.
- Poeciliopsis gracilis* (Heckel)
Pacific slope from Río Verde basin near Oaxaca City, Oaxaca, México eastward to tributaries of Gulf of Fonseca in Honduras (Río Choluteca) and probably Nicaragua. On Atlantic slope of México from 20 miles N of Veracruz City southward to Río Coatzacoalcos; also in upper Río Grijalva (Chiapas and adjacent Guatemala), Río Motagua (Guatemala), Río Ulua (Honduras), and Lake Nicaragua (Suttkus).
- Poeciliopsis* sp.
Lake Catemaco, in Río Papaloapam basin, Veracruz, México.
- Poeciliopsis* sp.
Laguna Pajaritos near Coatzacoalcos, Veracruz, México.
- Poeciliopsis fasciata* Meek
Pacific slope of México (Nuxco, 60 miles

- NW of Acapulco) to northwestern Guatemala; Atlantic headwaters of Río Coatzacoalcos near crest of Isthmus of Tehuantepec, Oaxaca, México.
- Poeciliopsis elongata* (Günther)
Pacific slope of western to central Panamá.
- Poeciliopsis retropinna* (Regan)
Pacific slope of Costa Rica and western Panamá.
- Poeciliopsis* sp.
Pacific slope of Costa Rica (Bussing).
- Phallichthys amates* (Miller)
Atlantic slope from Río Motagua basin to western Panamá, Pacific slope of central Costa Rica.
- Phallichthys fairweatheri* Rosen and Bailey
Northern British Honduras (N of Belize River) and northern Guatemala (Río Usumacinta basin).
- Phallichthys tico* Bussing
Atlantic slope of western Costa Rica (Río San Juan basin).
- Xenodexia ctenolepis* Hubbs
Atlantic drainage of central Guatemala, in upper part of Río Usumacinta basin.
- CICHLIDAE
- Aequidens coeruleopunctatus* (Kner and Steindachner)
Atlantic slope of central and eastern Panamá, Pacific slope of Costa Rica (Bussing) and Panamá, thence (doubtfully) to Colombia.
- Geophagus crassilabris* Steindachner
Both slopes of central and eastern Panamá.
- Cichlasoma*, section *Theraps*:
Cichlasoma eigenmanni Meek
Río Tonto and its tributaries in the Río Papaloapam basin, México.
- Cichlasoma nebuliferum* (Günther)
Atlantic slope of southern México (Río Coatzacoalcos to Río Grijalva?).
- Cichlasoma maculicauda* Regan
Atlantic slope from the Río Usumacinta basin, Petén, Guatemala, to Panamá (Río Chagres).
- Cichlasoma melanurum* (Günther)
Río de la Pasión and Lake Petén and adjacent lakes, Guatemala, and Belize River, British Honduras.
- Cichlasoma synspilum* Hubbs
Atlantic slope from Río Usumacinta basin, Guatemala to Belize River, British Honduras (may not be distinct from *C. melanurum*; includes *C. hicklingi* Fowler).
- Cichlasoma fenestratum* (Günther)
Atlantic slope of Veracruz (Río Chachalacas basin) and Oaxaca, México, not east of the Río Coatzacoalcos.
- Cichlasoma sexfasciatum* Regan
Known only from "Guapote, México."
- Cichlasoma bifasciatum* (Steindachner)
Río Usumacinta basin in Petén, Guatemala and adjacent parts of México.
- Cichlasoma heterospilum* Hubbs
Río Usumacinta basin in Guatemala and México.
- Cichlasoma guttulatum* (Günther)
Pacific slope of Middle America from Río Tehuantepec, Oaxaca, México, into Guatemala; Atlantic slope only in Río Coatzacoalcos basin, México (includes *C. zonatum* Meek).
- Cichlasoma godmani* (Günther)
Atlantic slope of Guatemala (Río Polochic basin, Lake Izabal, Sulphur River near Puerto Barrios).
- Cichlasoma microphthalmum* (Günther)
Río Motagua basin on the Atlantic slope of Guatemala (includes *C. oblongum* (Günther), *C. milleri* Meek, and *C. caeruleogula* Fowler).
- Cichlasoma gadowi* Regan
Río Tonto and tributaries, Río Papaloapam basin, México.
- Cichlasoma intermedium* (Günther)
Basins of the Río Usumacinta in Guatemala and México and of the Río Grijalva, México (includes *C. anguiliferum* (Günther)).
- Cichlasoma sieboldi* (Kner and Steindachner)
Pacific slope of Costa Rica to central Panamá; possibly Atlantic slope of Panamá (includes *Herichthys underwoodi* Regan; Bussing).
- Cichlasoma irregulare* (Günther)
Upper tributaries of the Río Usumacinta in México and Guatemala and the Río Polochic drainage, Guatemala.
- Cichlasoma lentiginosum* (Steindachner)
Río Usumacinta basin in Guatemala and México.
- Cichlasoma balteatum* (Gill and Bransford)
Great Lakes of Nicaragua (synonym of *C. nicaraguense*?).
- Cichlasoma nicaraguense* (Günther)
Great Lakes of Nicaragua (includes *C. balteatum*?).
- Cichlasoma* sp.

- Río de la Pasión (Río Usumacinta basin), northern Guatemala.
- Cichlasoma*, section *Archocentrus*:
- Cichlasoma spilurum* (Günther)
Atlantic slope from Belize River, British Honduras, southward to Bocas Province, western Panamá; also on Pacific slope of Costa Rica (includes *C. cutteri* Fowler).
- Cichlasoma nigrofasciatum* (Günther)
Pacific slope of Guatemala to Costa Rica; both slopes of Costa Rica.
- Cichlasoma octofasciatum* (Regan)
Atlantic slope from Río Paso San Juan (20 miles W of Veracruz City), Veracruz, México to Honduras (Río Ulua basin); also in Yucatan Peninsula (includes *C. hedricki* Meek).
- Cichlasoma centrarchus* (Gill and Bransford)
Atlantic slope from the Great Lakes and Río San Juan, Nicaragua into Costa Rica (Caldwell, *et al.*, 1959:26).
- Cichlasoma immaculatum* Pellegrin
Río Polochic basin, Atlantic slope of Guatemala.
- Cichlasoma spinosissimum* (Vaillant and Pellegrin)
Río Polochic basin, Atlantic slope of Guatemala.
- Cichlasoma*, section "*Herichthys*":
- Cichlasoma bocourti* (Vaillant and Pellegrin)
Lake Izabal and lower Río Polochic. Atlantic slope of Guatemala.
- Cichlasoma geddesi* Regan
Atlantic slope of southern México.
- Cichlasoma pearsei* (Hubbs)
Atlantic slope of México and northern Guatemala in the Río Usumacinta basin, including Río Champotón, Campeche, México.
- Cichlasoma*, section *Amphilophus*:
- Cichlasoma robertsoni* Regan
Río Coatzacoalcos basin, Veracruz, México southward along the Atlantic slope to 30 miles E of Tela, Honduras (includes *C. acutum* Miller).
- Cichlasoma longimanus* (Günther)
Great Lakes of Nicaragua.
- Cichlasoma macracanthum* (Günther)
Pacific slope of México (Río Tehuantepec basin) southward to El Salvador (Río de Paz basin).
- Cichlasoma guija* Hildebrand
Río Lempa basin of El Salvador and extreme southeastern Guatemala.
- Cichlasoma heterodontum* (Vaillant and pellegrin)
Pacific slope streams of the Isthmus of Tehuantepec, Oaxaca and Chiapas, México (includes *C. evermanni* Meek).
- Cichlasoma altifrons* (Kner and Steindachner)
Pacific slope of western Panamá and Costa Rica.
- Cichlasoma rostratum* (Gill and Bransford)
Great Lakes of Nicaragua to the Atlantic and Pacific slopes of Costa Rica (Bussing).
- Cichlasoma popenoei* Carr and Giovannoli
Río Choluteca basin, Pacific slope of Honduras.
- Cichlasoma margaritifera* (Günther)
Known only from the type, from the Petén region of Guatemala.
- Cichlasoma citrinellum* (Günther)
Atlantic slope of Nicaragua (including the Great Lakes basin) and Costa Rica.
- Cichlasoma erythraeum* (Günther)
Great Lakes of Nicaragua (possibly the female of *C. labiatum* or the same as *C. citrinellum*).
- Cichlasoma lobochilus* (Günther)
Great Lakes of Nicaragua.
- Cichlasoma alfaroi* Meek
Both slopes of Costa Rica, Atlantic slope of western Panamá (includes *C. lethrinus* Regan; Bussing).
- Cichlasoma labiatum* (Günther)
Great Lakes of Nicaragua (possibly the female is *C. erythraeum*).
- Cichlasoma tuyrense* Meek and Hildebrand
Pacific slope of eastern Panamá (Río Bayano, Río Tuira).
- Cichlasoma* sp.
Pacific slope of Guatemala; relative of *C. heterodontum*.
- Cichlasoma* sp.
Río de la Pasión and Río San Pedro, in Río Usumacinta basin, Petén, Guatemala.
- Cichlasoma*, section "*Paraneetroplus*":
- Cichlasoma bulleri* (Regan)
Atlantic slope of southern México from the Río Papaloapam to the Río Grijalva basins.
- Cichlasoma*, section *Parapetenia*:
- Cichlasoma mento* (Vaillant and Pellegrin)
Southern México (Río Negro).
- Cichlasoma urophthalmus* (Günther)
Atlantic slope of Middle America from the Río Coatzacoalcos basin southward

