

Cichlid fishes (Teleostei, Cichlidae) collected by Ferdinand DEPPE in Mexico

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Abstract

The specimens of Cichlidae collected by Ferdinand DEPPE during the first part of the 19th century in Mexico and housed in the Museum für Naturkunde, Berlin (ZMB) are described and their taxonomic status is clarified. Three species are recognized among DEPPE's material, viz. *Herichthys deppii* (HECKEL, 1840), *Paraneetroplus nebuliferus* (GÜNTHER, 1860) and *P. fenestratus* (GÜNTHER, 1860). *Heros montezuma* HECKEL, 1840 as well as *Herichthys geddesi* REGAN, 1905 are recognized as synonyms of *Herichthys deppii*. *Heros parma* GÜNTHER, 1862, *Cichlosoma sexfasciatum* REGAN, 1905, and *Cichlosoma gadovii* REGAN, 1905 are synonyms of *P. fenestratus*. A lectotype for *Heros parma* GÜNTHER, 1862 is designated. A short biography of Ferdinand DEPPE is given and the collecting sites of his Cichlidae are located. The type locality of *Heros deppii* and *Heros montezuma* is Misantla, Veracruz, Mexico; that of *Heros parma* is the Rio Papaloapan at Tlacotalpán, Veracruz, Mexico.

Resumen

Los ejemplares de la familia Cichlidae capturados en México por Ferdinand DEPPE en la primera parte del siglo 19 y preservados en el Museum für Naturkunde, Berlin (ZMB), son aquí descritos y se clarifica su estado taxonómico. Se reconocen tres especies entre el material de DEPPE como *Herichthys deppii* (HECKEL, 1840), *Paraneetroplus nebuliferus* (GÜNTHER, 1860) y *P. fenestratus* (GÜNTHER, 1860). *Heros montezuma* HECKEL, 1840 y *Herichthys geddesi* REGAN, 1905 se reconocen como sinónimos de *Herichthys deppii*. Los sinónimos de *P. fenestratus* son *Heros parma* GÜNTHER, 1862, *Cichlosoma sexfasciatum* REGAN, 1905, y *Cichlosoma gadovii* REGAN, 1905. Se designa un lectotipo para *Heros parma* GÜNTHER, 1862. Se ofrece además una breve biografía de Ferdinand DEPPE y se localizan los sitios de sus capturas. La localidad tipo de *Heros deppii* y *Heros montezuma* es Misantla, Veracruz, México; la de *Heros parma* en la cuenca del río Papaloapan en Tlacotalpán, Veracruz, México.

Kurzfassung

Die von Ferdinand DEPPE in der ersten Hälfte des 19. Jahrhunderts in Mexiko gesammelten Fische der Familie Cichlidae, die sich im Museum für Naturkunde Berlin (ZMB) befinden, werden beschrieben und ihr taxonomischer Status wird geklärt. Drei Arten wurden unter Deppes Material identifiziert: *Herichthys deppii* (HECKEL, 1840), *Paraneetroplus nebuliferus* (GÜNTHER, 1860) und *P. fenestratus* (GÜNTHER, 1860). *Heros montezuma* HECKEL, 1840 und *Herichthys geddesi* REGAN, 1905 werden als Synonyme von *Herichthys deppii* erkannt. *Heros parma* GÜNTHER, 1862, *Cichlosoma sexfasciatum* REGAN, 1905 und *Cichlosoma gadovii* REGAN, 1905 sind Synonyme von *P. fenestratus*. Ein Lectotypus für *Heros parma* GÜNTHER, 1862 wird festgelegt. Es wird ein kurzer Lebenslauf von Ferdinand DEPPE gegeben, und die Fundorte der von ihm gesammelten Cichliden werden identifiziert. Der Typusfundort von *Heros deppii* und *Heros montezuma* ist Misantla, Veracruz, Mexico, der von *Heros parma* ist der Rio Papaloapan bei Tlacotalpán, Veracruz, Mexico.

Key words

Ferdinand DEPPE, Mexico, Cichlinae, taxonomy, *Herichthys deppii*, *Paraneetroplus nebuliferus*, *Paraneetroplus fenestratus*, *Heros parma*, lectotype.

Introduction

In the early 19th century, the German (Prussian) naturalist Ferdinand DEPPE undertook two collecting trips to Mexico, the biological diversity of which was then little explored. He gathered extensive botanical and zoological collections, among them the oldest preserved collection of Mexican freshwater fishes (MILLER, 2006). The bulk of the material was acquired by the Zoological Museum of Berlin, where it unfortunately attracted little attention. This is particularly true for the cichlid fishes. A few specimens obtained at the second trip were sold to the Natural History Museum Vienna; and some of the Berlin specimens were later sent in exchange to the British Museum of Natural History, London. Based on this material, three nominal species have been established: *Heros deppii* and *Heros montezuma* by HECKEL (1840), and *Heros parma* by GÜNTHER (1862). However, their status and identity remained problematic up to now. The holotype of *Heros deppii* is missing, and the type series of *H. parma* includes two different species. Therefore, the cichlid specimens of DEPPE'S collection (partly topotypes) preserved at the Museum für Naturkunde Berlin are of considerable value for resolving some of the taxonomic problems. As pointed out by STAWIKOWSKI & WERNER (1998), there are at least three different species involved. Despite their varied appearances, all specimens were labelled as *Heros deppii*, with the general locality "Mexico". These regrettable circumstances led us to examine and to identify the specimens of Mexican cichlids collected by DEPPE available at the ZMB. The purpose of this paper is, therefore, to describe all these specimens, to discuss their identity and to clarify the taxonomic status of the nominal species based on DEPPE'S material. In addition, we give a short biography of the collector and outline his journeys in Mexico as documented in his letters and various publications in order to identify the collecting localities and to acknowledge his efforts.

Material and methods

Specimens examined are listed under the corresponding species account. Diagnoses of species are based on the material at hand as well as on published data (in particular MILLER, 2006; STAWIKOWSKI & WERNER, 1998; TAYLOR & MILLER, 1980; 1983; McMAHAN *et al.*, 2010; DE LA MAZA-BENIGNOS & DE LOURDES LOZANO-VILANO, 2013). Museum acronyms used follow FRICKE & ESCHMEYER (2012). Sources of the historical information are, beside the published papers listed below, DEPPE'S letters and other documents stored in the Historische Arbeitsstelle of the ZMB.

Measurements and meristic data were obtained using the methods described in KULLANDER (1986) and KULLANDER & NIJSSEN (1989). Measurements were made with an electronic digital calliper reading to the nearest 0.1 mm. Ratios are expressed as percentages of standard length (SL). Counts were made under a dissecting microscope. All discernible fin rays are included. Counting of fin rays in old alcohol-stored specimens is not without difficulties. Soft rays of anal and dorsal fins are easily overlooked, or the number of soft rays may be miscounted due to damage or distortion. Scale rows are numbered as described in KULLANDER (1990). E1 row scales (= Squ. long. in KULLANDER, 1986; KULLANDER & NIJSSEN, 1989) are those in the horizontal series directly above the row including the lower lateral line. Numbers in brackets immediately succeeding each count indicate the number of specimens examined with this condition. Questionable counts are indicated by an interrogation mark.

The naturalist Ferdinand DEPPE and his travels in Mexico

Born 1795 in Berlin, DEPPE worked first as a well-qualified court gardener in the royal garden of the castle of Charlottenburg (then a neighbouring town, now a district of Berlin). He also took part in the battles against Napoleon's occupation of Germany in 1813–1815. Besides, he was broadly interested in natural history. Therefore, at intercession of his brother Wilhelm, a bookkeeper at the Zoological Museum of Berlin, he was invited by the director of that Museum, Martin Hinrich Carl LICHTENSTEIN (1780–1857) to serve for that museum as collector of animals and plants in Mexico, which was at that time very poorly explored. To get prepared for this new task, he quitted his employment in 1821 and trained himself in many fields of physical exercises, in collecting, preserving and shipping natural materials as well as in drawing. Furthermore, he studied literature about zoology, botany and the geography of Central America; and last but not least he learned English and Spanish.

