

Fishes collected by Emanuel Ritter von Friedrichsthal in Central America between 1838–1841

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Abstract

The fish specimens sent to Vienna by the Austrian naturalist Emanuel Ritter von Friedrichsthal (1809–1842) constitute one of the oldest collections of freshwater fishes from Central America. The holotype of *Heros friedrichsthalii* and specimens of *Atherinella sardina* were collected in the Rio San Juan or Lago de Nicaragua drainage in Nicaragua. The types of *Cichlasoma urophthalmus stenozoneum*, *Heros melanopogon* and *Heros triagramma*, as well as specimens of *Petenia splendida* and *Eugerres plumieri* were most probably collected at Bacalar, Quintana Roo. *Cichlasoma loisellei* (Bussing, 1989), is synonymized with *Parachromis friedrichsthalii* (Heckel, 1840). The species hitherto referred to as *P. friedrichsthalii* takes the valid name *Parachromis multifasciatus* (Regan, 1905). A lectotype is designated for *Cichlasoma urophthalmus stenozoneum* (Hubbs, 1936), which is synonymized with *Mayaheros urophthalmus* (Günther, 1862).

Resumen

Los especímenes de peces enviados a Viena por el naturalista Austriaco Emanuel Ritter von Friedrichsthal (1809–1842) constituyen una de las colecciones más antiguas de peces dulceacuícolas de Centroamérica. El holotipo de *Heros friedrichsthalii* y especímenes de *Atherinella sardina* fueron colectados en la cuenca del Rio San Juan o en el Lago de Nicaragua en Nicaragua. Los tipos de *Cichlasoma urophthalmus stenozoneum*, *Heros melanopogon* y *Heros triagramma*, además de especímenes de *Petenia splendida* y *Eugerres plumieri* fueron muy probablemente colectados en Bacalar, Quintana Roo. *Cichlasoma loisellei* (Bussing, 1989), es sinonimizado con *Parachromis friedrichsthalii* (Heckel, 1840). La especie hasta ahora referida como *P. friedrichsthalii* toma el nombre válido *Parachromis multifasciatus* (Regan, 1905). Se designa un lectotipo para *Cichlasoma urophthalmus stenozoneum* (Hubbs, 1936), que es sinonimizado con *Mayaheros urophthalmus* (Günther, 1862).

Kurzfassung

Die von dem Österreichischen Naturforscher Emanuel Ritter von Friedrichsthal (1809–1842) nach Wien eingesandten Fisch-Exemplare bilden eine der ältesten Sammlungen von Süßwasserfischen aus Zentralamerika. Der Holotypus von *Heros friedrichsthalii* und Exemplare von *Atherinella sardina* wurden im Einzugs des Rio San Juan oder des Lago de Nicaragua in Nicaragua gesammelt. Die Typen von *Cichlasoma urophthalmus stenozoneum*, *Heros triagramma* und *Heros melanopogon* sowie Exemplare von *Petenia splendida* und *Eugerres plumieri* wurden wahrscheinlich in Bacalar, Quintana Roo, Mexiko, gesammelt. *Cichlasoma loisellei* (Bussing, 1989), wird mit *Parachromis friedrichsthalii* (Heckel, 1840) synonymisiert. Die bislang als *P. friedrichsthalii* bezeichnete Art erhält den gültigen Namen *Parachromis multifasciatus* (Regan, 1905). Ein Lectotypus wird für *Cichlasoma urophthalmus stenozoneum* (Hubbs, 1936), welcher mit *Mayaheros urophthalmus* (Günther, 1862) synonymisiert, festgelegt.

Key words

Historical collection, Nicaragua, Yucatán, type specimens, Cichlidae.

Introduction

Emanuel Ritter von Friedrichsthal was born on January 12, 1809, in Brünn, Moravia (then Austrian Empire; now Brno, Czech Republic) (ANONYMOUS, 1842; FISCHER-WESTHAUSER, 2017). He grew up at the manor of Urschitz (now Uhřice u Kroměříže, approx. 30 km SE of Brno), which his father had bought in 1810 (WOLNY, 1838). After being trained at the *Theresianische Ritterakademie*, Vienna, he took up a position in the Austrian civil service, which he soon left to devote himself to the study of nature and human society. In 1834–35, he traveled in southern Greece; in spring 1836 he joined an expedition through Serbia, Macedonia and the European part of Turkey, from which he returned in 1837 (NEILREICH, 1855).

In 1838, Friedrichsthal set out on an expedition to the New World. He visited Nicaragua and Costa Rica, and – after a prolonged stay in the United States – Yucatán. He gathered geographical, geological and meteorological data, collected botanical and zoological specimens, carried out researches in ethnology and archeology and studied political, economic and social conditions. Moreover, he was a pioneer of modern Maya research (FRIEDRICHSTHAL, 1841b, e; STEPHENS, 1843) and of photography (FISCHER-WESTHAUSER, 2007, 2015). Unfortunately, much of his scientific legacy is lost. In Yucatán, he contracted a fatal disease, possibly malaria. Already seriously ill (FRIEDRICHSTHAL, 1841a), he travelled homeward over New York, Paris and London to present his archeological findings and to exhibit his daguerreotypes. By the end of October 1841 he returned to Vienna. Before he was able to sort out his findings in a way that they could have been processed to a comprehensive publication, he passed away on March 13, 1842 (ANONYMOUS, 1842). The whereabouts of most of his collections, records and photographs – especially those taken during the last stage of his journey – are unknown (NOWOTNY, 1956; FISCHER-WESTHAUSER, 2007, 2015).

Among the items still preserved in scientific collections there are two small series of fish specimens stored in the Natural History Museum Vienna (Naturhistorisches Museum Wien; NMW), registered in 1840 and 1844, respectively. Neither is particularly comprehensive (altogether 18 specimens representing eight species) – but they make up the very first ichthyological collection from fresh waters of Lower Central America and the Yucatán peninsula.

The specimens were studied by Austrian ichthyologist Johann Jacob Heckel. In 1840, he described *Heros friedrichsthalii*. He also recognized the four cichlid species included in the 1844 series as new; at least he assigned a new name to each lot in the acquisition list of the museum. STEINDACHNER (1864) described two of these species (*Heros triagramma* and *Heros melanopogon*) as new, but identified the other two as conspecific with taxa meanwhile described by GÜNTHER (1862) from material collected by Osbert Salvin in Guatemala (*Heros*

urophthalmus and *Petenia splendida*). HUBBS (1936) described a new subspecies, *Cichlasoma urophthalmus steinonozonum*, based on STEINDACHNER'S (1864) description and figure of Friedrichsthal's specimen of *H. urophthalmus*.

Unfortunately, neither the NMW archival records nor the works by HECKEL (1840) or STEINDACHNER (1864) state the localities more precisely than 'Central America'. GÜNTHER (1868) suggested that Friedrichsthal could have collected at Lago Petén Itzá, Guatemala. However, this assumption was based solely on the fact that Salvin found most of the species in question at that lake, which, as GÜNTHER (1868) erroneously believed, would harbor a peculiar, largely endemic, fish fauna. The uncritical acceptance of his conclusion has led to some misidentifications, especially to the misapplication of the name *Heros friedrichsthalii* (MOYA MEOÑO, 1979; BUSSING, 1989; MILLER 2006).