- into Nicaragua (including Yucatán Peninsula and Isla Mujeres).
- Cichlasoma hogaboomorum* Carr and Giovannoli
Lower part of the Río Choluteca, Pacific slope of Honduras.
- Cichlasoma trimaculatum* (Günther)
Pacific slope of Middle America from Laguna Coyuca NW of Acapulco, México southward to Río Lempa, El Salvador (includes *C. mojarra* Meek, *C. centrale* Meek, *C. gordonsmithi* Fowler, and *C. cajali* Alvarez and Gutierrez).
- Cichlasoma tenue* Meek
Río Papaloapam basin, Atlantic slope of México.
- Cichlasoma salvini* (Günther)
Atlantic slope from Río Papaloapam, Veracruz, México southward to Sulphur River near Puerto Barrios, Guatemala.
- Cichlasoma friedrichsthalii* (Heckel)
Atlantic slope of southern México (east of the Río Coatzacoalcos) to Costa Rica.
- Cichlasoma managuense* (Günther)
Great Lakes of Nicaragua and Atlantic slope of Costa Rica (Rivas).
- Cichlasoma dowi* (Günther)
Great Lakes of Nicaragua and both slopes of Costa Rica.
- Cichlasoma motaguense* (Günther)
Atlantic slope of Guatemala (Río Motagua), Pacific slope of Guatemala, El Salvador, and Honduras. (Synonym of *C. friedrichsthalii*?, see, e.g., Hubbs, 1935:19.)
- Cichlasoma* sp.
Río Grande de Chiapa basin (Río Grijalva system), Chiapas, in Atlantic drainage of México.
- Cichlasoma* sp.
Río Comitán and adjoining lakes, Chiapas, México, an interior stream draining toward the Río Usumacinta basin.
- Cichlasoma*, section *Thorichthys*:
Cichlasoma callolepis (Regan)
Upper tributaries of the Río Coatzacoalcos basin on the Atlantic slope of the Isthmus of Tehuantepec, México.
- Cichlasoma aureum* (Günther)
Atlantic slope, from the basin of the Río Chachalacas, northwest of Veracruz City, México, eastward and southward to the Río Polochic-Lake Izabal and Río Motagua basins, Atlantic slope of Guatemala and adjacent Honduras; possibly also in British Honduras.
- Cichlasoma elliotti* Meek.
Upper tributaries of the Río Tonto in the Río Papaloapam basin, Veracruz, México. (Possibly the same as *C. helleri*).
- Cichlasoma helleri* (Steindachner)
Río Grijalva basin, Atlantic slope of southeastern México (range and status not clear).
- Cichlasoma champotonis* Hubbs
Río Grijalva-Usumacinta and Río Champotón basins in northern Guatemala and southeastern México.
- Cichlasoma affine* (Günther)
Lake Petén and nearby lakes in Petén, Guatemala to Río Grijalva basin, México.
- Cichlasoma meeki* (Brind)
Northern part of the Yucatán Peninsula.
- Cichlasoma hyorhynchum* Hubbs
Río Usumacinta basin, northern Guatemala and Belize River, British Honduras.
- Cichlasoma pasionis* Rivas
Rivers and lakes of Petén (Usumacinta basin), northern Guatemala.
- Cichlasoma*, incertae cedis:
Cichlasoma calobrense Meek and Hildebrand
Pacific slope of the eastern half of Panamá (Río Bayano, Río Tuira).
- Cichlasoma spilatum* Meek
Atlantic slope of Costa Rica.
- Cichlasoma umbriferum* Meek and Hildebrand
Pacific slope of eastern Panamá (Río Tuira) and Atlantic slope of Colombia (Río Atrato, Río Magdalena).
- Cichlasoma terrabae* Jordan and Evermann
Pacific slope of Costa Rica.
- Cichlasoma tuba* Meek
Atlantic slope of Costa Rica (includes *Tomocichla underwoodi* Regan).
- Cichlasoma* sp.
Upper part of the Río Coatzacoalcos basin, Atlantic slope of the Isthmus of Tehuantepec, México.
- Cichlasoma* sp.
Río Seniso near Cobán, in Río Usumacinta basin, Guatemala (Hubbs, 1950: 11).
- Cichlasoma* sp.
Upper tributaries of Río de la Pasión (Usumacinta basin), Guatemala.
- Petenia splendida* Günther
Atlantic slope from the Río Grijalva basin to the Río Usumacinta and the Belize

River, in southeastern México, northern Guatemala, and British Honduras.

Neetroplus nematopus Günther

Atlantic slope of Nicaragua (Great Lakes) and Costa Rica (Rivas).

Neetroplus panamensis Meek and Hildebrand

Atlantic (Río Chagres) and Pacific (Río Tuira) slopes of Panamá.

Herotilapia multispinosa (Günther)

Atlantic slope of Nicaragua (Great Lakes) and Costa Rica (Caldwell, *et al.*, 1959; Bussing).

SYNBRANCHIDAE

Synbranchus marmoratus Bloch

Both slopes of tropical America from southern México (Río Papaloapam, Río Tehuantepec) to Brazil and Perú (including Yucatán Peninsula to Islas Cozumel and Mujeres).

Furmastix infernalis (Hubbs)

Known only from a ciénaga in Yucatán, México.

III. PERIPHERAL FISHES

CARCHARHINIDAE

Carcharhinus leucas (Valenciennes)

Atlantic, from New York to southern Brazil, entering large tropical rivers (Papaloapam, Usumacinta, San Juan) and lakes (Izabal, Nicaragua).

PRISTIDAE

Pristis pectinatus Latham

Widespread in the tropical-subtropical Atlantic to the Mediterranean and in the tropical eastern Pacific; in brackish water of lower reaches of large rivers in the tropics.

Pristis perotteti Müller and Henle

Both sides of the Atlantic. In the Americas, from southern Florida to Brazil, entering lakes (Izabal and Nicaragua) and coastal lagoons.

Pristis microdon Latham

Recorded from strictly fresh water in the Río Chucunaque basin, Pacific slope of eastern Panamá, by Breder (1927:99).