In October 1824 DEPPE started his first journey to Mexico as companion and partly at the expense of the wealthy Prussian count Sebastian Albert VON SACK († 1828). Very soon, however, he pursued on his own ways because of differences with his quarrelsome sponsor. He also obtained financial support by the Zoological Museum Berlin (Fig. 1). Alone or partly together with his acquaintance William BULLOCK jr. (dates of life unknown), he visited several regions of Mexico, i.e. the vicinities of Alvarado, Jalapa (now Xalapa de Enriquez), Mexico City and several other places within or adjacent to the Valley of Mexico, Puebla, Tehuacan, Oaxaca and Tehuantepec. We refer to STRESEMANN (1954) for a detailed account and itinerary of DEPPE'S first journey.

Back to Berlin in April 1827, DEPPE did not get an appointment at the royal garden or at any scientific in-

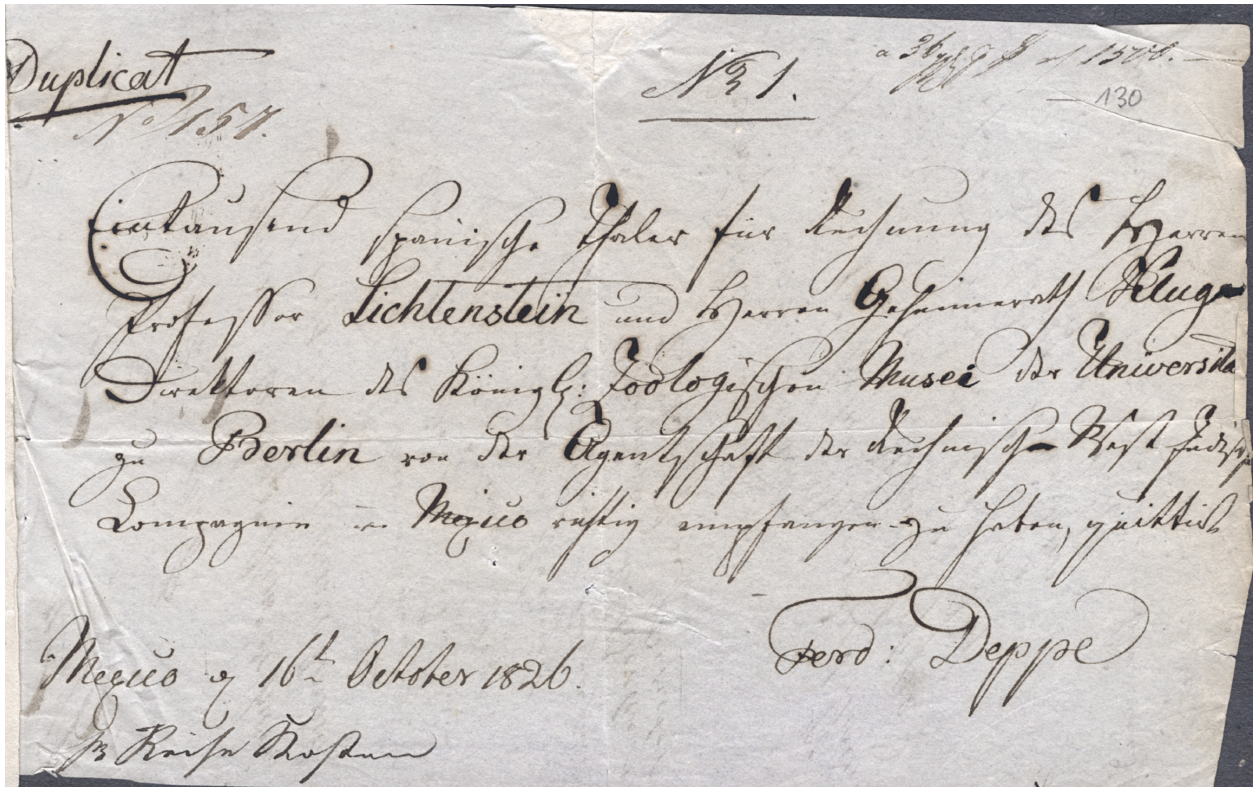


Fig. 1. Receipt for 1000 ‘spanische Thaler’, which DEPPE received via intermediaries by the order of LICHTENSTEIN and KLUG (then directors of the Zoological Museum Berlin) to refund his travel expenses in Mexico. Ferdinand DEPPE confirmed the correct reception of the amount in Mexico on 16th October 1826. Historische Arbeitsstelle of the Museum für Naturkunde (ZMB), Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin. Files of Ferdinand DEPPE.

stitution in his hometown he had hoped for. Therefore, he prepared for a second journey to Mexico - this time at his own risk. He was accompanied by his old friend, the gardener, botanist and physician Wilhelm SCHIEDE (1798–1836), whose letters were published (SCHIEDE, 1829; 1830) and allow a reconstruction of the itinerary: DEPPE and SCHIEDE arrived in Veracruz at the end of June 1828. In July they proceeded to Jalapa, where they took up residence for some time. On September 4, 1828 they left for an excursion to Pico de Orizaba. They took a route via Perote and the high plateau west of Orizaba. They ascended the Pico but failed to reach the summit due to bad weather conditions. On their way back to Jalapa they visited the Laguna Huetulaca (also spelled ‘Huetulacán’; this must be one of the maar lakes of the Cuenca Oriental, most likely Laguna Quechulac) west of Cofre de Perote. In October 1828 they spent some time at a ‘Hacienda de la Laguna’ south of Jalapa, which belonged to an Englishman. On 28 November 1828 they left Jalapa for Papantla, a city (than a larger village) north of Rio Tecolutla. The route they took led mostly through montane and submontane regions and had stopovers in Jalacingo, Hueytamalco, Mesa Chica and Mapilque. The travellers spent about two month at Papantla, which was the basis for several more or less extended excursions including one to Tecolutla at the estuary of the river of the same name in January 1829. In February, they went southwards along to coast via Nautla to Barra des Palmas,

thence up the valley of Rio Misantla to the town of the same name. Here they spent a few weeks collecting. DEPPE left for Jalapa and Veracruz in middle of March 1829, SCHIEDE followed a few days later. At the beginning of May 1829 DEPPE left Jalapa and for collecting in the Valley of Mexico.

Soon, however, the two friends were forced to give up their activities. The journey of DEPPE and SCHIEDE was a financial failure. None of the great museums or private collectors in Europe was willing to pay the prices claimed for the zoological and botanical material from Mexico. Because of lack of money they had to look for another livelihood: SCHIEDE worked in Mexico as a physician, where he died in 1836. DEPPE assumed an appointment as commission agent for merchants in Acapulco (Guerrero) and Monterey (California, then part of Mexico). After being financially ruined by fraud he decided to leave Mexico forever. He sailed from Monterey via Hawaii (then Sandwich Islands), the Philippines, Canton (Guangzhou) and the Malayan Sea, not without again collecting natural and ethnographical objects. After his final return to Berlin in 1838 DEPPE had no choice but starting a modest business of his own in Berlin-Witzleben, not far from his former working place in Charlottenburg. This became famous for the beautiful roses and dahlia cultivated by him. No longer needed and therefore forgotten by science, but blessed with wife and children, he worked there up to his dead in 1861.

Possible localities of the freshwater fishes collected by DEPPE

References to the collection of freshwater fishes are rare unfortunately not only in DEPPE's letters but also in the publications about his travels by LICHTENSTEIN (1826a; 1826b), STRESEMANN (1954), PFÜLLER *et al.* (1980), BANKMANN (1999) and others, as well as in the sales lists by W. DEPPE (1830) and LICHTENSTEIN (1836) and in the acquisition lists of the Zoological Museum Berlin. Nevertheless, a few localities where fishes have been obtained are mentioned in some of these sources. Furthermore, by retracing DEPPE's traveling routes we are able to identify the streams, rivers and lagoons, which were visited by him during his collecting trips. This, in connection with the known distribution of the species concerned, allows us to infer where certain fishes could have been collected.