The purpose of the present paper is to describe Friedrichsthal's itinerary, to narrow down the collecting localities as close as possible, to provide descriptions and figures of the specimens collected by him (with special focus on type material), and to review the taxonomic status of the species included.

Material and Methods

Specimens examined are listed under the respective species heading. Measurements were taken with digital calipers to nearest 0.1 mm. Counts and measurements for cichlids were obtained as described by KULLANDER (1980, 1990) except for head and snout length, which were measured point to point. Vertebral counts follow HUBBS & LAGLER (1964). Scale counts of *Atherinella* were taken according to BUSSING (1979). Numbering of vertical bars correspond to that of ŘÍČAN *et al.* (2005). Generic classification of the Cichlidae follows ŘÍČAN *et al.* (2016).

Geographic names correspond to current usage unless stated otherwise. Lago de Nicaragua is preferred over Lago Cocibolca due to familiarity and historical context. Yucatán refers to the peninsula rather than to the federal state throughout this paper; Belize refers to the city except in distributional ranges.

Results

Friedrichsthal's itinerary

A reconstruction of Friedrichsthal's travels in Central America is not without difficulties. The few contemporary accounts – mostly extracts from his lectures, letters and manuscripts – contain some inconsistencies in timing. Moreover, they are interspersed with data taken from



Fig. 1. Map showing Friedrichsthal's travels in Central America. The yellow dashed line shows a possible alternative route, see text for explanation.

external sources, which are not always marked as such due to the publication in excerpts. For example, he gives – quite out of context (obviously taken from a much longer manuscript; NOWOTNY, 1956) – geographic information for some cities, volcanoes and other places in present-day Guatemala and El Salvador (FRIEDRICHSTHAL, 1841c). This and the introductory note “The disturbed state of Mexico having prevented M. Friedrichsthal from executing his original intention of travelling into California, he turned his steps to Guatemala ...” (FRIEDRICHSTHAL, 1841c: 97) has led to the assumption that he visited those countries (TARACENA CARRIOLA & SELLEN, 2006). This is not the case, however. From the title of his article, “Notes on the Lake of Nicaragua and the Province of Chontales, in Guatemala” (FRIEDRICHSTHAL, 1841c), from the original labels of his herbarium specimens [see <http://herbarium.univie.ac.at/database>], and from his handwritten travelogue (FRIEDRICHSTHAL, 1841f) it is evident that he referred to the entire Federal Republic of Central America (a confederation of the present-day states Guatemala, Honduras, El Salvador, Nicaragua and Costa Rica, which had emerged in 1824 from the former *Capitanía General de Guatemala* and was about to dissolve at the time of Friedrichsthal's travels) as ‘Guatemala’. Moreover, FRIEDRICHSTHAL (1841b, f) makes no mention of any stay in Guatemala or El Salvador in his own accounts of the journey.

Friedrichsthal traveled chiefly at his own expense, but he also obtained state support. On the agency of State Chancellor Prince Klemens Wenzel von Metternich (1773–1859) a subsidy of 3000 Guilders was granted to him. Moreover, he was appointed an attaché of the Austrian legation in North America for the duration of his journey (NOWOTNY, 1956). Before crossing the Atlantic, he made a stop in Paris, where he met Alexander von

Humboldt (1769–1859) and the French geographer and Egyptologist Edmé François Jomard (1777–862), on whose recommendation he abandoned his original plan to go to California and chose Nicaragua and Costa Rica as his field of research instead (FRIEDRICHSTHAL, 1841f). Friedrichsthal's travels in these countries are fairly well documented (FRIEDRICHSTHAL, 1839, 1840, 1841b, c, d, f; unpublished letters quoted by FISCHER-WESTHAUSER, 2015; locality data of botanical collections): On January 12, 1839, he arrived at the port of San Juan de Nicaragua, where he stayed a few days (at least to January 20; FRIEDRICHSTHAL, 1841d), before he ascended the Rio San Juan in a pirogue. After seven days he landed at the northeastern shore of Lago de Nicaragua and entered the interior of Chontales, where he lived for some time among the natives and took botanical and archeological collections. Herbarium samples are recorded from Rio Mayales (a tributary to Lago de Nicaragua, which drains the environs of Juigalpa) and a “Hacienda de Sta. Luca” (= possibly Santa Lucía, about 10 km south of Acoyapa); and there is also a barometrical record for Acoyapa (FRIEDRICHSTHAL, 1841d). He penetrated northward to a “Affen-Fluß” (FRIEDRICHSTHAL, 1841f; = most likely Rio Mico, a headwater tributary to the Rio Escondido close to the Lago de Nicaragua watershed). Thence he returned to the lake and proceeded along its shore towards Granada, from where he undertook several excursions, e.g., to the island of Ometepe (Lago de Nicaragua), to Laguna Masaya, Lago de Managua, and Laguna Asososca Managua (FRIEDRICHSTHAL, 1839). At the beginning of May 1839 he turned to the Pacific coast and to Costa Rica. After passing the Aguacate Mountains (Guanacaste, Costa Rica) he entered the *Valle Central* of Costa Rica. He visited Alajuela, Heredia, San José, Cartago and Turrialba (FRIEDRICHSTHAL, 1840). The southernmost point he reached was the valley of Orosi south of Cartago (FRIEDRICHSTHAL, 1841f).

Although he had previously expressed the intention to proceed northward to El Salvador and Guatemala (FRIEDRICHSTHAL, 1839), he decided to avoid the tropical rainy season and to travel to the United States. He left Costa Rica in August 1839. He went down Rio Sarapiquí and Rio San Juan back to San Juan de Nicaragua (FRIEDRICHSTHAL, 1841b, f). From there he sailed via Chagres, Panamá, to Jamaica. After visiting Santo Domingo and Cuba he landed in New Orleans in October 1839, and travelled over land to Washington, D.C. (FRIEDRICHSTHAL, 1841f).

In the United States Friedrichsthal was mostly occupied with diplomatic tasks, but he prepared to resume his research in Central America (FRIEDRICHSTHAL, 1840). In August 1840, he met the archeologist John Lloyd Stephens (1805–1852) in New York, who had just (on July 31, 1840; STEPHENS, 1841) returned from his first expedition to the lands of the Maya (FRIEDRICHSTHAL, 1841f). Upon Stephens' accounts and recommendations, Friedrichsthal decided to head for Yucatán.

On August 24, 1840 (FISCHER-WESTHAUSER, 2015), Friedrichsthal boarded a ship to Belize, which he could

have reached at the earliest by mid-September. From there he proceeded to Bacalar in the southeast of Yucatán, at that time a port of some regional importance (Laguna Bacalar, now more or less landlocked, had an open connection to the lower Rio Hondo and the Bahía de Chetumal; SMITH, 1842). The inhabitants of Bacalar kept a small, semi-legal trade with Belize by market-boats (ALLEN, 1840), so there was probably no lack of opportunities for Friedrichsthal to get there.