ELOPIDAE

Megalops atlanticus Valenciennes

North Carolina to Brazil, entering larger rivers and lakes, (Usumacinta, San Juan, Chagres; Izabal and Nicaragua).

Elops saurus Linnaeus

Ascending lagoons and river mouths of the Atlantic slope from Cape Cod to Brazil.

Elops affinis Regan

Ascending rivers of the Pacific slope from the Colorado River (including Salton Sea), Arizona-California southward to Perú.

CHANIDAE

Chanos chanos (Forskäl)

Western and eastern Pacific; recorded by Regan (1906-08:179) from brackish lagoons at Chiapam, Pacific coast of Guatemala.

CLUPEIDAE

Harengula pensacolatae Goode and Bean

Florida southward to Brazil; taken in Río Champotón at mouth, Yucatán Peninsula (Hubbs, 1936).

Harengula thrissina (Jordan and Gilbert)

Gulf of California to Perú, entering brackish to nearly fresh water.

Lile stolifera (Jordan and Gilbert)

Entering fresh water along the Pacific slope from Baja California to Perú.

Ilisha furthi (Steindachner)

Pacific coast from Panamá Bay, Panamá to the Gulf of Guayaquil, Perú, entering the locks of the Panamá Canal.

Dorosoma petenense (Günther)

Kentucky and southern Indiana to Florida and Texas, thence southward to the Belize River, British Honduras.

Dorosoma anale Meek

Atlantic slope from the Río Papaloapam, Veracruz and Oaxaca, México southward to the Río Usumacinta basin, northern Guatemala.

Dorosoma chavesi Meek

Great Lakes of Nicaragua.

ENGRAULIDAE

Anchovia macrolepidota (Kner and Steindachner)

Gulf of California to Ecuador, entering rivers.

Anchoa spinifer (Valenciennes)

Atlantic coast from Panamá to Santós, Brazil; Pacific coast from Panamá to Guayaquil, Ecuador. Recorded from fresh water in locks of the Panamá Canal.

Anchoa panamensis (Steindachner)

Pacific coast from Mazatlán, México to Puerto Pizarro, Perú, entering nearly fresh water in Panamá.

Anchoa mundeoloides (Breder)

Pacific coast from San Felipe, Baja Cali-

- fornia to Río Los Pescadores above Masachapa, Nicaragua (Rivas).
- Anchoa hepsetus* (Linnaeus)
Atlantic slope from Maine to Uruguay, entering rivers.
- Anchoa lamprotaenia* Hildebrand
Florida south through the West Indies to Panamá, entering brackish lagoons.
- Anchoa parva* (Meek and Hildebrand)
West Indies and Atlantic coast from Guatemala to Venezuela, entering fresh water (Lake Izabal, Guatemala, Río Chagres, Panamá).
- Anchoa curta* (Jordan and Gilbert)
Pacific coast from the mouth of the Río Yaqui, Sonora, México to Puerto Pizarro, Perú, entering nearly fresh water in Panamá.
- Anchoa mitchilli* (Valenciennes)
Cape Cod to Yucatán, entering rivers (e.g., Soto la Marina) and coastal lagoons of México.
- Anchoa lucida* (Jordan and Gilbert)
Pacific coast from the mouth of the Río Yaqui, Sonora, México to Ecuador, entering brackish water.
- Anchoviella elongata* (Meek and Hildebrand)
Atlantic slope from Río Escondido W of Bluefields, Nicaragua (Rivas) to Panamá.
- Lycengraulis poeyi* (Kner and Steindachner)
Pacific slope of Panamá, from tidal streams and the Río Bayano.
- ARIIDAE²
- Bagre marinus* (Mitchill)
Atlantic coast from Cape Cod to Lake Izabal, Guatemala, entering rivers and lakes.
- Bagre filamentosus* (Swainson)
Atlantic coast of Central America, entering rivers and lakes (Nicaragua).
- Bagre panamensis* (Gill)
Pacific coast from Mazatlán, México to Ecuador, entering river mouths.
- Bagre pinnimaculatus* (Steindachner)
Pacific coast from western México (Mazatlán) to Ecuador, entering river mouths.
- Selenaspis dowi* (Gill)
Pacific coast of Panamá to Ecuador, ascending streams.
- Netuma planiceps* (Steindachner)
Pacific slope from Sinaloa, México to Panamá (Río Sabana, Río Cianati, Darién).
- Netuma oscula* (Jordan and Gilbert)
Pacific coast of Panamá, entering the Río Tuira.
- Arius melanopus* Günther
In rivers and lakes of the Atlantic slope from the Río Papaloapam, Veracruz, México southward to Panamá.
- Arius taylori* Hildebrand
Río Lempa, El Salvador, and possibly other Pacific slope streams.
- Arius multiradiatus* Günther
Pacific coast from Panamá Bay to Paita, Perú, entering rivers.
- Arius furthi* Steindachner
Pacific coast of Costa Rica (Bussing) and Panamá, entering rivers.
- Arius felis* (Linnaeus)
Atlantic slope of North America from Cape Cod to Yucatán, entering rivers in the southern part of its range.
- Arius guatemalensis* Günther
Pacific slope of Middle America, from Mazatlán, México to Panamá, ascending rivers.
- Arius seemani* Günther
Pacific coast from México to Ecuador, entering rivers.
- Arius caeruleus* Günther
Pacific coast from Sonora, México to Guatemala, entering lagoons (Huamuchal, Guatemala).
- Arius assimilis* Günther
Atlantic coast of Central America, ascending streams and lakes (Lake Izabal, Guatemala).
- Arius tuyra* Meek and Hildebrand
Río Tuira, Pacific slope of Panamá, in fresh and brackish water.
- Potamarius nelsoni* (Evermann and Goldsborough)
Rivers and lakes in the Río Usumacinta basin in northern Guatemala and adjacent parts of southeastern México. Restricted to fresh water.
- Potamarius izabalensis* Hubbs and Miller
Lake Izabal and the lower Río Polochic, Atlantic slope of Guatemala. Restricted to fresh water.
- OPHICHTHIDAE
- Myrophis punctatus* Lütken
West Indies and Gulf coast of the United States southward to Brazil, entering tidal streams (Caldwell, *et al.*, 1959:15).
- Pisodonophis daspilotes* Gilbert
Pacific coast of Panamá, ascending streams.

² I do not recognize *Galeichthys* and *Arius*, as defined by Meek and Hildebrand (1923:96), as distinct genera.

ANGUILLIDAE

Anguilla rostrata (Lesueur)

Cape Cod to Colombia, entering rivers.

HEMIRAMPHIDAE

Hyporhamphus roberti hildebrandi Jordan and Evermann

Atlantic coast from the Río Sarstún, Guatemala-British Honduras border southward to Panamá (Collette).

Hyporhamphus snyderi Meek and Hildebrand

Tidal streams on the Pacific coast of central Panamá (Río Anton, Miraflores Locks) northward to Baja California.

Hyporhamphus mexicanus Alvarez

Confined to freshwater streams and lagunas of the Río Usumacinta basin in Petén, Guatemala westward to the Río Coatzacoalcos, México (Collette).

Chriodorus atherinoides Goode and Bean

Florida Keys, Bahamas, Cuba, and Yucatán Peninsula (mouth of the Río Champotón, Hubbs, 1936:209).

BELONIDAE

Strongylura notata (Poey)

Bahamas, Florida, West Indies (Cuba and Jamaica), and bordering mainland of southern México (recorded by Hubbs, 1936:207, from brackish-water ciénagas near Progreso, Yucatán).

Strongylura marina (Walbaum)

Atlantic coast of America from Cape Cod to Brazil including the West Indies, entering rivers (includes *S. timucu* (Walbaum)).