Most of his travels led DEPPE over high plateaus and mountain ranges, where fish habitats are scarcely to expect. For instance, DEPPE (in LICHTENSTEIN, 1826b) explicitly mentioned that the rivers in the vicinity of Oaxaca contain no fish because of their strong current and seasonal droughts. A few species must have been taken at the Valley of Mexico, e.g. the atherinopsid *Chirostoma humboldtianum* (VALENCIENNES, 1835) and the cyprinid *Algansea tincella* (VALENCIENNES, 1844). DEPPE is known to have collected repeatedly in that area, but cichlids do not occur there (nor elsewhere on the Mexican plateau).

On the other hand in the lowlands of the state of Veracruz he passed many different water bodies. LICHTENSTEIN (1826a: 284) mentioned "einige Fische und Schildkröten aus dem Rio de Alvarado und auch einen 8 Fuß langen Krokodil" ("fishes and turtles from the Rio de Alvarado [now Rio Papaloapan] as well as a crocodile of eight feet"), which DEPPE obtained at Tlacotalpán on December 31, 1824. These animals were sent to Berlin with DEPPE's first shipment of February 1825. They are mentioned by LICHTENSTEIN in his report about it on June 7, 1825 (Historische Arbeitsstelle of the ZMB: Acta 'Reiseunternehmen des Ferdinand Deppe in Mexico').

The sales lists by Wilhelm DEPPE (1830) and LICHTENSTEIN (1836), as well as the acquisition lists of the Zoological Museum Berlin, contain several lots of freshwater fishes. In the list of selected crustaceans, fishes and amphibians from DEPPE's sixth shipment of November 24, 1829, we find references to "(1) Guevina Miscantla, (2) Chinchoxas (Mugil) Tecolutla" and especially to "(3) Guapotes Chromis ? Miscantla". The vernacular name 'Guapote' usually denotes the large piscivore cichlids of the genus *Parachromis* in Central American countries, but in Mexico it is (sometimes in the variant 'Guapota' and with apposition) more generally used for cichlids (Juan Miguel ARTIGAS AZAS, pers. comm.). "Miscantla" is evidently a misspelling for Misantla, a place where DEPPE and SCHIEDE gathered extensive collections of zoological and botanical specimens in February and March 1829. SCHIEDE (1829) mentions the collection of fishes

at Tecolutla on the mouth of the river of the same name. Beside the *Mugil* (or *Agonostomus*?) species mentioned above, only poeciliids are linked with this locality (see also PAEPKE & MEYER, 1995), but we found no reference to cichlids.

In DEPPE's at least eleven shipments, birds are predominant and received much more attention than the comparatively inconspicuous fishes. Therefore, one of the most important analyses of DEPPE's letters, which are difficult to decipher, was made by the ornithologist STRESEMANN (1954). He refers – among others – to collections at Valle Real. This locality could be identified by means of old maps as Valle Nacional (BINFORD, 1990). DEPPE visited this place first on his way from Oaxaca to Alvarado in December 1825. Impressed by its beauty and rich fauna and flora, he returned with better equipment in January 1926 and stayed until the end of February. Although little is known about the collections from Valle Real, it is not unlikely that a few fishes including cichlids caught in the Valle Nacional River, a tributary to Rio Papaloapan.

MARTENS (1865) listed several localities where DEPPE found fresh and brackish water molluscs. At some of these places he had also collected fishes, e.g. Mexico City, Tecolutla, Misantla, and possibly the coastal lagoons near Veracruz.

The Cichlids

Herichthys deppii (HECKEL, 1840)

Heros deppii HECKEL, 1840: 382.

Heros montezuma HECKEL, 1840: 383.

Herichthys geddesi REGAN, 1905: 436.

Diagnosis. *Herichthys deppii* is distinguished from all other species of the genus by the following combination of characters: usually VI (sometimes VII, rarely V) anal spines (vs. modally V or less in all other species except *H. pantostictus* and *H. molango*); labio-lingually compressed anterior jaw teeth with pointed cusps (vs. anterior teeth conical to canine-like in *H. bartoni*, *H. steindachneri*, *H. labridens*, *H. pantostictus*, *H. pratinus*, *H. pame*, *H. molango* and *H. minckleyi*, compressed with truncated cusps in *H. carpintis* and *H. tamasopoensis*); presence of red spots on head and anterior body region (vs. absent in all other species); absence of iridescent blue, turquoise or silvery spots on head and body (vs. present in *H. cyanoguttatus*, *H. carpintis*, *H. minckleyi* and *H. tamasopoensis*).

Description. Based on four specimens, ZMB 2837, 89–132.5 mm SL. State of preservation rather poor, all spec-

Table 1. Morphometric data of *Herichthys deppii*. Mean = arithmetic mean; SD = standard derivation.

	<i>Herichthys deppii</i>					
	2837	2837	2837	2837	mean	SD
ZMB	2837	2837	2837	2837		
Standard length (mm)	89	132.5	110.8	91.8		
in % of SL						
Total length	128.1	127.5	122.7	127.5	126.5	2.49
Head length	34.5	33.7	33.2	34.5	34.0	0.64
Body depth	42.7	41.6	42.8	44.6	42.9	1.23
Predorsal length	42.4	41.4	41.2	40.7	41.4	0.69
Prepelvic length	39.8	40.1	37.6	39.8	39.3	1.13
Preanal length	65.8	68.1	68.6	65.3	66.9	1.64
Dorsal fin base length	59.2	53.8	57.8	61.8	58.1	3.33
Anal fin base length	26.9	24.2	26.4	25.7	25.8	1.19
Pectoral fin length	24.5	26.8	22.8	23.7	24.5	1.69
Pelvic spine length	12.7	12.9	11.8	12.5	12.5	0.47
Pelvic fin length	24.2	30.9	23.1	24.6	25.7	3.55
Caudal peduncle length	9.7	10.6	10.9	9.3	10.1	0.77
Caudal peduncle depth	16.4	16.0	16.0	16.3	16.2	0.22
in % HL						
Preorbital depth	28.3	34.0	30.4	27.8	30.1	2.82
Orbital diameter	29.5	24.8	26.1	29.2	27.4	2.30
Interorbital width	32.6	34.5	33.7	35.6	34.1	1.29
Snouth lengts	28.3	35.3	34.2	29.0	31.7	3.57


Fig. 2. *Herichthys deppii* (ZMB 2837). 91.8mm SL. Courtesy of the ZMB.

imens are soft, the fins are partly damaged; and many scales are lost, sometimes in large areas.

See table 1 for measurements, and fig. 2 for general aspect of shape and coloration. Body moderately deep, laterally compressed; dorsal head profile straight to slightly concave in front of orbit, convex at nape. Prepelvic contour gently convex. Caudal peduncle deeper than long. Head moderately large, as deep as long or slightly deeper. Mouth terminal, rather small, posterior tip of maxilla not quite reaching vertical through anterior margin of orbit. Jaws isognathous. Lips not thickened,

fold of the lower lip interrupted at symphysis. Teeth in the outer row of both jaws slightly recurved, labio-lingually compressed, but pointed, anterior teeth enlarged, and with a weakly developed minor cusp.

E1 row scales 26(1), 27(2) or 28(1), Lateral line scales 18/10(2), 18/11(1) or 19?/11(1); scales between dorsal fin base and upper lateral line 4–5 anteriorly, 2–2½ posteriorly. Predorsal scales irregularly arranged, only slightly smaller than flank scales. Chest scales distinctly smaller, gradually decreasing in size towards midline of chest. Cheek scales in 4(2), 5(1) or 6(1) rows. Fin

squamation weakly developed. Dorsal and anal fin bases with a scaly sheath, interradial scales in single rows of at most three scales, starting from the membrane of last dorsal fin spine, in anal fin confined to soft part. Caudal fin covered with small scales on basal fourth.