The remaining itinerary is only vaguely and incompletely described, possibly because Friedrichsthal did not want to anticipate a comprehensive, illustrated account – a project for which he requested further financial support from Metternich (FRIEDRICHSTHAL, 1841f). He stated to have crossed Yucatán over its whole latitude, proceeding in westward direction. If so, he could have taken the trail to Mérida, which existed since the colonial era in the otherwise unexplored interior part of the peninsula (BANCROFT, 1883). TARACENA CARRIOLA & SELLEN (2006) suggested (with reference to NOWOTNY, 1956) that he had to abandon the way over land due to illness and an assault by locals and returned to Bacalar in order to proceed by ship to the port of Sisal in northern Yucatán. The assault is mentioned in the obituary (ANONYMOUS, 1842), but there is some reason to doubt that the attendant circumstances are reported correctly. FRIEDRICHSTHAL (1841f) himself states only that he had to make great sacrifices especially during the last stage of his journey. Elsewhere, he mentions some troubles with the locals impeding his research in the ruins (FRIEDRICHSTHAL, 1841e). It appears, therefore, more likely that the incident happened during one of his excursions to the Maya ruins towards the end of his stay in Yucatán. From his notes (FRIEDRICHSTHAL, 1841b, e; [1841] in OROZCO Y BERRA, 1856) it seems that he had visited at least Aké, Izamal, Chichén Itzá and Uxmal (though only the latter two being actually explored), probably starting from Mérida since the distances are given chiefly from that place. Finally, he took residence in Campeche for some time in spring 1841. In June 1841, he left Yucatán.

Fishes collected in Nicaragua

The first of Friedrichsthal's collections, registered at the NMW in 1840 (FITZINGER, 1880a; acquisition number 1840.XII.1–3; these numbers are not to be confused with actual dates, see SCHIFTER *et al.*, 2007) must have been obtained during Friedrichsthal's expedition to Nicaragua and Costa Rica, since it was first reported upon already by HECKEL (1840). The exact publication date of Heckel's work is unknown. However, in the supplement to *Serapaeum*, a semimonthly journal for library science, issued November 15, 1840, it is listed in an overview of recent publications (WEIGEL, 1840), so it must have been out at the latest in early November (i.e. less than two months after Friedrichsthal's arrival in Belize, see above). Considering transportation time, determination of the material, preparation of the description, and processing the

manuscript to publication, the possibility that specimens from Yucatán could have reached Vienna to be included in HECKEL's (1840) work can be ruled out. Comparison of the collector's itinerary with the known distribution and habitat preferences (BUSSING 1979, 1989, 1998) of the two species identifiable allow the conclusion that they have been collected in the Rio San Juan or Lago de Nicaragua drainage. Besides the two species treated below, the collection contained two specimens identified by Heckel in the acquisition list as "Pimelodus Nhamdia Cuv. Val.". They could not be located in the NMW, and there is no published account, so nothing can be said about their identity. Heckel's tentative determination would suggest a species of the catfish genus *Rhamdia* (Heptapteridae).

Atherinella sardina (Meek, 1907)

NMW 70363, 7 specimens; "Central-Amerika" (Nicaragua, Rio San Juan or Lago de Nicaragua drainage)

Remarks: The acquisition book lists eight specimens (originally cataloged as *Atherina brasiliensis*). One is now missing, and may be lost or destroyed. The remaining specimens are in a very poor state of preservation, too shrunk and too distorted to allow measurements, and the vertical fins are badly damaged or lost. The general appearance of the specimens suggests that they must have been dried for some time. Scale counts are as follows: transverse series 7, median longitudinal series 38–41, predorsal series 19–21. The scales are crenate, especially anterodorsally. The present color in alcohol is a rather dark reddish-brown, lighter on the lower part of the abdomen, with a conspicuous silvery-yellow lateral stripe about half as wide as the median flank scales.

In spite of their bad state of preservation, the specimens are readily identified by squamation characters. The scale counts exclude all other species known to occur in Nicaragua except *A. hubbsi* (BUSSING, 1979), which differs from *A. sardina* in having the scales except those in the predorsal series smooth-edged (BUSSING, 1979, 1998).

Parachromis friedrichsthalii (Heckel, 1840)

NMW 35322, Holotype, 99.4 mm SL. "Central-Amerika" (Nicaragua, Rio San Juan or Lago de Nicaragua drainage). Figs 2, 3.

Description: The specimen is not well preserved; it is bent, with some scales missing, the fins partly damaged. A cut runs from the chest to the end of the anal-fin base on the right side. The soft parts of the body are shrunk, probably the result of temporary desiccation.

See Figure 2 for general aspect and Table 1 for measurements. Body moderately deep. Caudal peduncle deeper than long. Dorsal head profile strongly concave in front of orbit, occipital and predorsal nuchal region convex. Head large, slightly longer than deep. Mouth large, oblique, maxilla reaching to vertical from anterior margin of orbit. Lower jaw projecting. Lower lip continu-

Table 1. Morphometric data of *Heros friedrichsthalii*, *H. triagramma*, *H. melanopogon* and *Petenia splendida*.

	<i>Heros friedrichsthalii</i>	<i>Heros triagramma</i>	<i>Heros melanopogon</i>		<i>Petenia splendida</i>
	Holotype	Holotype	Syntypes		
	NMW 35322	NMW 76584	NMW 17535:1	NMW 17535:2	NMW 24540
Standard Length	99.4mm	79.4mm	92.0mm	49.4mm	89.5mm
in % SL					
Head Length	37.3	36.1	30.6	34.6	36.4
Body Depth	43.1	45.6	45.3	44.3	32.8
Preorbital Depth	5.7	7.3	7.7	6.6	3.9
Orbital Diameter	9.6	10.4	8.8	9.9	8.7
Interorbital width	11.3	9.7	10.8	7.2	7.7
Lower Jaw Length	19.8	17.3	10.3	10.9	29.4
Dorsal Fin Base length	58.6	63.9	62.6	59.3	50.5
Anal Fin Base Length	32.2	31.0	29.2	27.4	21.5
Last Dorsal Spine Length	14.7	16.4	13.4	15.0	11.7
Pectoral length	26.0	22.0	25.1	/	19.7
Caudal Peduncle Depth	14.9	16.5	15.8	16.5	11.7
Caudal Peduncle Length	10.1	13.5	14.2	13.3	17.3
Snout Length	11.1	12.1	10.6	11.4	/
in % HL					
Preorbital Depth	15.3	20.1	25.1	19.2	10.8
Orbital Diameter	25.7	28.7	28.7	28.7	23.8
Interorbital width	30.3	26.9	35.4	20.8	21.2
Lower Jaw Length	53.1	48.0	33.6	31.7	80.6
Snout Length	29.8	33.5	37.4	32.9	/

ous, secondary fold (“second lower lip” sensu ŘÍČAN *et al.*, 2016) well developed, slightly wider than lip. Outer row jaw teeth conical, recurved; symphyseal pair in upper jaw greatly enlarged canines, next one on each side set off and distinctly smaller, remaining teeth more or less evenly spaced and regularly decreasing in size posteriorly. Symphyseal pair of teeth in lower jaw widely spaced and very small, next two teeth on each side distinctly enlarged canines (but not quite as large as those in the upper jaw), about equal in size, remaining teeth small, slightly decreasing posteriorly. Gill rakers on the first ceratobranchial 8 (12 in total).