Strongylura exilis (Girard)

Pacific coast from California to Perú, entering rivers occasionally (e.g., Río Anton, Panama Bay).

Strongylura scapularis (Jordan and Gilbert)

Tidal streams on the Pacific slope of central Panamá southward to Ecuador.

ATHERINIDAE³*Menidia* sp.

Río Lagartos, northern tip of Yucatán Peninsula.

Menidia colei Hubbs

Brackish-water ciénagas about Progreso, Yucatán, México.

Archomenidia sallei (Regan)

Confined to freshwater in the lower Río Papaloapam basin, Atlantic slope of Veracruz, México.

Archomenidia bolivari Alvarez and Carranza
Confined to fresh water in the Río Coatzacoalcos basin, Atlantic slope of Oaxaca and Veracruz, México.

Archomenidia sp.

Río Teapa near Teapa, Tabasco, México.

Membras martinica (Valenciennes)

Gulf of Mexico, entering coastal lagoons.

Melaniris meeki (Miller)

Atlantic slope of Guatemala (Río Motagua) and Honduras.

Melaniris chagresi (Meek and Hildebrand)

Fresh and brackish water of the Atlantic slope of Costa Rica and Panamá.

Melaniris sardina Meek

Great Lakes of Nicaragua.

Melaniris guija (Hildebrand)

Río Lempa basin, Guatemala and El Salvador, and Río Choluteca, Honduras.

Melaniris guatemalensis (Günther)

Pacific coast of Central America; described from coastal lagoons at Huamuchal, Guatemala.

Melaniris sp.

Río Coatzacoalcos basin, Atlantic slope of México.

Melaniris sp.

Lake Petén, Petén, Guatemala.

Melaniris sp.

Río Polochic basin, Atlantic slope of Guatemala.

Xenatherina lisa (Meek)

Río Papaloapam basin, Atlantic slope of México.

Xenatherina schultzi Alvarez and Carranza

Upper part of the Río Coatzacoalcos, Oaxaca, México.

SYNGNATHIDAE

Syngnathus scovelli (Evermann and Kendall)

Atlantic coast from Florida to the Yucatán Peninsula, chiefly in salt and brackish water but penetrating river mouths.

Syngnathus elcapitanensis (Meek and Hildebrand)

Freshwater streams on the Pacific slope of Costa Rica and Panamá.

Oostethus lineatus (Kaup)

Atlantic coast from South Carolina to Panamá, entering fresh water.

Oostethus sp.

Lake Izabal, Atlantic slope of Guatemala.

Pseudophallus starksi (Jordan and Culver)

Pacific coastal streams of mainland México (near Mazatlán) and San José del Cabo, Baja California southward to Ecuador.

³I regard *Thyrinops* as a synonym of *Melaniris*.

Pseudophallus mindii (Meek and Hildebrand)

Atlantic coastal streams from Venezuela northward to Honduras and, possibly, to the Río Sarstún, Guatemala–British Honduras boundary.

CENTROPOMIDAE

Centropomus undecimalis (Bloch)

Atlantic coast from Florida to Río de Janeiro, Brazil, ascending streams.

Centropomus nigrescens Günther

Pacific coast from Río Yaqui, Sonora, and Baja California, México to Perú, entering streams.

Centropomus parallelus Poey

Atlantic slope from near Veracruz City, México southward to Brazil, entering fresh water.

Centropomus poeyi Chávez

Gulf of Mexico from Tampico, Tamaulipas to Frontera, Tabasco, México, entering river mouths (Chávez, 1961).

Centropomus pectinatus Poey

Both coasts of tropical America, entering brackish water.

Centropomus armatus Gill

Pacific coast from Chiapam, Guatemala to Guayaquil, Ecuador, entering tidal streams.

Centropomus robalito Jordan and Gilbert

Pacific coast from Río Yaqui, Sonora, México to Perú, entering rivers.

Centropomus ensiferus Poey

Atlantic coast from Florida to Brazil; taken in Lake Izabal, Guatemala.

LUTJANIDAE

Lutjanus novemfasciatus Gill

Pacific coast from Baja California to the Galápagos Islands, entering tidal streams.

Lutjanus cyanopterus (Cuvier)

Atlantic coast of tropical America, entering brackish water.

Lutjanus griseus (Linnaeus)

Atlantic coast from Massachusetts to Brazil, entering fresh water (Río Champotón, Yucatán, Hubbs, 1936:248).

Lutjanus jocu (Bloch and Schneider)

Cape Cod (as strays) southward to Florida, the West Indies, and mainland Middle America to Brazil, entering brackish and fresh water (Caldwell, *et al.*, 1959:24).

Lutjanus apodus (Walbaum)

Atlantic Ocean from Massachusetts to Bahía, Brazil, entering brackish water.

Lutjanus argentiventris (Peters)

Pacific coast from Baja California to Perú, entering fresh water (Caballo Blanco, Guatemala, Meek, 1908:140).

Lutjanus colorado Jordan and Gilbert

Pacific coast from Guaymas, Sonora, México to Panamá, entering tidal streams.

CARANGIDAE

Caranx latus Agassiz

Atlantic coast of tropical America, entering rivers.

Caranx marginatus (Gill)

Pacific coast from Mazatlán, México to Panama Bay, Panamá, entering fresh water.

Caranx hippos (Linnaeus)

Both coasts of tropical America, entering tidal streams.

Oligoplites saurus (Bloch and Schneider)

Both coasts of tropical America, entering tidal streams.

Oligoplites mundus Jordan and Starks

Pacific coast from Gulf of California to Perú, in tidal streams and coastal lagoons.

GERRIDAE

Eucinostomus argenteus Baird and Girard

Atlantic coast from New Jersey to Brazil, Pacific coast from California to Ecuador, entering brackish water.

Eucinostomus pseudogula Poey

Bermuda, Florida, West Indies, and southeastern México to Brazil (taken in Río Champotón, Yucatán; Hubbs, 1936:252). (Same as *E. melanopterus*?)

Eucinostomus gracilis (Gill)

Pacific coast from Baja California to the Galápagos Islands (taken in fresh water in western México).

Eucinostomus melanopterus (Bleeker)

Atlantic coast and tidal streams (occasionally in strictly fresh water) from Louisiana and Texas to Brazil including the West Indies; West Africa.

Gerres cinereus (Walbaum)

Atlantic and Pacific slopes from Bermuda and Florida to Venezuela and from Baja California to Perú and the Galápagos Islands, entering river mouths.

Diapterus rhombeus (Cuvier)

West Indies and Atlantic slope from Campeche, México to Brazil, entering coastal lagoons.

Diapterus evermanni Meek and Hildebrand

Atlantic coast from Veracruz, México to Venezuela, in coastal lagoons and river mouths.

- Diapterus axillaris* Günther
Pacific coast from Mazatlán, México to Guatemala, entering coastal lagoons.
- Diapterus peruvianus* (Cuvier)
Pacific coast from Mazatlán, México to Perú, entering tidal streams.
- Diapterus olithostomus* (Goode and Bean)
Atlantic coast from Florida to Brazil, entering rivers.
- Diapterus lineatus* (Humboldt)
Pacific coast from Acapulco, México to Colombia, entering brackish lagoons.
- Diapterus brevimanus* (Günther)
Pacific coast from Guatemala to Panamá, entering coastal lagoons. (Chiapam, Guatemala).
- Diapterus plumieri* (Cuvier)
Atlantic coast from Florida to Panamá, entering coastal lagoons.
- Diapterus mexicanus* (Steindachner)
Restricted to fresh water on the Atlantic slope of southern México and northern Guatemala (Río Coatzacoalcos to Río Usumacinta basins).