Dorsal fin rays XVI.11?(1), XVI.12(2) or XVII.12(1); anal fin rays VI.8(1), VI.9(2) or VII.8(1). Dorsal fin originating above posterior margin of opercle, soft dorsal and anal fin pointed, reaching to vertical at about one third of caudal fin. Pectoral fin shorter than head, reaching vertical through vent. Pelvic fin with the first soft ray the longest, about as long as or slightly longer than pectoral, in the largest specimen almost extending to anal fin origin. Caudal fin subtruncate.

Colour in alcohol brown with a slight yellowish tinge, somewhat darker on dorsum, paling to light brown or dirty white on lower part of abdomen. Unpaired fins and pelvic fins with the colour of body or somewhat darker, without discernible markings. Five to six indistinct dark vertical bars on the posterior part of body: bar 1 on caudal fin base, not extending on peduncle, forming a roundish to oval black spot, about two thirds of which lie above the lower lateral line; bar 2 across caudal peduncle; bar 3 between the posterior parts of dorsal and anal fin bases, bar 4 at level of last spines/first soft rays of the fins, bar 5 above beginning of the anal fin base, weakly developed, partly confluent with bar 4 or 6; bar 6 above vent, very weakly developed. In the two smallest specimens, the bars are darkened to form a series of roughly squarish blotches immediately above lower lateral line. Hardly any melanin pattern, except faint traces of vertical bars, is discernible in the largest specimen. The second-largest specimen shows, in addition to the vertical bars and the caudal spot, a blackish chin and gular region.

Distribution. *Herichthys deppii* occurs in the Nautla and Misantla river drainages in the state of Veracruz (STAWIKOWSKI & WERNER, 1998; KULLANDER, 2003), possibly also in adjacent river basins. MILLER (2006) gives a wider distribution from Rio Cazones to Rio Santa Ana (south of Rio Misantla). However, in the accompanying map '6.438' in MILLER (2006) the taxonomic status of populations from north of Rio Nautla is indicated as undetermined.

Remarks. In spite of their comparatively poor state of preservation, these specimens are identifiable as a species of *Herichthys* by colour pattern and jaw dentition. The elevated anal fin spine count of six or seven is diagnostic for the southernmost species of this genus (MILLER, 2006). It is obvious that these are the 'Guapotes' mentioned in the list of acquisitions from DEPPE'S sixth shipment (see above). It is therefore justified to regard this entry as evidence for the specimens ZMB 2837 being collected at Misantla, Veracruz.

The identity of *Heros deppii* HECKEL, 1840 was long unknown for several reasons: The type locality is given no more precisely than 'Mexico', and the original de-

scription, based on a single specimen collected by DEPPE is not as detailed as desirable (but nevertheless informative, see below). Furthermore, the holotype, which is now lost (KULLANDER, 2003; H. WELLENDORF, pers. comm.), has never been figured. Subsequent authors (e.g. GÜNTHER 1862, JORDAN & EVERMANN 1898, MEEK 1904) could merely give short summaries of the original description. Only PELLEGRIN (1904), who has examined specimens in the Paris Museum (which, according to his description, may well belong to this species as now understood), was able to add a few additional data. REGAN (1905) included it in the 'section' *Theraps* of the genus *Cichlasoma* (an unjustified emendation of *Cichlasoma*) and suggested that it might be a close relative of *C. sieboldii* (KNER, 1863). His descriptions of both species are based on previously published accounts. A synonymy between them can immediately be ruled out by the distribution of '*Cichlasoma sieboldii*' (confined to Costa Rica and Panama, see also remarks under *Paraneotroplus nebuliferus*) and requires no further consideration.

STAWIKOWSKI & WERNER (1998) were the first to suggest using the name *Herichthys deppii* for a species occurring in the Nautla and Misantla drainages in Veracruz, Mexico. They based their conclusion both on the presence of *Herichthys* specimens sent by DEPPE from Misantla in the ZMB collection and on a reconstruction of the outline of the lost holotype of *Heros deppii*. Subsequently, their view was accepted by KULLANDER (2003) and MILLER (2006).

HECKEL'S original description contains several data enabling us to conclude that *Heros deppii* is indeed a *Herichthys* species. The melanin pattern is described as follows: "Fasciis 6 verticalibus obsolete in parte posteriore trunci et in cauda, ultima ad basim pinnae caudalis macula obscura notata" (HECKEL, 1840: 382); "in der zweiten Hälfte des Körpers, vom Anus nämlich bis zur Schwanzflosse ziehen sich 6 dunklere vertikale Streifen mit eben so breiten Zwischenräumen von oben bis unten hinab und in der Mitte des letzten befindet sich ein noch dunklerer Fleck" (op. cit.: 383). A pattern of vertical bars in the posterior half of the body, most pronounced in breeding adults, is typical for most species of the *Herichthys cyanoguttatus* group. Breeding *Astatheros macracanthus* (GÜNTHER, 1864) have a superficially similar colour pattern, but with the foremost bar running in a more anterior position, i.e. between pelvic fin insertion and vent. Furthermore, this species has invariably five anal fin spines and an elevated number of soft dorsal fin rays (12–15; MEEK, 1904; REGAN, 1905; HILDEBRAND, 1925; pers. obs.), whereas HECKEL (1840) gives D XVII.10, A VI.8 for *H. deppii*. Except for the slightly lower number of soft dorsal rays, these counts fall within the range observed in our material, as do the scale counts. Furthermore, HECKEL (1840) created a useful (though largely disregarded) tool to encode the body shape and certain structures (such as fin origins, eye, nostril, gill covers etc.) into some kind of 'numerical diagnosis', which allows to reconstruct the outline of the lost holotype. Morphometrics and non-quantifiable



Fig. 3. *Heros montezuma*, Holotype (NMW 17359). Courtesy of the NMW.

shape characteristics taken from the specimen thus re-drawn agree well with our ZMB specimens. The dorsal head profile is somewhat steeper and slightly concave in front of the eye. Unfortunately, the length of the specimen is not given, but the general impression is that of a large male. The rather small eye supports that view, for the orbital diameter is negatively allometric with size, as also evident from the ZMB material.

In conclusion, circumstantial evidence suggests that the missing holotype of *Heros deppii* HECKEL, 1840 is conspecific with our material from Misantla. Most probably, it was collected together with the ZMB specimens. The material purchased by the Vienna Museum was first sent to Berlin, where DEPPE's brother Wilhelm arranged the sale of specimens not acquired by the ZMB (SCHIFTER *et al.*, 2007). Therefore, most likely, the holotype of *H. deppii* was originally part of the same lot as the ZMB specimens. Consequently, we identify Misantla, Veracruz (approx. 19° 56' N, 96° 51' W) as the type locality of *Heros deppii*. As there is only a single native cichlid species known to occur at this place, we see no justification for designating a neotype.

The history of *Heros montezuma* HECKEL, 1840 is quite similar to that of *H. deppii*. The original description is even shorter, stating mostly the differences to *H. deppii*: the head is less elevated with a more gently sloping profile, the eye is larger, the preorbital bone is less deep, the preopercle forms an obtuse rather than a right angle, the dorsal and anal fin bases are shorter and both fins have fewer spines. The colour pattern is very similar, but somewhat more pronounced. The anal fin formula is erroneously given as “5/4” in the description (HECKEL 1840: 383) but as “5/9” in the numerical diagnosis (op. cit.: 458), a count later confirmed by STEINDACHNER (1864).

PELLEGRIN (1904) synonymized *H. montezuma* and *H. deppii*, using the latter as valid name (as *Cichlasoma deppii*). Thus, he acted as First Reviser fixing the rela-

tive precedence of the simultaneously established names. The holotype of *H. montezuma*, NMW 17359 (fig. 3), is a specimen of 97 mm SL. The colour pattern is now completely faded. The morphometric differences noted by HECKEL (1840) are largely confirmed, but the specimen falls within the variation of the ZMB material. The exceptional presence of only five anal fin spines is in accordance with the data presented by MILLER (2006) and does therefore not preclude the identification of *H. montezuma* as conspecific with our material. Most likely, the holotype has been collected together with the ZMB specimens at Misantla. The synonymy with *H. deppii* is thus confirmed.