E1 scales 27, lateral line 18/11, scales between upper lateral line and first/last dorsal spine 4/2 ½; scale rows on cheek 7, between pectoral and pelvic fin insertion 4; chest scales gradually (but slightly) decreasing in size downward and forward. Dorsal- and anal-fin bases with a scaly sheath; soft parts with interradiating rows of up to 6 (D) or 7 (A) scales; caudal fin scaled on proximal third. Dorsal XVIII/10, soft part produced into a filament extending backward to about middle of caudal fin; anal IX/8, tip of soft part broken off; caudal fin rounded; pectoral-fin rays 14, reaching to level of third anal-fin spine, first ray of pelvic fin reaching to fourth anal-fin spine. Vertebrae 29 (13 precaudal, 16 caudal).

Ground color in alcohol brown with a yellow-reddish tinge, somewhat lighter below. A dark band from posterior margin of orbit to caudal-fin base, directly above level of lower lateral line, about 1 ½–2 scales wide, pos-

teriorly broken into six blotches corresponding to position of vertical bars: 1p – caudal blotch, distinctly set off, entirely on fin, vertical-oval, a second, smaller and much fainter blotch below lateral line; 1a – on peduncle, irregular, slightly higher than long; 2 and 3 – below soft and posterior spiny part of dorsal, respectively, rectangular, longer than high; 4 – midlateral blotch, roughly squarish, slightly darker than posterior blotches, 5 – indistinct due to damage in this area, confluent with anterior, continuous part of lateral band. The vertical bars themselves much fainter, fading out in the lower section, bars 2 and 3 vertically split. An irregularly shaped blotch centered on the junction of lower tip of opercle, sub- and interopercle, a dark stripe from posteroventral margin of orbit towards this blotch, but not reaching it. Pectoral fins almost colorless, transparent; other fins with the color of body, soft unpaired fins with faint dark spots.

Remarks: As shown above, the holotype of *H. friedrichsthalii* is of Nicaraguan origin. Already JORDAN & EVERMANN (1898) gave – without explanation – Rio San Juan, Nicaragua, as type locality, which was dismissed as unwarranted by HUBBS (1935) and BUSSING (1989) following GÜNTHER’s (1868) erroneous assumption that Friedrichsthal’s specimens were collected from Lago Petén Itzá. Consequently, the name *Parachromis friedrichsthalii* has been misapplied to a species occurring in the Petén region in Guatemala as well as in southern Mexico and Belize (BUSSING, 1989; GREENFIELD & THOMERSON,



Fig. 2. *Parachromis friedrichsthalii*, NMW 35322 (holotype of *Heros friedrichsthalii* Heckel). 99.4 mm SL. Scale bar = 10 mm. Courtesy of Naturhistorisches Museum Wien.

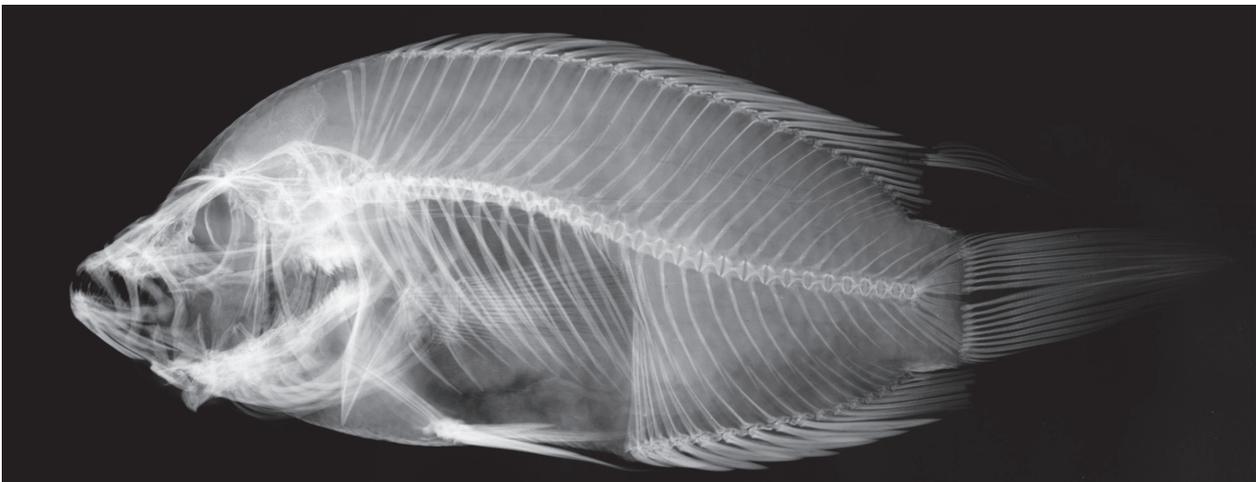


Fig. 3. Holotype of *Heros friedrichsthalii* Heckel, NMW 35322. X-ray. © Naturhistorisches Museum Wien.

1997; STAWIKOWSKI & WERNER, 1998; KULLANDER, 2003; MILLER, 2006).

Three species of the genus are known to occur in Nicaragua, i.e. *Parachromis managuensis* (Günther, 1867), *P. dovii* (Günther, 1864) and *P. loisellei* (Bussing, 1989) (ASTORQUI, 1971; MOYA MEOÑO, 1979; BUSSING, 1989). They are readily identified by meristic characters: anal-fin spines 6–8 in *P. managuensis*, 6–7 in *P. dovii*, 7–9 in *P. loisellei*; lateral line scales 19–22/11–14 in *P. managuensis*, 20–23/11–14 in *P. dovii*, 17–21/9–14 in *P. loisellei*; gill rakers 14–15 in *P. managuensis*, 9–13 in *P. dovii*, 10–13 in *P. loisellei* (MOYA MEOÑO, 1979; BUSSING, 1989). The holotype of *Heros friedrichsthalii*, with nine anal-fin spines, 18/11 lateral line scales and 12 gill rakers, clearly corresponds to *P. loisellei*. Therefore, the valid name for this species is *Parachromis friedrichsthalii* (Heckel, 1840); *Cichlasoma loisellei* (Bussing, 1989) is a junior synonym.

BUSSING (1989) differentiated *P. loisellei* from the putative "real" *P. friedrichsthalii* (i.e., the species from Mexico, Guatemala and Belize) chiefly by color pattern,

which is dominated by a broad black longitudinal stripe in the former and by prominent vertical bars in the latter. He found that HECKEL'S (1840) "described a fish with six wide blackish vertical bars, four of which split into two above the lateral line. This rules out the possibility that *friedrichsthalii* could be applied to the form herein described as *C. loisellei* from southern Central America" (BUSSING, 1989: 158). However, according to the original description (HECKEL, 1840) and in the preserved color pattern of the specimen, the most prominent marking is a longitudinal stripe. Although vertical bars are present, they are much fainter, confined to the posterior portion of the body and fade out below the lateral line, a condition that falls well within the variation of *P. loisellei* (see e.g., MOYA MEOÑO, 1979: fig. 9C, D; STAWIKOWSKI & WERNER, 1998: 375). In the species hitherto misidentified as *P. friedrichsthalii* the lateral stripe is disrupted into a blotch row over its whole length and may be completely masked by a prominent pattern of vertical bars, especially in breeding adults (MOYA MEOÑO, 1979; STAWIKOWSKI & WERNER, 1998; ARTIGAS AZAS, 2017).



Fig. 4. *Parachromis multifasciatus*, from top to bottom: BMNH 1864.1.26: 65 (syntype of *Cichlosoma multifasciatum* Regan), BMNH 1864.1.26.64, BMNH 1864.1.26.63. © The Trustees of The Natural History Museum, London. Scale bar = 20 mm.