POMADASYIDAE

- Pomadasys leuciscus* (Günther)
Pacific coast from Mazatlán, México to Perú, entering coastal lagoons.
- Pomadasys bayanus* Jordan and Evermann
Pacific coast from Baja California to Perú, entering rivers.
- Pomadasys macracanthus* (Günther)
Pacific coast from Mazatlán, México to Panamá, entering coastal lagoons.
- Pomadasys crocro* (Cuvier)
Atlantic coast of tropical America, entering rivers.
- Pomadasys branicki* (Steindachner)
Pacific coast from Mazatlán, México to Perú, entering rivers.
- Pomadasys boucardi* (Steindachner)
Atlantic coast of tropical America, entering rivers (Río Papaloapam) and lakes (Lake Nicaragua).

SCIAENIDAE

- Bairdiella ronchus* (Cuvier)
Atlantic coast from the West Indies and eastern México to Brazil, entering coastal lagoons.
- Stellifer lanceolatus* (Holbrook)
Chesapeake Bay, Maryland southward to Laguna de Términos, Campeche, México.
- Stellifer rastrifer* (Jordan and Evermann)
Atlantic slope of southern Central America

- to Brazil, taken in Río Prinzapolca, Nicaragua (Astorqui).
- Micropogon furnieri* (Desmarest)
West Indies and Atlantic coast of Middle America to northern South America, entering fresh water (Río Champotón, Yucatán Peninsula; Lake Izabal, Guatemala).
- Micropogon altipinnis* Günther
Pacific coast from Guatemala to Ecuador, entering coastal lagoons.
- Aplodinotus grunniens* Rafinesque
Lakes and rivers in the Atlantic drainage from northeastern North America southward to the Río Usumacinta basin, Guatemala.
- Cynoscion arenarius* Ginsburg
Gulf coast of the United States and México southward at least to Laguna de Términos, Campeche.

SPARIDAE

- Archosargus aries* (Valenciennes)?
Atlantic coast from British Honduras to Brazil, entering rivers and lakes (Lake Izabal, Guatemala).

MUGILIDAE

- Mugil liza* Valenciennes
West Indies and tropical Atlantic American mainland southward to Brazil.
- Mugil cephalus* Linnaeus
Worldwide, entering rivers.
- Mugil curema* Valenciennes
Both coasts of the Americas and West Africa, entering rivers.
- Mugil trichodon* Poey
Atlantic coast from Florida to Brazil, entering rivers.
- Mugil* sp.
Río Coatzacoalcos near mouth, Veracruz, México.
- Agonostomus monticola* (Bancroft)
Freshwater streams of both slopes of North and Middle America and the West Indies, entering rivers, northward to Florida and Sonora, México.
- Joturus pichardi* Poey
West Indies and Atlantic slope of American mainland from northern Veracruz, México to Río Chagres, Panamá, restricted to swiftly flowing fresh water.

DACTYLOSCOPIDAE

- Dactyloscopus thysanotus* Böhlke
Pacific slope from southern Guatemala

(Miller and Briggs, 1962:9) to Chame Point, Panamá entering brackish and fresh water.

ELEOTRIDAE

- Gobiomorus dormitor* Lacépède
Streams of the West Indies and of southern Florida and Texas southward to Surinam.
- Gobiomorus maculatus* (Günther)
Pacific streams from Río Yaqui, Sonora, México southward to Perú.
- Dormitator maculatus* (Bloch)
Atlantic slope from North Carolina to Brazil, in sluggish streams.
- Dormitator latifrons* (Richardson)
Pacific slope from southern California to Perú, in sluggish streams.
- Guavina guavina* (Valenciennes)
Atlantic coast from Cuba and México (near Veracruz City) to Río de Janeiro, entering river mouths.
- Guavina micropus* Ginsburg
Miraflores Locks, Panama Canal.
- Leptophilypnus fluviatilis* Meek and Hildebrand
In fresh and brackish water of the Panama Canal Zone (originally Atlantic only); also near Tortuguero, Costa Rica (Caldwell *et al.*, 1959:28, as *Microeleotris mindii*).
- Leptophilypnus panamensis* (Meek and Hildebrand)
Streams of the Pacific slope of central Panamá (Río Chorrera, Río Juan Díaz).
- Leptophilypnus* sp.
Rapids of the Río de la Pasión (Usumacinta basin), Petén, Guatemala.
- Leptophilypnus* sp.
Río Polochic, Atlantic slope of Guatemala.
- Eleotris pisonis* (Gmelin)
Atlantic slope from Florida and Texas to Brazil, entering fresh water.
- Eleotris picta* Kner and Steindachner
Pacific slope from the Colorado River, California to Perú, in lower stream courses.
- Eleotris amblyopsis* (Cope)
Atlantic coast and streams from South Carolina to Surinam; West Indies.
- Eleotris isthmensis* Meek and Hildebrand
Atlantic slope of Panamá, in or near brackish water.
- Hemieleotris latifasciatus* (Meek and Hildebrand)
Streams of the Pacific slope from Costa Rica to southern Colombia.
- Erotilis armiger* (Jordan)
Baja California to Panamá (includes

Euleptoeleotris clarki Hildebrand), entering fresh water.

- Erotilis smaragdus* (Valenciennes)
Florida, the West Indies, and Panamá (as *Euleptoeleotris shropshirei* Hildebrand) to Venezuela, entering brackish water.

GOBIIDAE

- Bathygobius mystacium* Ginsburg
West Indies and vicinity of Veracruz City. Veracruz, México southward to Colón, Panamá, entering river mouths.
- Evorthodus lyricus* (Girard)
Atlantic coast from Chesapeake Bay to Surinam; West Indies; entering fresh water.
- Gobionellus boleosoma* (Jordan and Gilbert)
North Carolina to Venezuela (possibly to Brazil); West Indies; entering rivers.
- Gobionellus shufeldti* (Jordan and Eigenmann)
Gulf coast of the United States and northeastern México, entering river mouths.
- Gobionellus daguae* (Eigenmann)
Pacific slope of Panamá (Río Tuira basin) to Colombia.
- Gobionellus claytonii* (Meek)
Fresh and brackish waters along the Atlantic slope from northern Veracruz, México to Venezuela, including Trinidad; West Indies.
- Gobionellus hastatus* Girard
Gulf coast of the United States and México, entering brackish water.
- Gobionellus sagittula* (Günther)
Gulf of California to Perú, in brackish estuaries and lagoons.
- Gobionellus microdon* (Gilbert)
Pacific coast from Sonora, México to Panamá, entering fresh water.
- Awaous tajasica* (Lichtenstein)
Atlantic coast streams from Florida and the Río Grande to Bahía, Brazil; West Indies.
- Awaous transandeanus* (Günther)
Pacific coast streams from Río Yaqui, Sonora, México to Perú.
- Microgobius miraflorensis* Gilbert and Starks
Tidal streams and coastal lagoons of the Pacific slope from Laguna Coyuca, near Acapulco, México to central Panamá (Miller, 1958).
- Garmannia hildebrandi* Ginsburg
Gatún Locks, Panama Canal.
- Garmannia homochroma* Ginsburg

Both slopes of the Panama Canal, entering fresh water.

Garmannia spes Ginsburg

Atlantic slope from Costa Rica to Venezuela, entering coastal lagoons (Caldwell, *et al.*, 1959:28).

Gobioides broussonneti Lacépède

Atlantic coast from Florida to Brazil, entering fresh water.

Sicydium salvini Ogilvie-Grant

Streams of both slopes of central Panamá southward to Colombia and Ecuador.

Sicydium gymnogaster Ogilvie-Grant

Rivers of the Atlantic slope from Misantla, Veracruz, México southward at least to Honduras.

Sicydium altum Meek

Atlantic slope of Costa Rica.

Sicydium multipunctatum Regan

Pacific slope streams from near Mazatlán, México southward at least to the Río Choluteca, Honduras (Carr and Giovannoli, 1950:35).