Herichthys geddesi REGAN, 1905 was originally described on the basis of six small specimens (BMNH 1880. 4.7.40–45; 47–65 mm TL). The type locality is imprecise given as “Southern Mexico” by REGAN (1905). In the register of the Natural History Museum, however, a place named “Hacienda del Hobo”, located between Veracruz and Tampico, is recorded. According to TOBLER (2005; quoted from DE LA MAZA-BENIGNOS, unpubl.) ‘Hobo’ is an incorrect transliteration of ‘Jobo’. The Hacienda del Jobo (in full “San Joaquin del Jobo”; ARTIGAS AZAS, pers. comm.) was an estate of GUADALUPE VICTORIA, the first president of the Republic of Mexico; it was situated within the municipality of Tlapacoyan. That area is drained by tributaries of the Rio Filobobos (Rio Nautla drainage). The only native cichlid species known to occur in this river system is *Herichthys deppii*. We have not seen the type series of *Herichthys geddesi*, but the original description and the figure in REGAN (1906–1908), together with the now identified type locality, provide sufficient evidence for regarding this nominal species as a junior synonym of *H. deppii*. The combination of compressed anterior jaw teeth (REGAN's reason for placing *H. geddesi* in the genus *Herichthys*) and meristics (in particular the presence of VI–VII anal fin spines) is unique among Mexican cichlids.



Fig. 4. *Paraneetroplus nebuliferus* (ZMB 2835). 191 mm SL. Courtesy of the ZMB.

Paraneetroplus nebuliferus (GÜNTHER, 1860)

Chromis nebulifera GÜNTHER, 1860: 318.

Cichlasoma eigenmanni MEEK, 1902: 119.

Diagnosis. *Paraneetroplus nebuliferus* differs from all other species of the genus except *P. bulleri* and *P. gibbiceps* by having a narrow and subterminal mouth (vs. wider and terminal, although the upper jaw can slightly project in some species), a caudal peduncle longer than deep (vs. deeper than long or, rarely, as long as deep), and a truncate to slightly emarginate caudal fin (vs. subtruncate to rounded, but sometimes also truncate in *P. regani* and *P. argenteus*). *P. nebuliferus* is distinguished from *P. bulleri* and *P. gibbiceps* by having conical to cylindrical anterior jaw teeth (vs. spatulate) and by showing either a more or less continuous longitudinal band or vertical bars, or both, along the flanks (vs. a series of blotches).

Description. Based on a single specimen, ZMB 2835, 191 mm SL. State of preservation moderate, the specimen is firm, the fins are largely intact, but some scales are missing, and almost no colour pattern is retained.

See table 2 for measurements, and fig. 4 for general aspect of shape and coloration. Body elongate and laterally compressed; dorsal head profile straight at snout, otherwise evenly convex. Prepelvic contour gently convex. Caudal peduncle longer than deep. Head rather small, somewhat deeper than long. Mouth subterminal, small, posterior tip of maxilla not nearly reaching vertical trough anterior margin of orbit. Lower jaw shorter than the upper. Lips not thickened, fold of the lower lip interrupted at symphysis. Teeth in the outer row of both jaws unicuspid, slightly recurved, conical to cylindrical with blunt tips, anterior teeth enlarged.

Lower pharyngeal bone rather massive, 1.53 times as broad as long, heavily dentigerous. Teeth of the four median rows distinctly enlarged, molariform; lateral teeth bicuspid, gradually smaller and more slender towards margin of the bone.

E1 row scales 31, Lateral line scales 22/13; scales between dorsal fin base and upper lateral line 5 anteriorly, 3 posteriorly. Predorsal scales irregularly arranged, slightly smaller than flank scales. Chest scales distinctly smaller than adjacent flank scales, gradually decreasing in size towards midline of chest. Cheek with 6 scale rows. Dorsal and anal fin bases with a well-marked scaly sheath, but only a few interradiated scales at the bases of middle soft rays. Caudal fin covered with small scales on basal third.

Dorsal fin rays XVIII.13, anal fin rays VI.9. Dorsal fin originating above posterior margin of opercle, soft dorsal and anal fin slightly pointed, reaching to vertical at caudal fin base. Pectoral fin distinctly shorter than head, not nearly reaching vertical through vent. Pelvic fin with the first soft ray the longest, slightly longer than pectoral, barely extending to vent. Caudal fin truncate.

The colour in alcohol is a rather dark reddish brown, somewhat darker on dorsum. Head, chest, and anterior parts of flank and dorsum blackened (see remarks below). Unpaired and pelvic fins brownish without markings. No clearly discernible body markings except a small, roughly triangular spot at the centre of caudal fin base, which does not extend onto peduncle.

Distribution. *Paraneetroplus nebuliferus* is endemic to the Rio Papaloapan drainage. It is recorded only from a few scattered localities so far, mostly in montane and submontane regions (MEEK, 1904; STAWIKOWSKI & WERNER, 1998; MILLER, 2006).

Remarks. This specimen is easily to determine. The only other Mexican cichlids with an entirely similar morphology are *Paraneetroplus bulleri* REGAN, 1905 from the upper and middle Rio Coatzacoalcos drainage (Oaxaca) and *P. gibbiceps* (STEINDACHNER, 1864) from fast-flowing tributaries of the lower Rio Grijalva (Chiapas and Tabasco). None of them could have been collected by DEPPE according to his itineraries. Furthermore, both are clearly distinguished from *P. nebuliferus* by having spatulate anterior jaw teeth.

Table 2. Morphometric data of *Paraneetroplus fenestratus*. Mean = arithmetic mean; SD = standard derivation.

	<i>Paraneetroplus</i>						<i>nebuliferus</i>
	<i>fenestratus</i>						
ZMB	2834	2836	2836	2838			2835
Standard length (mm)	114.3	169	178	208			191
in % of SL					mean	SD	
Total length	133.9	133.7	132.0	126.9	131.6	3.25	128.8
Head length	33.9	32.0	30.7	31.8	32.1	1.32	26.8
Body depth	53.1	49.8	53.4	43.7	50.0	4.52	37.1
Predorsal length	42.1	41.5	40.7	39.5	40.9	1.13	36.5
Prepelvic length	42.1	42.0	41.2	44.6	42.5	1.47	36.3
Preanal length	67.6	68.6	71.2	69.2	69.2	1.52	62.3
Dorsal fin base length	66.4	62.1	59.6	60.4	62.1	3.05	59.7
Anal fin base length	29.3	28.4	28.4	26.9	28.3	0.99	25.9
Pectoral fin length	27.6	27.0	24.6	22.8	25.5	2.19	17.8
Pelvic spine length	17.4	14.8	16.4	14.3	15.7	1.44	11.1
Pelvic fin length	33.5	31.5	30.4	21.5	29.2	5.32	21.8
Caudal peduncle length	9.4	11.0	10.3	12.5	10.8	1.29	16.0
Caudal peduncle depth	17.2	16.8	17.4	16.0	16.9	0.65	14.2
in % HL							
Preorbital depth	26.6	30.2	30.8	27.8	28.8	1.96	35.7
Orbital diameter	28.2	25.0	26.0	22.2	25.3	2.47	21.9
Interorbital width	42.6	44.1	45.8	42.7	43.8	1.47	37.1
Snout length	25.6	29.5	29.5	32.9	29.4	3.00	33.6

The dark coloration of this specimen appears to be an artefact of preservation rather than remains of the natural colour pattern. The same effect is seen in ZMB 2838 (*P. fenestratus*; see below). The life colours of these and related species are well known and would not result in such an unusual preserved coloration. In addition, even the extracted lower pharyngeal bone of ZMB 2835 is blackened. As no other specimen of DEPPE's collection seen by us shows a similar effect, we suspect that it is caused by fixation rather than by storage. Therefore, it may be an indication that the specimens ZMB 2835 und ZMB 2838 have been collected at the same occasion. There are, however, no data in the acquisition lists, letters and publications, which would link them to a particular locality. Judging from the known distribution of *P. nebuliferus*, DEPPE could have collected that species only during his first journey. He might have found it somewhere along his way from Tehuacan to Oaxaca in the upper Rio Papaloapan drainage, but more likely in the course of his extensive collecting activities at Valle Real (now Valle Nacional; see BINFORD, 1990).