Parachromis friedrichsthalii, as identified here, is widespread on the Atlantic slope from Rio Negro (eastern Honduras) to coastal drainages of Laguna de Chiriquí (western Panamá); on the Pacific slope it has been recorded from Rio Tamarindo in Nicaragua, as well as from various localities in Costa Rica and Panama, where it has been introduced (BUSSING 1989; 1998). The status and identity of *Parachromis* from northern Honduras, which have been included in this species by MARTIN (1972), MOYA MEOÑO (1979), BUSSING (1998) and MATAMOROS *et al.* (2009) requires further study (BUSSING 1989).

The species erroneously identified as *P. friedrichsthalii* takes the valid name *Parachromis multifasciatus* (Regan, 1905), originally described as *Cichlosoma multifasciatum* based on two syntypes (BMNH 1864.1.26.65–66) collected by Osbert Salvin at Lago Pe-

tén Itzá. REGAN (1905) found that these specimens, which were previously included by GÜNTHER (1868) in *Heros friedrichsthalii* together with two others of the same origin (BMNH 1864.1.26.63–64), represent a different species, distinguished by color pattern and morphometrics. The latter are said to show 7–8 vertical bars forming a row of blotches below the upper lateral line, whereas *C. multifasciatus* exhibits about 10 bars. Photographs and observations of live individuals show that both states are different expressions of the same color pattern depending on age, stage of maturity and reproductive activity (ARTIGAS-AZAS, 2017; personal observation). The seemingly varying number of bars reflects only the different degree of vertical splitting of the principal body bars (see Figure 4). Proportional differences are due to individual condition and vary within Regan's two "spe-

cies” as much as between them (REGAN, 1905). Therefore all the specimens in question are considered conspecific.

The distribution of *Parachromis multifasciatus* comprises southern Mexico from Rio Tonalá in the west to Quintana Roo in the east (excluding central and northern Yucatán), the Usumacinta drainage and Petén region in Guatemala, as well as Belize south to Mango Creek (GREENFIELD & THOMERSON, 1997; MILLER, 2006).

Fishes collected in Yucatán

Friedrichsthal’s second fish collection, registered in 1844 (FITZINGER, 1880b; acquisition number 1844.IX.1–5), contained five species. The state of preservation is much better than in the first collection, except that the color pattern is quite faded. These specimens, obtained by the Vienna Museum only after Friedrichsthal’s death, must have been collected during the Yucatán expedition. All but one species included are absent from the interior of northern Yucatán, Friedrichsthal’s main study area (see above). The specimens could have been taken either in the environs of Belize City, or at Bacalar, Quintana Roo, México. Belize seems to have been a mere transit station for Friedrichsthal, and nothing in his reports or other sources indicates any exploration there. Bacalar, from where Friedrichsthal started his tour through Yucatán, is situated in the southeastern part of the peninsula, on the western shore of the Laguna Bacalar. All of the species represented in the collection have been subsequently recorded from this lake (GAMBOA-PÉREZ & SCHMITTER-SOTO, 1999; MILLER, 2006). While, therefore, the location of collecting site(s) must remain speculative, circumstantial evidence favors Laguna Bacalar as the most plausible origin.

Mayaheros urophthalmus (Günther, 1862)

NMW 17696, lectotype of *Cichlasoma urophthalmus stenozonum* (present designation); 98 mm SL. “Central-Amerika” (probably Laguna Bacalar, Quintana Roo, Mexico). Figs 5, 6.

Description: Unfortunately, this specimen could be located only subsequently to my visit in Vienna. High resolution photographs and x-rays allow some descriptive notes (see also Figs. 5 and 6): Dorsal- and anal-fin counts are XVI/13 and VI/9 respectively; there are 26 E1 scales and 29 vertebrae (14 precaudal, 15 caudal). The caudal blotch is large, vertically oval and placed to two thirds above lower lateral line, to one below, entirely on fin. It is still nearly deep black with remains of a bluish edging. There are seven vertical bars, about as wide as the interspaces, not quite reaching the lower outline of body: bar 1a on peduncle, close to caudal blotch but well separated from it and with a median expansion; bars 2–6 below dorsal fin base, bar 4 slightly intensified below lateral line, bars 5 and 6 indistinct; bar 7, between nape and humeral region, barely visible.

Remarks: HUBBS (1936: 263) named a subspecies, *Cichlasoma urophthalmus stenozonum*, based on STEINDACH-

NER’s (1864) description and figure of *Heros urophthalmus*, stating that the “type specimens, if still extant, are in the Vienna Museum”. STEINDACHNER (1864: 66) gives no explicit material list, stating only: “Im Wiener Museum durch Baron Friedrichsthal”. NMW 17696 is the only specimen of *M. urophthalmus* in Friedrichsthal’s collection. Likewise, it is listed as unique under “*Heros nov. sp. ocellatus*” (Heckel’s manuscript name for this species) in the acquisition book of the NMW. General aspect and details of head and mouth shape leave no doubt that the figure in STEINDACHNER (1864: pl. V, fig. 2) was based on this specimen, but the color pattern is not accurately reproduced. The caudal blotch is shown bisected by the lower lateral line; the bars are depicted too narrow and partly in wrong positions. STEINDACHNER (1864: 66) twice refers to “Exemplare[n]” (plural), which could be an inaccuracy, a generalization, or an indication that he had additional material from an unknown source. Given this ambiguity, and in accordance with Recommendation 73F (ICZN, 1999), NMW 17696 is considered to be a syntype rather than a holotype. It is herewith designated as the lectotype of *Cichlasoma urophthalmus stenozonum* HUBBS, 1936.

Mayaheros urophthalmus is the only species included in Friedrichsthal’s collection that is known to occur in northern Yucatán. It is present at least at one of his study sites, Chichén Itzá. However, the populations from there are well documented (HUBBS, 1936, 1938) and show certain peculiarities in color pattern not seen in NMW 17696. It appears therefore more likely that the specimen was collected together with the other species, i.e. probably at Laguna Bacalar.

Principal diagnostic characters of *C. u. stenozonum* are the elevated fin-counts and details of the color pattern, especially the narrow vertical bars (“much narrower than the interspaces”; HUBBS, 1936: 263). The fin formulae given by STEINDACHNER (1864) obviously include GÜNTHER’s (1862) data for the types of *urophthalmus*; the fin counts of the lectotype fall well within the range of other nominal subspecies except for the presence of 13 soft dorsal-fin rays (vs. 12 or less). However, the x-ray image (Fig. 6) indicates that the high count is the result of a malformation. The supposedly diagnostic color traits are inferred from STEINDACHNER’s (1864) figure; none of them is actually shown by the lectotype (see above). Therefore, and for reasons considered below, *C. u. stenozonum* is regarded here as a junior synonym of *Mayaheros urophthalmus*.

The same is true for *Heros troschelii* Steindachner, 1867. This nominal species, synonymized with *M. urophthalmus* by REGAN (1905), was described based on two specimens from an unknown location in Mexico, said to be in private property of STEINDACHNER. One of the syntypes (NMW 74261; 142.4 mm SL) is now stored in the NMW. It agrees well with the original description except that I cannot confirm the high longitudinal scale count (32–34). I count 28 E1 scales. The specimen is rather deep-bodied (body depth 49.7% SL), but not unique in this respect. The bar pattern on the left side is irregular, with bar 1a not well defined and partly fused with bar 2,



Fig. 5. *Mayaheros urophthalmus*, NMW 17696 (lectotype of *Cichlasoma urophthalmus stenozonum* Hubbs). 98.0 mm SL. Scale bar = 10 mm. © Naturhistorisches Museum Wien.