Sicydium pittieri Regan

Streams of the Pacific slope of Costa Rica and western Panamá.

BROTULIDAE

Typhliasina pearsei (Hubbs)

Cenotes of the Yucatán Peninsula.

BOTHIDAE

Citharichthys gilberti Jenkins and Evermann

Pacific coast from Guaymas, Sonora and Laguna Santa María, Baja California, México southward to Perú, entering rivers.

Citharichthys spilopterus Günther

Atlantic coast from New Jersey to Brazil, entering rivers southward.

SOLEIDAE

Achirus lineatus (Linnaeus)

Florida and Texas to Brazil, sometimes ascending river mouths.

Achirus mazatlanus Steindachner

Pacific coast from Sonora, México to Perú, occasionally entering fresh water but more frequently in brackish lagoons.

Trinectes fonsecensis (Günther)

Pacific coast from Río Yaqui, Sonora, México to Perú, entering fresh water.

Trinectes maculatus (Bloch and Schneider)

Atlantic coast from Massachusetts to Venezuela, entering rivers southward.

BATRACHOIDIDAE

Batrachoides gilberti Meek and Hildebrand

Atlantic slope of Central America (Panamá to Nicaragua), entering fresh water (Deadman's Creek, Bluefields, Nicaragua; Rivas).

Batrachoides goldmani Evermann and Goldsborough

Restricted to the basin of the Río Usumacinta in Chiapas, Tabasco, and Campeche, México, and Petén, Guatemala.

Opsanus beta (Goode and Bean)

Periphery of the Gulf of Mexico from the Yucatán Peninsula (including Campeche Bank) through the Florida Keys and northward to at least Palm Beach, Florida (Walters and Robins, 1961:12); entering rivers.

GOBIESOCIDAE

Gobiesox potamius Briggs

Rivers of the Pacific slope of Costa Rica.

Gobiesox nudus (Linnaeus)

Rivers of the Atlantic slope from Costa Rica to Venezuela; West Indies.

TETRAODONTIDAE

Sphoeroides testudineus (Linnaeus)

Atlantic slope from Massachusetts to Brazil; West Indies; entering river mouths (Río Champotón, Hubbs, 1936:248; Río Prinzapolca, Nicaragua; Astorqui).

Sphoeroides annulatus (Jenyns)

Pacific coast from Gulf of California to northern Perú and the Galápagos Islands; entering rivers (two records in Nicaragua by Rivas).

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LITERATURE CITED

- BEHRE, E. H. 1928. A list of the fresh water fishes of western Panama between long. 81° 45' and 83° 15' W. Ann. Carnegie Mus. 18(2): 305-328.
- BÖHLKE, J. E. 1958. Studies on fishes of the family Characidae. No. 16—A new *Hyphessobrycon* from Costa Rica. Bull. Fla. State Mus. Biol. Sci. 3(4):173-178.
- BREder, C. M., JR. 1927. The fishes of the Río Chucunaque drainage, eastern Panama. Bull. Am. Mus. Nat. Hist. 57:91-176.
- BUSSING, W. A. 1963. A new poeciliid fish, *Phallichthys tico*, from Costa Rica. Los Angeles Co. Mus. Contrib. Sci. 77:1-13.
- CALDWELL, D. K., L. H. OGREN, AND L. GIOVANNOLI. 1959. Systematic and ecological notes on some fishes collected in the vicinity of Tortuguero, Caribbean coast of Costa Rica. Rev. Biol. Trop. 7(1):7-33.
- CARR, A. F., JR. AND L. GIOVANNOLI. 1950. The fishes of the Choluteca drainage of southern Honduras. Occ. Pap. Mus. Zool., Univ. Mich. No. 523, 38 pp.
- CHÁVEZ, U. 1961. Estudio de una nueva especie de robalo del Golfo de México y redescubrimiento de *Centropomus undecimalis* (Bloch). Ciencia 21(2):75-83.
- DARNELL, R. M. 1962. Fishes of the Río Tamesí and related coastal lagoons in east-central Mexico. Pub. Inst. Mar. Sci., Univ. Texas 8:299-365.
- GOSLINE, W. A. 1947. Contributions to the classification of the loricariid catfishes. Arq. Mus. Nac. (Brasil) 41:79-144.
- HILDEBRAND, S. F. 1925. Fishes of the Republic of El Salvador. Bull. U. S. Bur. Fish. 41:238-287.
- . 1938. A new catalogue of the fresh-water fishes of Panama. Zool. Ser., Field Mus. Nat. Hist. 22(4):219-359.
- . 1946. A list of fresh-water fishes from San José Island, Pearl islands, Panamá. Smith. Misc. Coll. 106(3):1-3.
- HUBBS, C. L. 1935. Fresh-water fishes collected in British Honduras and Guatemala. Misc. Pub. Mus. Zool., Univ. Mich. No. 28, 22 pp.
- . 1936. Fishes of the Yucatan Peninsula. Carnegie Inst. Wash. Pub. 457:157-287.
- . 1950. Studies of cyprinodont fishes. XX. A new subfamily from Guatemala, with ctenoid scales and a unilateral pectoral clasper. Misc. Pub. Mus. Zool., Univ. Mich. No. 78, 28 pp.
- . 1953. Geographic and systematic status of the fishes described by Kner and Steindachner in 1863 and 1865 from fresh waters in Panamá and Ecuador. Copeia 1953(3):141-148.
- AND R. R. MILLER. 1960. *Potamarius*, a new genus of ariid catfishes from the fresh waters of Middle America. Copeia 1960(2): 101-112.
- MALDONADO-KOERDELL, M. 1964. Geohistory and paleogeography of Middle America. In: Handbook of Middle American Indians, vol. 1. R. Wauchope and R. C. West, eds., pp. 3-32. Univ. Texas Press, Austin, Texas.
- MARSHALL, N. B. 1965. The life of fishes. Weidenfeld and Nicolson, London, England.
- MEEK, S. E. 1907. Synopsis of the fishes of the Great Lakes of Nicaragua. Field Colum. Mus. Pub. 121, Zool. Ser. 7(4):97-132.
- . 1908. Notes on fresh-water fishes from Mexico and Central America. *Ibid.* 124, Zool. Ser. 7(5):133-157 (Oct. 1907-Jan. 8, 1908).
- AND S. F. HILDEBRAND. 1923. The marine fishes of Panama. Part I. Zool. Ser., Field Mus. Nat. Hist. 15:1-330.
- MILLER, R. R. 1955. A systematic review of the Middle American fishes of the genus *Profundulus*. Misc. Pub. Mus. Zool., Univ. Mich. No. 92, 64 pp.
- . 1957. Fishes from Laguna Octotal. In: Biological investigations in the Selva Lacandona, Chiapas, Mexico. R. A. Paynter, Jr., (ed.). Bull. Mus. Comp. Zool., Harvard 116(4): 238-241.
- . 1958. A Panamanian gobiid fish, *Microgobius miraflorensis*, from western México, with taxonomic and ecologic notes. Copeia 1958(3):235-237.
- . 1959. Origin and affinities of the fresh-water fish fauna of western North America. In: Zoogeography, C. L. Hubbs, ed., pp. 187-222. Am. Assoc. Adv. Sci. Symp. Vol. 51.
- AND J. C. BRIGGS. 1962. *Dactyloscopus amnis*, a new sand stargazer from rivers of the Pacific slope of southern Mexico. Occ. Pap. Mus. Zool., Univ. Mich. No. 627, 11 pp.
- AND B. C. NELSON. 1961. Variation, life colors, and ecology of *Cichlasoma callolepis*, a cichlid fish from southern Mexico, with a discussion of the *Thorichthys* species group. Occ. Pap. Mus. Zool., Univ. Mich. No. 622, 9 pp.
- MYERS, G. S. 1966. Derivation of the freshwater fish fauna of Central America. Copeia 1966(4):766-773.
- REGAN, C. T. 1905. A revision of the fishes of the American cichlid genus *Cichlasoma* and of the allied genera. Ann. Mag. Nat. Hist., Ser. 7, 16:60-77, 225-243, 316-340, 433-445.
- . 1906-08. Pisces. In: Biologia Centrali-Americana 8:1-203.
- RIVAS, L. R. 1962. *Cichlasoma pasionis*, a new species of cichlid fish of the *Thorichthys* group, from the Río de la Pasion, Guatemala. Quart. J. Fla. Acad. Sci. 25(2):147-156.
- . 1963. Subgenera and species groups in the poeciliid fish genus *Gambusia* Poey. Copeia 1963(2):331-347.
- . 1965. Review of: The poeciliid fishes (Cyprinodontiformes), their structure, zoogeography, and systematics. By D. E. Rosen and R. M. Bailey. Copeia 1965(1):117-118.
- ROSEN, D. E. AND R. M. BAILEY. 1963. The poeciliid fishes (Cyprinodontiformes), their structure, zoogeography, and systematics. Bull. Am. Mus. Nat. Hist. 126(1):1-176.
- RYAN, R. M. 1963. The biotic provinces of Central America. Acta Zool. Mex. 6(2-3):1-55.
- SCHULTZ, L. P. 1944a. The catfishes of Venezuela, with descriptions of thirty-eight new forms. Proc. U. S. Nat. Mus. 94:173-338.