McMAHAN *et al.* (2010) excluded *P. nebuliferus* from the genus *Paraneetroplus*, for it was recovered far outside the clade comprising the remaining species. However, a check of the materials list reveals that this conclusion is based on a misidentification. The used sequence stems from a specimen STRI 1161 from Rio Coto, Costa Rica. The same sample was already included by MARTIN & BERMINGHAM (1998; as *Paraneetroplus sieboldii*) and by CONCHIERO PÉREZ *et al.* (2007; as '*Heros*' sp. cf. *punctatus* [= *Cichlasoma punctatum* MEEK, 1909, actually a junior

synonym of '*Cichlasoma sieboldii*, see BUSSING 1975]). The species '*Cichlasoma sieboldii* (KNER, 1863), currently not referable to any nominal genus, occurs on the Pacific slope of southern Costa Rica and western Panama, whereas *P. nebuliferus* is confined to the Rio Papaloapan drainage in Mexico. The latter species was recovered within *Paraneetroplus* in a recent phylogenetic study by ŘÍČAN *et al.* (2013).

Cichlasoma eigenmanni MEEK, 1904, is consistently regarded as a junior synonym of *P. nebuliferus* in the recent literature (e.g. STAWIKOWSKI & WERNER, 1998; KULLANDER, 2003; MILLER, 2006).

Paraneetroplus fenestratus (GÜNTHER, 1860)

Chromis fenestrata GÜNTHER, 1860: 318.

Heros parma GÜNTHER, 1862: 285.

Cichlosoma sexfasciatum REGAN, 1905: 230.

Cichlosoma gadovii REGAN, 1905: 232.

Diagnosis. *Paraneetroplus fenestratus* is distinguished from the remaining *Paraneetroplus* species as follows: body moderately elongate to very deep, caudal peduncle deeper than long (vs. body elongate, caudal peduncle longer than deep in *P. bulleri*, *P. nebuliferus* and *P. gibbiceps*); mouth terminal, moderately large, horizontal to slightly oblique in adults (vs. mouth small, narrow and clearly subterminal in *P. bulleri*, *P. nebuliferus* and *P. gib-*



Fig. 5. *Paraneetroplus fenestratus* (ZMB 2836). 178 mm SL. Courtesy of the ZMB.



Fig. 6. *Paraneetroplus fenestratus* (ZMB 2838). 208 mm SL. Courtesy of the ZMB.

biceps; small to moderate, horizontal or slightly angled downwards in *P. argenteus*, *P. bifasciatus*, *P. breidohri*, *P. guttulatus*, *P. hartwegi*, *P. maculicauda*, *P. regani* and *P. zonatus*); longitudinal band extending from caudal fin base to opercle, running below level of lower lateral line over most of the flank (vs. running at midline in *P. nebuliferus*, *P. breidohri* and *P. hartwegi*, confined to posterior half or third of body in *P. melanurus*, absent in *P. argenteus*, *P. regani* and *P. maculicauda*); well-developed pattern of vertical bars in adults (vs. vertical bars incomplete, indistinct or absent in all other species).

Description. Based on three specimens, ZMB 2834 (1), 114 mm SL, ZMB 2836 (2), 169–178 mm SL. Specimen ZMB 2838 is treated separately. Material in reasonably good condition: firm, only a few scales are missing, fins largely intact; colour pattern somewhat faded, but still discernible.

Morphometric data are summarized in table 2; see Fig. 5 for general appearance and coloration. Body deep, laterally compressed; dorsal head profile concave in front of orbit, convex at nape. Prepelvic contour convex. Caudal peduncle deeper than long. Head moderately large, deeper than long. Mouth terminal, slightly oblique, moderately large, maxilla not quite reaching vertical through anterior margin of orbit. Jaws isognathous. Lips not thickened, fold of the lower lip interrupted at symphysis. Teeth in the outer row of both jaws recurved, conical; anterior teeth enlarged and with a well-developed posterior cusp. Major cusp slightly worn in the larger specimens.

Lower pharyngeal bone (specimen of 169 mm SL) 1.28 times as broad as long, heavily denticerous. Teeth of the two median rows enlarged, but not molariform; lateral teeth bicuspid, gradually smaller and more slender towards margin of the bone.



Fig. 7. *Paraneetroplus fenestratus*. Type series (part) of *Heros parma* (BMNH 1861.2.5.1-3). The lectotype of *Heros parma* (the largest specimen) in the middle. © BMNH.

E1 row scales 29(3); lateral line scales 19/11(1), 20/11(1) or 20/14(1); scales between dorsal fin base and upper lateral line 5–6 anteriorly, 3–4 posteriorly. Predorsal scales irregularly arranged, only slightly small-

er than flank scales. Chest scales smaller than adjacent flank scales, gradually decreasing in size towards mid-line of chest. Cheek scales in 6(1) or 7(2) rows. Posterior parts of dorsal and anal fin bases with a scaly sheath, in-

terradial scales in single rows of up to five scales, starting from the membrane of last dorsal fin spine, in anal fin confined to soft part. Caudal fin covered with small scales on basal fourth.

Dorsal fin rays XVII.12(2) or XVII.13(1); anal fin rays VI.8(1) or VII.9(2). Dorsal fin originating shortly in front or above posterior margin of opercle, soft dorsal and anal fin pointed, reaching to vertical at about one third to middle of caudal fin. Pectoral fin shorter than head, not quite reaching vertical through vent. Pelvic fin with the first soft ray the longest, longer than pectoral, extending to vent or anal fin origin. Caudal fin subtruncate.

Colour in alcohol generally yellowish brown, somewhat darker on dorsum, lighter on lower part of abdomen. Unpaired fins and pelvic fins with same colour as body, Pectoral fins pale.

Six indistinct vertical bars on body sides, running from back to lower part of flanks, where they fade out. The 169 mm specimen with another very faint bar across the caudal peduncle and remains of an irregular longitudinal band from above pectoral to caudal fin base, running mostly below level of lower lateral line.

ZMB 2838, 208 mm SL: The specimen is somewhat soft, a few scales are missing, and only faint remains of the colour pattern are traceable. Measurements are given in Table 1. See Fig. 6 for general aspect of shape and coloration. Body less deep than in specimens described above (body depth <44 % of SL versus >49.5). Dorsal fin XVI.12; anal fin VI.9; E1 scales 29; lateral line scales 18/11; scales between dorsal fin base and upper lateral line 6 anteriorly, 3 posteriorly. Fin squamation somewhat less extensive. Pectoral and pelvic fins shorter.

Colour in alcohol generally yellowish brown, somewhat darker on dorsum; flank and caudal peduncle with faint traces of six vertical bars and a longitudinal band. Head and chest sooty black (likely an artefact of preservation, see remarks on *Paraneetroplus nebuliferus*)

Distribution. The species is widespread in rivers draining into Gulf of Mexico from Rio Actopán (Chachalacas basin) to lower Rio Coatzacoalcos, records from east of Rio Coatzacoalcos are based on misidentifications (MILLER, 2006).

Remarks. Although the specimen ZMB 2838 differs considerably from the remaining material, we identify it nevertheless as *P. fenestratus* because of its colour pattern and shape of head and mouth. The only other similar species that DEPPE could have collected is *P. zonatus*, which is known to occur in the vicinity of Tehuantepec. This species is readily distinguished by a steep and distinctly convex dorsal head profile, a straight to slightly downward-angled mouth and the lack of distinctive vertical bars. The morphometric differences of ZMB 2838 in comparison to ZMB 2834 and ZMB 2836 (cf. Tab. 2; Fig. 5 and 6), as well its less extensive squamation anal and dorsal fin, are correlated with the lower body depth of this specimen. Its relatively elongated body shape may well be attributable to epigenetic (environmental) fac-

tors, since it has probably been collected together with *Paraneetroplus nebuliferus* (see remarks above), a species adapted to fast currents.