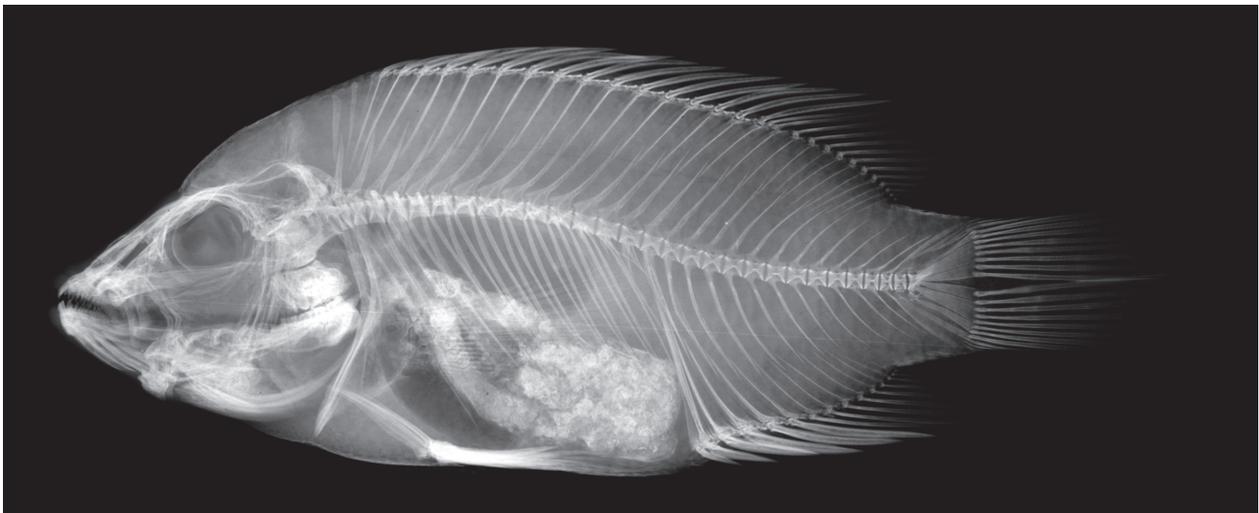


Fig. 6. Lectotype of *Cichlasoma urophthalmus stenozonum* Hubbs, NMW 17696. X-ray. © Naturhistorisches Museum Wien.

which is vertically split, and bar 7 extending downward beneath the pectoral axilla. HUBBS (1936) revalidated *H. troscheli* provisionally as a subspecies on the basis of the STEINDACHNER'S (1867) description and figure with special reference to some of those characters. However, the peculiarities in color pattern are not even consistently developed in the one specimen at hand.

HUBBS (1935; 1936; 1938) described nine more subspecies of *Mayaheros urophthalmus*. KULLANDER (2003) elevated all but one (*C. u. trispilum* Hubbs, 1935) of them to species level – not without noting, however, the provisional character of that step. MILLER (2006), on the other hand, rejected even the recognition of subspecies (with reference to unpublished work by J.N. Taylor). This view is supported by BARRIENTOS-VILLALOBOS *et al.* (2018), who found that morphological differences are correlated with environmental conditions. Genetic diversity is low, without a clear-cut geographic structure (RAZO-MENDIVIL *et al.*, 2013; HARRISON *et al.*, 2014; BARRIENTOS-VILLALOBOS *et al.*, 2018).

Mayaheros urophthalmus is widespread on the Atlantic slope of Central America from the lower Coatzacoalcos drainage (México) to Nicaragua (MILLER, 2006).

***Trichromis salvini* (Günther, 1862)**

NMW 76584, holotype of *Heros triagramma*, 79.4 mm SL. “Central-Amerika” (probably Laguna Bacalar, Quintana Roo, Mexico). Figs 7, 8.

Description Except for the color markings being considerably faded, the specimen is in a rather good state of preservation. It is firm, shows no obvious signs of shrinkage and has the fins largely intact.

See Figure 7 for general aspect and Table 1 for measurements. Body moderately deep, caudal peduncle distinctly shorter than deep. Dorsal head profile concave in front of orbit, predorsal region convex. Head large, almost as deep as long. Mouth moderate, oblique, maxilla barely reaching to vertical from anterior margin of orbit; lower jaw slightly projecting. Lower lip continuous, sec-



Fig. 7. *Trichromis salvini*, NMW 76584 (holotype of *Heros triagramma* Steindachner). 79.4 mm SL. Scale bar = 10 mm. Courtesy of Naturhistorisches Museum Wien.

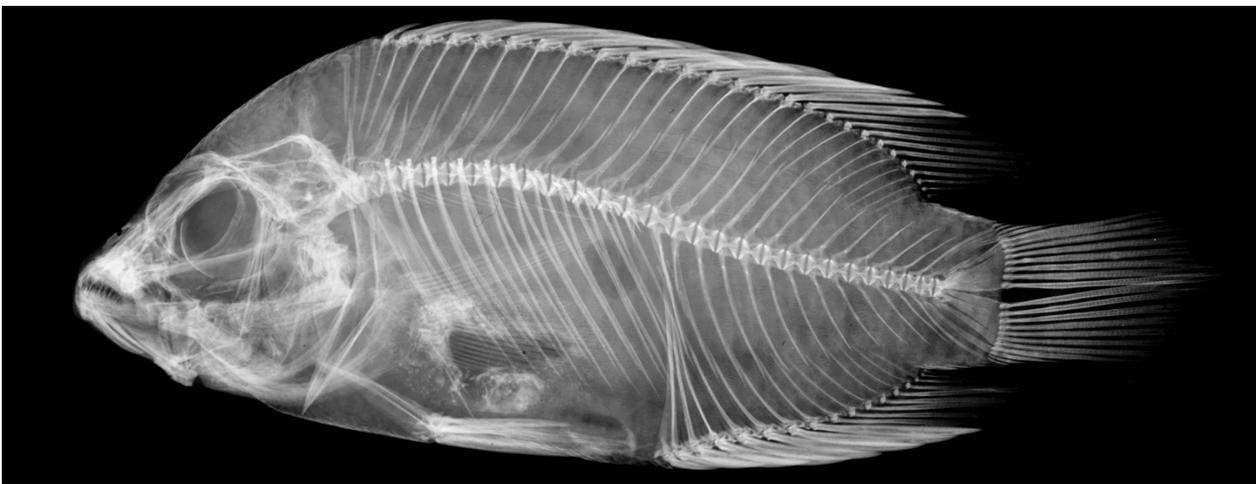


Fig. 8. Holotype of *Heros triagramma* Steindachner, NMW 76584. X-ray. © Naturhistorisches Museum Wien.

ondary fold laterally well developed, somewhat narrower than lip. Outer row jaw teeth conical, recurved; symphy-sial pair of upper jaw enlarged, next one on each side abruptly smaller, remaining teeth regularly decreasing posteriad. Symphy-sial pair of lower jaw very small, next two teeth on each side enlarged, remaining teeth small, slightly decreasing posteriad. Gill rakers on first cerato-branchial 8.