- . 1944b. A new genus and species of pimelodid catfish from Colombia. J. Wash. Acad. Sci. 34(3):93-95.
- SCHWARTZ, F. J. 1964. Natural salinity tolerances of some freshwater fishes. Underwater Natur. 2(2):13-15.
- STUART, L. C. 1964. Fauna of Middle America. In: Handbook of Middle American Indians, vol. 1. R. Wauchope and R. C. West, eds., pp. 316-362. Univ. Texas Press, Austin, Texas.
- WALTERS, V. AND C. R. ROBINS. 1961. A new toadfish (Batrachoididae) considered to be a glacial relict in the West Indies. Am. Mus. Novit. No. 2047, 24 pp.
- WEST, R. C. 1964. Surface configuration and associated geology of Middle America. In: Handbook of Middle American Indians, vol. 1. R. Wauchope and R. C. West, eds., pp. 33-83. Univ. Texas Press, Austin, Texas.
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ADDENDUM

- During the eight years since this list was published, the following major changes and additions have been noted by me or others.
- Compsura* and *Pseudocheirodon* were both synonymized with *Cheirodon* by Fink and Weitzman (1974, Smith. Contrib. Zool. 172); hence *C. gorgonae* becomes *Cheirodon gorgonae* Evermann and Goldsborough, *P. affinis* becomes *Cheirodon affinis* (Meek and Hildebrand), and *P. terrabae* (see below) becomes *Cheirodon terrabae* (Bussing). P. 784.
- Pseudocheirodon* sp. = *P. terrabae* Bussing, 1967 (Rev. Biol. Trop. 14 (2); 1966). Known only from Río Grande de Térraba basin, Pacific slope of Costa Rica. P. 784.
- Cheirodon dialepturus* Fink and Weitzman (*op. cit.*). Pacific slope of Panamá and Costa Rica, from Coclé Province to Río Coto. Add to p. 784.
- Cheirodon mitopterus* Fink and Weitzman (*op. cit.*). Atlantic slope of central Panamá (Río Coclé del Norte basin). Add to p. 784.
- Bramocharax* sp. = *Bramocharax dorioni* Rosen (as *B. bransfordi dorioni*, 1970, Am. Mus. Novit. 2435). Upper tributaries of Río Usumacinta basin in Alta Verapaz, Guatemala. (Now regarded as a full species, Rosen, pers. comm., 1974.) P. 785.
- Bramocharax baileyi* Rosen, 1972 (Am. Mus. Novit. 2500). Upper reaches of Río de la Pasión and Río Salinas, Alta Verapaz, Guatemala. Add to p. 785.
- Hypheosobrycon* sp. = *H. savagei* Bussing, 1967 (*op. cit.*). Known only from Río Grande de Térraba basin, Pacific slope of Costa Rica. P. 785.
- Rhoadsia eigenmanni* is now called *Carlana eigenmanni* (Fink and Weitzman, *op. cit.*). P. 785.
- Roeboides salvadoris* is a synonym of *R. guatemalensis* (Miller and Carr, 1974, Copeia: 121). P. 785.
- Pterobrycon myrmae* Bussing, 1974 (Rev. Biol. Trop. 22(1):138-144, figs. 1-3). Known only from the Pacific slope of southern Costa Rica. Insert at bottom, p. 785, col. 1.
- Piabucina boruca* Bussing, 1967 (*op. cit.*). Río Grande de Térraba and Río Coto basins, Pacific slope of Costa Rica. Add to p. 786.
- Gymnotus carapo* is unknown from Costa Rica (Bussing, 1967, *op. cit.*). P. 786.
- Gymnotus cylindricus* occurs also in Costa Rica (Bussing, 1967, *op. cit.*). P. 786.
- Imparales* sp. = *I. panamensis* Bussing, 1970 (L. A. Co. Mus. Contrib. Sci., 196). Pacific and Atlantic (Río Chagres) slopes of Panamá. P. 786.
- Rhamdia heteracantha* is also on Pacific slope of Costa Rica (Bussing, 1967, *op. cit.*). P. 787.
- Rhamdia nasuta* is also on Atlantic slope of Costa Rica (Bussing, 1967, *op. cit.*). P. 787.
- Nannorhamdia lineata* Bussing, 1970 (*op. cit.*). Pacific slope of Costa Rica (Puntarenas Prov.). Add to p. 787, col. 1.
- Rivulus myersi* is probably a synonym of *R. marmoratus* Poey; that species is known in Middle America from México and Belize (material at USNM and UMMZ). P. 788.
- Rivulus godmani* is a synonym of *Rivulus tenuis* (Miller and Carr, *op. cit.*). P. 788.
- Rivulus* sp. = *R. robustus* Miller and Hubbs, 1974 (Copeia: 865-869). P. 788.
- Xiphophorus signum* Rosen and Kallman (as *X. helleri signum*, 1969, Am. Mus. Novit. 2379). Río Chajmaic, Río Usumacinta basin, Alta Verapaz, Guatemala. (Now regarded as a full species, Rosen, pers. comm., 1974.) Add to p. 789.