The considerable morphometric variation within this species led several authors to recognize more than one species among *P. fenestratus* samples at hand. MEEK (1904) already distinguished between a deep-bodied (*Cichlasoma parma*) and a more elongate species (misidentified as *C. melanurum*). REGAN (1905) described *Cichlosoma sexfasciatum* based on a single specimen of 223 mm TL from an unknown Mexican locality, said to differ from *C. fenestratum* mainly in body depth, eye diameter and the relative lengths of head, last dorsal fin spine and pectoral fin (REGAN, 1905; 1906-1908). Otherwise, it agrees well with *P. fenestratus*; and it shows the colour pattern diagnostic for that species. The synonymy of *C. sexfasciatum* with *P. fenestratus* was first proposed by R.R. MILLER (in STAWIKOWSKI & WERNER, 1985), and was adopted by subsequently authors (e.g. STAWIKOWSKI & WERNER, 1998; KULLANDER, 2003). MILLER (2006) confirmed that status after examination of the holotype.

Cichlosoma gadovii REGAN, 1905 was distinguished (see REGAN, 1905; 1906-1908) from *C. fenestratum* by a lower body depth and a more slender caudal peduncle (its depth 50-75% of its length in *fenestratum* vs. 75-80% in *gadovii*). TAYLOR & MILLER (1980: 13) synonymized *C. gadovii* and *P. fenestratus* on grounds of "body depth not being a reliable distinguishing feature". The (minor) difference in caudal peduncle depth is obviously correlated with body depth, as also indicated in our material (see table 1). Therefore, we follow TAYLOR & MILLER (1980) and subsequent authors (STAWIKOWSKI & WERNER, 1998; KULLANDER, 2003; MILLER, 2006) in regarding *C. gadovii* as a synonym of *P. fenestratus*. We note, however, that a detailed analysis of geographic and/or ecophenotypic variation within this species has yet to be carried out.

GÜNTHER (1862) described *Heros parma* based on three specimens from DEPPE's Mexico collection (obtained by the British Museum as *Heros deppii* from the Berlin Museum) and on four specimens collected in Guatemala by Salvin. All seven specimens are thus syntypes of this nominal taxon. PELLEGRIN (1904) synonymized *Heros parma* with *Cichlasoma fenestratum*, but treated the Guatemalan form as a subspecies, *C. fenestratum* var. *parma*. REGAN (1905) recognized that the type series of *H. parma* represents two species. He identified the Mexican specimens as *Cichlosoma fenestratum*. On the Guatemalan syntypes (plus additional specimens from Guatemala and Panama) he based a new species, *Cichlosoma maculicauda* (now *Paraneetroplus maculicauda*), which is readily distinguished from *P. fenestratus* by a large, prominent black blotch on the caudal peduncle and the lack of the diagnostic colour elements of *P. fenestratus*.

The Mexican syntypes of *Heros parma* (BMNH 1861.2.5.1-3) agree very well with the specimens ZMB 2834 and ZMB 2836 in general appearance, coloration and state of preparation (cf. Figs. 5 and 7). Therefore, we have no doubt that all these specimens were collected

together. After careful consideration of DEPPE's itinerary and the historical documents we regard it as most likely that these are the fishes obtained by him at Tlacotalpán on the lower Rio Papaloapan.

Since the syntype series of *Heros parma* GÜNTHER, 1862 contains two species, viz. *Paraneetroplus fenestratus* (GÜNTHER, 1860) and *P. maculicauda* (REGAN, 1905), it is necessary to designate a lectotype in order to stabilize the nomenclature. This is particularly true with regard to the potential threat of the validity of the name *P. maculicauda*, which is generally used for a widespread and common species of some economic importance. Therefore, for proper and consistent application of the name we designate the largest specimen of BMNH 1861.2.5.1–3 as lectotype (see Fig. 7, middle) of *Heros parma* GÜNTHER, 1862. Thereby, the type locality is restricted to the Rio Papaloapan at Tlacotalpán, Veracruz, Mexico (approx. 18° 37' N, 95° 40' W). This nomenclatural act definitely links the name *Heros parma* to the species recognized here under the name *Paraneetroplus fenestratus*.

Discussion

The lectotype designation for *Heros parma* was a necessary and overdue step. We have refrained, however, from selecting a neotype for *Heros deppii*. The available data allow the unambiguous identification of this nominal taxon (see diagnosis and remarks above), thus, there is currently no need for replacing the lost holotype. A neotype designation is only valid when such a need is demonstrated and further provisions of the code (ICZN 1999) are fulfilled. Many well-known species group taxa are without name bearing type specimens (MAYR & ASHLOCK, 1991).

The generic classification of Middle American cichlids is still in a very unsatisfactory state. The majority of genera are not well defined, and many species are not properly classified (see e.g. KULLANDER, 2003; MILLER, 2006). Therefore, a few remarks to the generic names used here may be appropriate: *Herichthys* BAIRD & GIRARD, 1854 (type species *Herichthys cyanoguttatus* BAIRD & GIRARD, 1854), formerly defined by dental characters only (see REGAN, 1905; 1906-1908), was re-diagnosed by KULLANDER (1996) on the basis of two colour traits (i.e. a series of black blotches or short vertical bars on the posterior part of the body and a unique breeding coloration with upper half or entire head and anterior flank region pale in contrast to black adjacent areas). This diagnosis, however, is not entirely satisfactory and requires further revision. In particular, a breeding coloration with pale upper parts contrasting to black ventral regions is rather widespread among heroine cichlids. Nevertheless, KULLANDER's concept of the genus is strongly and consistently supported by recent phylogenetic studies (HULSEY

et al., 2004; CONCHIERO PEREZ *et al.*, 2007; ŘÍČAN *et al.*, 2008; LÓPEZ-FERNÁNDEZ *et al.*, 2010; ŘÍČAN *et al.*, 2013). The genus includes the following valid species: *H. bartoni* (Bean, 1892), *H. carpintis* (JORDAN & SNYDER, 1899), *H. cyanoguttatus* BAIRD & GIRARD, 1854, *H. deppii* (HECKEL, 1840), *H. labridens* (PELLEGRIN, 1903), *H. minckleyi* (TAYLOR & KORNFIELD, 1983), *H. molango* DE LA MAZA-BENIGNOS & DE LOURDES LOZANO-VILANO, 2013, *H. pame* DE LA MAZA-BENIGNOS & DE LOURDES LOZANO-VILANO, 2013, *H. pantostictus* (TAYLOR & MILLER, 1983), *H. pratinus* DE LA MAZA-BENIGNOS & DE LOURDES LOZANO-VILANO, 2013, *H. steindachneri* (JORDAN & SNYDER, 1899) and *H. tamasopoensis* ARTIGAS AZAS, 1993.