E1 scales 26, lateral line 19/10; scales between upper lateral line and first/last dorsal spine 5/3; scale rows on cheek 6; 5 between pectoral and pelvic fin insertion, chest scales gradually decreasing in size downward and forward. Dorsal- and anal-fin base with a scaly sheath; soft parts with interradi- al rows of up to 5 scales; caudal fin scaly on the proximal half. Dorsal XVII/10, anal VIII/8; soft parts produced into filaments extending backward to about middle of caudal; caudal rounded; pectoral rays 14, reaching to anal fin origin, first soft ray of pelvic fila- mentous, reaching to second anal spine. Vertebrae 28 (13 precaudal, 15 caudal).

Present color in alcohol light brown with a yellowish tinge, darker on dorsum, lighter below, opercle and chest

almost whitish. A dark stripe from posterior margin of or- bit to caudal fin base, directly above level of lower lateral line, about 1 ½–2 scales wide, scarcely visible on head, posteriorly darker and broken into 5 blotches correspond- ing to position of vertical bars: 1p – caudal blotch, entire- ly on fin, vertical-oval, expanded downward below lateral line; 1a – on peduncle, 2 and 3 – below soft and poste- rior spiny part of dorsal, respectively, squarish, not fully separated from each other; 4 – midlateral blotch, roughly squarish to roundish, slightly darker than other markings. The vertical bars themselves no longer visible (but see STEINDACHNER, 1864). A row of irregular blotches, partly confluent with each other and/or with the blotch elements of the lateral stripe but leaving a light area above the mid- lateral blotch and well separated from the stripe anteriorly, above upper lateral line, posteriorly expanded onto base of soft dorsal. Interorbital stripes and other head markings no longer visible. Pectoral fins transparent; other fins with the color of the body, no distinct markings.

Remarks *Trichromis salvini* is widespread on the Atlan- tic slope of South México, Belize and Guatemala, exclud-

ing the Upper Rio Grijalva (Rio Grande de Chiapa). The westernmost record is a tributary to Laguna Mandinga Grande south of Veracruz, México (MILLER, 2006); the eastern-/southernmost one is a sulfur river west of Puerto Barrios, Guatemala (MILLER, 1907).

Trichromis salvini is easily recognized by its color pattern. There is some gradual geographic variation in life colors (mostly with regard to the amount of red on belly and lower flank); otherwise the species is rather uniform over its vast range (ARTIGAS AZAS, 2017).

Cichlasoma tenue Meek, 1906 was erroneously placed in the synonymy of *T. salvini* by KULLANDER (2003). As demonstrated by MILLER (1976), it is actually a junior synonym of *Amphilophus trimaculatus* (GÜNTHER, 1867). Probably, the original type locality (Achtal, Veracruz, Mexico), which is situated within the range of *T. salvini*, has caused some confusion. However, MILLER (1976) demonstrated that some locality mix-up had occurred in the collection containing the type series and concluded that the types likely came from near Tehuantepec (Oaxaca, Mexico). They are rather slender but readily identified as *A. trimaculatus* by color pattern (humeral blotch, a series of spots in the posterior part of body including midlateral and caudal spot) and low anal spine count (MEEK, 1906).

Vieja melanurus (Günther, 1862)

NMW 17353, two specimens, syntypes of *Heros melanopogon*; 92.0 and 49.4 mm SL. “Central-Amerika” (probably Laguna Bacalar; Quintana Roo, Mexico). Figs. 9, 10.

Description: State of preservation as in NMW 76584. See Figure 9 for general aspect and Table 1 for measurements. Body rather deep, caudal peduncle deeper than long. Dorsal head profile in the 92mm specimen steeply convex, with a slight concavity in front of eye, snout blunt; in the 49.4mm specimen similar but shallower, snout somewhat more pointed. Head moderate to short, deeper than long. Mouth small, straight, maxilla not reaching to vertical from anterior margin of orbit. Jaws equal anteriorly. Lower lip interrupted, without secondary fold. Outer row jaw teeth conical, recurved, in the larger specimen anterior teeth in both jaws with a well-developed posterior cusp, labial surface of main cusp slightly flattened. Premaxillary teeth regularly increasing in size towards symphysis, lower jaw teeth in the small specimen similar, in the large one anterior six teeth enlarged, remaining teeth abruptly smaller, decreasing posteriad. Gill rakers on the first ceratobranchial.

E1 scales 28–29, lateral line 20–21/10; scales between upper lateral line and first and last dorsal spine 6/4; scale rows on cheek 5–6; 6 between pectoral and pelvic fin insertion, chest scales small, gradually decreasing in size downward and forward. Dorsal- and anal-fin base with a scaly sheath; soft parts with interradiating rows of at most 4 scales; caudal fin scaly on the proximal quarter to third. Dorsal XVI–XVII/12, anal VI/8–9; soft parts slightly pointed without filaments, extending backward to first quarter of caudal; caudal subtruncate; pectoral

rays 14, reaching barely to vent, first soft ray of pelvic fin reaching to vent or to anal fin origin (in the smaller specimen). Vertebrae 30 (14–15 abdominal, 15–16 caudal).

Present color of the large specimen light yellowish brown, darker brown on dorsum, nape, forehead and cheeks. Chin region and lowermost part of gill covers weakly blackened. A series of four or five blackish blotches in the posterior half of body: the posteriormost and largest one occupying much of caudal fin base and peduncle (corresponding to position of bar 1p+1a sensu ŘÍČAN *et al.*, 2005), roundish to slightly elongate, centered on lower lateral line, remaining spots higher than long, mostly (on bar 2) or completely below lower lateral line, decreasing in size anteriorly. Another series of four spots (about as large as eye or slightly smaller) on dorsum, completely above upper lateral line, between level of first dorsal spines and first soft rays. The spots of the two series partly connected by very faint vertical bars. None of the interorbital and nuchal stripes described by STEINDACHNER (1864) visible anymore. Pectoral fins colorless; other fins with the color of body, no distinct markings.

The smaller specimen has a similar base color, but is generally lighter, almost silvery white below. Lower series of spots less well-marked, but spots irregular and partly fused, other markings as well as darkening of chin region absent.

Remarks The larger specimen is evidently the one figured by STEINDACHNER (1864: pl. I, fig. 3). However, both specimens were originally included in the new species, and neither is explicitly designated as the single name-bearing type. Consequently, both are syntypes. As they are clearly conspecific and there is no reason to assume that they are from different localities, there is no need for a lectotype designation.

The larger specimen is evidently a young adult preserved in breeding coloration. The eponymous blackened chin region (*melanopogon* = black beard [Greek]) is only seen in individuals guarding eggs or fry in this and related species. The four well-defined, evenly sized blotches along the dorsum in combination with the vertically expanded blotches of the caudal series seem to be characteristic for the breeding coloration in Laguna Bacalar; other populations, even in adjacent regions, have these markings less clearly defined. This character would therefore support the supposed origin of the collection.

Vieja melanurus is widely distributed in Gulf of México drainages from the lower Grijalva system to about Campeche, including large parts of the Usumacinta system in México and Guatemala, furthermore in Lago Petén Itzá and adjacent regions (Petén, Guatemala), and at the Caribbean slope in northern Belize (southward to North Stann Creek) and Quintana Roo, México (GREENFIELD & THOMERSON, 1997; MILLER, 2005; McMAHAN *et al.*, 2011).