- Genus and species (Cnesterodontinae) Rosen = *Scolichthys iota* Rosen and *S. greenwayi* Rosen (1967, Am. Mus. Novit. 2303). Both inhabit upper tributaries of Río Usumacinta in Alta Verapaz, Guatemala. P. 789.
- Brachyrhaphis* sp. = *B. holdridgei* Bussing, 1967 (*op. cit.*). Atlantic slope of Costa Rica. P. 790, col. 1, line 8 down.
- Poecilopsis* sp. = *P. paucimaculata* Bussing, 1967 (*op. cit.*). P. 791.
- Phallichthys fairweatheri* Rosen and Bailey. Range includes the lower Río Usumacinta basin (Chiapas-Tabasco, UMMZ 196422) and Caobas Laguna (Campeche-Quintana Roo, UMMZ 196466), México. P. 791.
- Cichlasoma maculicauda*. Although Rivas (1962: 154) recorded this species from the Usumacinta basin, Guatemala, examination of his specimen (now number 5430, Gulf Coast Res. Lab.) shows it to be a juvenile of *C. heterospilum* Hubbs. An adult male (GCRL 5698) from 36 km WNW of Sayaxché, El Petén, Guatemala, also represents this species. One distinguishing character is the length of the pectoral fin, the tip of which extends to the vent in *maculicauda* but to beyond the anal origin in *heterospilum*. *C. maculicauda* is known northward to the basin of Golden Stream, southern Belize (UMMZ 195944). P. 791.
- Cichlasoma lyonsi* Gosse, 1966 (Bull. Inst. R. Sci. Nat. Belg. 42: 16). Tributary to Río Coto, Pacific slope of Costa Rica (Puntarenas Prov.). Insert after *C. heterospilum*, p. 791.
- Cichlasoma nicaraguense* (Günther). For account of variation, coloration, and systematic status, see López, 1974 (Rev. Biol. Trop. 22(1):161-185, figs. 1-11). P. 791.
- Cichlasoma sajica* Bussing, 1974 (Rev. Biol. Trop. 22(1):30-37, fig. 1). Pacific slope of southern Costa Rica from just south of Punta Mala to the Río Esquinas basin. Insert after *C. nigrofasciatum*, p. 792.
- Cichlasoma diquis* Bussing, 1974 (*op. cit.*:37-44, fig. 2). Pacific slope of southern Costa Rica from just south of Punta Mala to the Río Coto drainage. Insert after *C. alfaroi*, p. 792.
- Cichlasoma spilurum*. Range should read "Atlantic slope from eastern Campeche, México, southward to . . ." (material at UMMZ and Gulf Coast Res. Lab.). P. 792.
- Cichlasoma robertsoni*. Range emended and extended to eastern Honduras (Miller and Carr, *op. cit.*). P. 792
- Cichlasoma longimanus*. Also Pacific slope of Costa Rica (Bussing, 1967, *op. cit.*). P. 792.
- Cichlasoma guija*, regarded as perhaps only a race of *C. macracanthum* by Kähnsbauer (1972, Ann. Naturhistor. Mus. Wien, 72: 165), is herewith synonymized with that species since comparison of the holotype (USNM 87301, *C. meeki*) with *C. macracanthum* fails to support specific separation. P. 792.
- Cichlasoma heterodontum* is a synonym of *C. macracanthum* (Miller, MS). P. 792.
- Cichlasoma bulleri*. Range should read "Upper tributaries of the Río Coatzacoalcos basin, Oaxaca, México." P. 792.
- Cichlasoma atromaculatum* Regan. Atlantic slope of Panamá (San Blas Prov., material in USNM) east to Atrato and San Juan basins, Colombia. Insert under *Parapetenia*, p. 792.
- Cichlasoma managuense*. Add to range "into eastern Honduras" (material at UMMZ). P. 793.
- Cichlasoma dowi*. Add to range "northward into Honduras" (Miller and Carr, *op. cit.*). P. 793.
- Cichlasoma motaguense*. Also Atlantic slope of Costa Rica (Bussing, 1967, *op. cit.*). P. 793.
- Cichlasoma* sp. = *C. mento* (Vaillant and Pellegrin). P. 793, col. 1, line 21 up.
- Cichlasoma affine*. For "Río Grijalva basin, México" substitute "Laguna Bacalar, Quintana Roo, México" (material at UMMZ). P. 793.
- Cichlasoma* sp. = *C. regani* Miller, 1974 (Proc. Biol. Soc. Wash., 87(40):465-472). P. 793, col. 2, line 14 up.
- Chanos chanos*. Unpublished record for Corinto, northwest coast of Nicaragua, Meek, 1906 (FMNH 5830). P. 794.
- Anchoa cayorum* (Fowler). Recorded from the fresh waters of Belize by Thomerson and Greenfield (1975, Copeia: 50-52). P. 795.
- Anchoviella belizensis* Thomerson and Greenfield, 1975 (*op. cit.*). Lowland fresh waters of Belize. P. 795.
- Arius melanopus* as listed is a complex (W. R. Taylor, pers. comm., 1974). *A. aguadulce* (Meek), Río Papaloapan basin, Veracruz, México, southeastward to Río Polochic basin, Guatemala. *A. melanopus* (Günther), Río Motagua basin, Guatemala, into northwestern Honduras. P. 795.
- Strongylura timucu* (Walbaum). Atlantic slope, from Florida and Veracruz, México (FMNH 4568), southward and eastward through the Antilles to Brazil, entering rivers (Collette, 1968, Copeia: 190). Add to p. 796.

- Strongylura hubbsi* Collette, 1974 (Copeia: 612). Atlantic slope streams from basins of Río Papaloapan, México, to Río Usumacinta, Guatemala. Add to p. 796.
- Melaniris meeki*. Confined to Río Motagua basin, Guatemala (Miller and Carr, *op. cit.*). P. 796.
- Melaniris alvarezii* Diaz-Pardo, 1972 (Anal. Esc. Nac. Biol. 19 (1-4): 145-152). Basin of lower Río Grijalva, Tabasco, México. Add to p. 796.
- Centropomus poeyi* Chávez. Recorded from Belize by Greenfield (1975, Copeia; in press). P. 797.
- Oligoplites palometa* (Cuvier). Atlantic slope of Central America to northern South America, entering fresh water (e.g., Lake Yzabal, Guatemala—Regan, 1906, Biol. Centrali-Amer., 8: 15). Add to p. 797.
- Diapterus olisthostomus* (Goode and Bean) is a synonym of *D. auratus* Ranzani (Deckert, in press, Bull. So. Calif. Acad. Sci.); *D. evermanni* Meek and Hildebrand is the juvenile of *D. olisthostomus* (C. L. Hubbs, pers. comm., 1967). Pp. 797-798.
- Diapterus* (or *Eugerres*) *brasilianus* (Valenciennes). Recorded from the fresh waters of Belize by Thomerson and Greenfield (1975, *op. cit.*). P. 798.
- Larimus breviceps* Cuvier. West Indies to Brazil (see Gilbert and Kelso, 1971, Bull. Fla. St. Mus. 16). Add to p. 798.
- Menticirrhus americanus* (Linnaeus). Atlantic slope from Chesapeake Bay southward to Costa Rica, entering lagoons (Gilbert and Kelso, *op. cit.*). Add to p. 798.
- Echeneis naucrates* Linnaeus. The addition of this marine fish (Echeneidae) is on the authority of Gilbert and Kelso (*op. cit.*). Add to p. 798, before Dactyloscopidae.
- Bathygobius soporator* (Valenciennes). Florida and Gulf Coast southward to Rio de Janeiro; recorded from fresh water in Costa Rica (Gilbert and Kelso, *op. cit.*). Add to p. 799.
- Gobionellus claytoni* is restricted to Gulf of Mexico drainage in México (see next entry). P. 799.
- Gobionellus fasciatus* (Gill). Southern Caribbean basin from Costa Rica to Dominica, entering fresh water (Gilbert and Kelso, *op. cit.*). Add to p. 799.
- Gobionellus pseudofasciatus* Gilbert and Randall, 1971 (in Gilbert and Kelso, *op. cit.*). Atlantic slope of Belize to Panamá and Trinidad (see Thomerson and Greenfield, *op. cit.*). Add to p. 799.
- Citharichthys uhleri* Jordan. West Indies and Atlantic coast of Middle America where it enters rivers (as in México, UMMZ 184533, and Costa Rica—Gilbert and Kelso, *op. cit.*). Add to p. 800.
- Trinectes paulistanus* Miranda-Ribeiro. Southeastern Yucatán, México, to Brazil, entering fresh water (Gilbert and Kelso, *op. cit.*; USNM 114281, Río Sauce, L. Yzabal, Guatemala). Add to p. 800.
- Batrachoides gilberti* Meek and Hildebrand. Recorded from fresh water in Belize by Greenfield and Greenfield (1973, Copeia: 564). P. 800.

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