The synonymy of *H. melanopogon* with *V. melanurus* was first proposed by REGAN (1905). It has never been questioned since, probably under the assumption that both came from the same type locality (Lago Petén Itzá;



Fig. 9. *Vieja melanurus*, NMW 17535:1 (Syntype of *Heros melanopogon* Steindachner). 92.0 mm SL. Scale bar = 10 mm. Courtesy of Naturhistorisches Museum Wien.

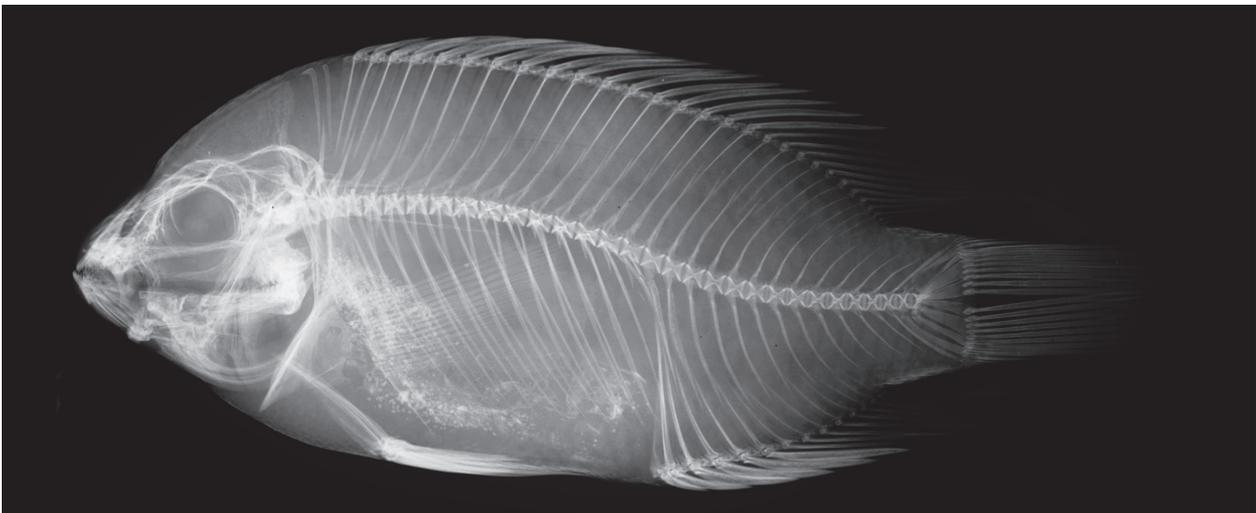


Fig. 10. Syntype of *Heros melanopogon* Steindachner, NMW 17535:1. X-ray. © Naturhistorisches Museum Wien.

Guatemala). HUBBS (1935) described a similar species, *Cichlasoma synspilum*. FOWLER (1956) described another nominal species, *Cichlaurus hicklingi*, which MILLER (1966) synonymized with *C. synspilum*. The latter species has since been regarded as widespread in South México, Guatemala and Belize, whereas *V. melanurus* was believed to be confined to Lake Petén Itzá and adjacent waters. Therefore, *Heros melanopogon* would be an older name for *C. synspilum*. However, McMAHAN *et al.* (2011) synonymized *C. synspilum* with *V. melanurus*, and their broader definition of that species covers also *H. melanopogon*.

The specific name *melanurus* is frequently treated as an adjective with the ending altered according to the gender of the generic name (e.g. *Vieja melanura*). However, since it was originally published without indication whether it is a noun or an adjective and could be either, it has to be treated as a noun in apposition (ICZN, 1999: Art. 31.2.2) and remains unaltered irrespective of the gender of the generic name.

***Petenia splendida* GÜNTHER, 1862**

NMW 24540, 1 specimen 89.5mm SL; “Central America” (probably Laguna Bacalar, Quintana Roo, Mexico). Fig. 11.

Description The color pattern is almost completely faded, the soft dorsal fin is somewhat lacerated and the jaws are fixed in a slightly protruded position. Otherwise the specimen is in good condition.

See figure 11 for general aspect and table 1 for measurements. Body elongate, caudal peduncle longer than deep. Dorsal head profile straight, predorsal region slightly convex. Head large, longer than deep. Mouth large, oblique, maxilla reaching to about middle of orbit, premaxillary pedicel to nape. Lower jaw projecting. Lower lip continuous, secondary fold (“second lower lip”) laterally well developed, narrower than lower lip. Outer row jaw teeth small, conical, strongly recurved; symphyseal pair of the upper jaw slightly larger than remaining teeth, which regularly decrease posteriad. Symphyseal teeth of lower jaw absent, next one or two on each side a little



Fig. 11. *Petenia splendida*, NMW 24540. 89.5 mm SL. Scale bar = 10 mm. Courtesy of Naturhistorisches Museum Wien.



Fig. 12. *Eugerres plumieri*, NMW 72686. 101.0 mm SL. Scale bar = 10 mm. Courtesy of Naturhistorisches Museum Wien.

larger than remaining teeth of lower jaw very small. Gill rakers on the first ceratobranchial 10.

E1 scales 35, lateral line 22/16; scales between upper lateral line and first and last dorsal spine $6/3 \frac{1}{2}$, about 9 somewhat irregular scale rows on cheek, 5 between pectoral and pelvic fin insertion, chest scales gradually decreasing in size downward and forward. Dorsal and anal fin base completely scaleless. Dorsal XVI/12, anal V/8; soft parts slightly rounded, not quite reaching to caudal fin base; caudal subtruncate; pectoral rays 14, reaching to vent; first soft ray of pelvic slightly filamentous, reaching to vent.

Present color in alcohol light brown with a reddish-yellowish tinge, darker on dorsum, lighter below, flanks with a silvery shine, chest almost whitish. Melanin markings barely visible (somewhat better on the right side). A large spot at the caudal fin base mostly above lower lateral line. Six vertical bars, the anterior two scarcely detectable. Bar 4 with a roughly round midlateral spot directly above midline. No head and fin markings.

Remarks STEINDACHNER (1864) published Heckel's manuscript name, *Heros insidiator*, in the synonymy of

P. splendida. It is not nomenclaturally available (ICZN, 1999; Art. 11.6).

Petenia splendida occurs in southern México from the lower Grijalva drainage to Campeche and Quintana Roo, in northern Belize (south to Monkey River), and in Guatemala (Petén, upper Usumacinta).

***Eugerres plumieri* (Cuvier, 1830)**

NMW 72686, 2 specimens, 101 and 108 mm SL; "Central America" (probably Bacalar, Quintana Roo, Mexico). Fig. 12.

These specimens, not examined by myself, were originally identified as *Gerres brasiliensis* by Heckel (acqu. 1844. IX.5). They were studied in 2009 by Adrián González-Acosta, who provided the following notes (pers. comm.): "Both specimens were determined as *Eugerres plumieri* (Cuvier, 1830), based on their anal formula (III, 8 vs. III, 7 in *E. brasiliensis*), the absence of scales in the premaxillary groove, as well as the length of the second dorsal and anal fins." For a detailed delimitation against similar species and distributional data see GONZÁLEZ-ACOSTA *et al.* (2007).

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