Paraneetroplus REGAN, 1905 (type species *Paraneetroplus bulleri* REGAN, 1905) has long been thought to include the species *P. bulleri*, *P. nebuliferus* and *P. gibbiceps* (see e.g. STAWIKOWSKI & WERNER, 1987; 1998; KULLANDER, 2003). *Paraneetroplus omonti* ALLGAYER, 1988, is a synonym of the latter (MILLER, 2006). STAWIKOWSKI & WERNER (1987) attempted to diagnose the genus accordingly, but compared it only with *Theraps* GÜNTHER, 1862 and did not demonstrate the taxonomic value of the supposed generic characters. The only phylogenetic analysis so far including all these species (ŘÍČAN *et al.*, 2013) recovered them indeed within a single clade, but the inclusion of the morphologically distinctive species *P. regani* and *P. argenteus* renders *Paraneetroplus* sensu STAWIKOWSKI & WERNER (1987) paraphyletic. In addition, it confirms the results of previous phylogenetic studies (HULSEY *et al.*, 2004; ŘÍČAN *et al.*, 2008; LÓPEZ-FERNÁNDEZ *et al.*, 2010; McMAHAN *et al.*, 2010), which showed the type species *Paraneetroplus bulleri* consistently nested within a larger clade of species formerly placed in the genera *Vieja* FERNANDEZ-YEPEZ, 1969 and/or *Paratheraps* WERNER & STAWIKOWSKI, 1989. None of these genera has ever been properly defined; and the names were used in a quite arbitrary and inconsistent way. Therefore, we tentatively follow the proposal of McMAHAN *et al.* (2010) to consider *Vieja* and *Paratheraps* junior synonyms of *Paraneetroplus*. Included species are: *P. argenteus* (ALLGAYER, 1991), *P. bifasciatus* (STEINDACHNER, 1864), *P. breidohri* (WERNER & STAWIKOWSKI, 1987), *P. bulleri* REGAN, 1905, *P. fenestratus* (GÜNTHER 1860), *P. gibbiceps* (STEINDACHNER, 1864), *P. guttulatus* (GÜNTHER, 1864), *P. maculicauda* (REGAN, 1905), *P. melanurus* (GÜNTHER, 1862) (*Cichlasoma synspilum* HUBBS 1936 is a synonym, see McMAHAN *et al.* 2011) *P. nebuliferus* (GÜNTHER, 1860), *P. regani* (MILLER, 1974) and *P. zonatus* (MEEK, 1905).

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References

- BANKMANN, U. (1999): Zwischen Pazifik und Lietzensee – Ferdinand DEPPE, Gärtner und Sammler für die Berliner Museen. – *Mitteilungen des Vereines für die Geschichte Berlins*, **95**: 566–579.
- BINFORD, L.C. (1990): The location of the Mexican locality, Valle Real. – *Wilson Bulletin*, **102**: 150–154.
- BUSSING, W.A. (1975): Taxonomy and biological aspects of the Central American cichlid fishes *Cichlasoma sieboldii* and *C. tuba*. – *Revista Biología Tropical*, **23**: 189–211.
- CONCHEIRO PÉREZ, G.A., ŘÍČAN, O., ORTÍ, G., BERMINGHAM, E., DOADRIO, I. & ZARDOYA, R. (2007): Phylogeny and biogeography of 91 species of heroine cichlids (Teleostei: Cichlidae) based on sequences of the cytochrome b gene. – *Molecular Phylogenetics and Evolution*, **43**: 91–110.
- DE LA MAZA-BENIGNOS, M. & DE LOURDES LOZANO-VILANO, M. (2013): Description of three new species of the genus *Herichthys* (Perciformes: Cichlidae) from eastern Mexico, with redescription of *H. labridens*, *H. steindachneri*, and *H. pantostictus*. – *Zootaxa*, **3734**: 101–129.
- DEPPE, W. (1830): Preis-Verzeichniß der Säugethiere, Vögel, Amphibien, Fische und Krebse, welche von den Herren DEPPE und SCHIEDE in Mexico gesammelt worden, und bei dem unterzeichneten Bevollmächtigten in Berlin gegen baare Zahlung in Preuß. Courant zu erhalten sind. – Berlin
- FRICKE, R. & ESCHMEYER, W.N. (2012): Guide to Fish Collections. (<http://research.calacademy.org/research/ichthyology/catalog/collections.asp>). – Electronic version accessed 21 October 2012.
- GÜNTHER, A. (1860): On new reptiles and fishes from Mexico. – *Proceedings of the Zoological Society of London*, **1860**: 316–319.
- GÜNTHER, A. (1862): Catalogue of the fishes in the British Museum. Vol. 4. Catalogue of the Acanthopterygii, Pharyngognathi and Anacanthini in the collection of the British Museum. – London: 1–534.
- HECKEL, J.J. (1840): Johann Natterer's neue Flussfische Brasilien's nach den Beobachtungen und Mittheilungen des Entdeckers beschrieben (Erste Abtheilung, Die Labroiden). – *Annalen des Wiener Museums der Naturgeschichte*, **2**: 325–471.
- HILDEBRAND, S.F. (1925): Fishes of the Republic of El Salvador, Central America. – *Bulletin of the Bureau of Fisheries*, **41**: 237–287.
- HULSEY, C.D., DE LEON, F.J.G., JOHNSON, Y.S., HENDRICKSON, D.A. & NEAR, T.J. (2004): Temporal diversification of Mesoamerican cichlid fishes across a major biogeographic boundary. – *Molecular Phylogenetics and Evolution*, **31**: 754–764.
- International Commission on Zoological Nomenclature – ICZN (1999): *International Code of Zoological Nomenclature*, 4th Edition. – International Trust for Zoological Nomenclature, London. 306 pp.
- JORDAN, D.S. & EVERMANN W.A. (1898): The fishes of North and Middle America: a descriptive catalogue of the species of fish-like vertebrates found in the waters of North America, north of the Isthmus of Panama. Part II. – *Bulletin of the United States National Museum*, **47**: 1241–2183.
- KULLANDER, S.O. (1983): A revision of the South American Cichlid genus *Cichlasoma* (Teleostei: Cichlidae). – *Swedish Museum Natural History, Stockholm*. 296 pp.
- KULLANDER, S.O. (1986): Cichlid fishes of the Amazon River drainage of Peru. – *Swedish Museum of Natural History, Stockholm*. 431 pp.
- KULLANDER, S.O. (1990): *Mazarunia mazarunii* (Teleostei: Cichlidae), a new genus and species from Guyana, South America. – *Ichthyological Exploration of Freshwaters*, **1**: 3–14.
- KULLANDER, S.O. (1996): *Heroina isonycterina*, a new genus and species of cichlid fish from western Amazonia, with comments on cichlasomine systematics. – *Ichthyological Exploration of Freshwaters*, **7**: 149–172.
- KULLANDER, S.O. (2003): Family Cichlidae (Cichlids). – *In*: REIS, R.E., S.O. KULLANDER & C.J. FERRARIS, JR. (eds.): *Check List of the Freshwater Fishes of South America and Central America*. – EDIPUCRS, Porto Alegre, Brazil: pp. 605–654.
- KULLANDER, S.O. & NIJSSEN, H. (1989): The cichlids of Surinam. Teleostei: Labroidei. – E.J. Brill, Leiden. 256 pp.
- LICHTENSTEIN, M.H. (1826a): *Neuester Reisebericht aus Mexico. Columbus – Amerikanische Miscellen*, **1826** (1): 280–318.
- LICHTENSTEIN, M.H. (1826b): *Nachrichten über Mexico. Politisches Journal nebst Anzeige von gelehrten und andern Sachen*, **2** (7): 844–855
- LICHTENSTEIN, M.H. (1936): *Verzeichniß von Säugethieren, Vögeln, Amphibien, Fischen, Krebsen und Süßwasser-Conchylien aus Mexico welche am 24sten März 1836 durch den königl. gerichtlichen Bücher-Auctions-Commissarius Rauch in der Schützengasse Nr. 10 meistbietend gegen gleich baare Bezahlung in Preuß. Courant versteigert werden sollen*. – Berlin.
- LÓPEZ-FERNÁNDEZ, H., WINEMILLER, K.O. & HONEYCUTT, R.L. (2010): Multilocus phylogeny and rapid radiations in Neotropical cichlid fishes (Perciformes: Cichlidae: Cichlinae). – *Molecular Phylogenetics and Evolution*, **55**: 1070–1086.
- MARTENS, E. v. (1865): *Ueber die mexikanischen Binnen-Conchylien aus den Sammlungen von DEPPE und UHDE im Berliner Museum*. – *Malakologische Blätter*, **12**: 1–78.
- MARTIN, A.P. & BERMINGHAM, E. (1998): Systematics and evolution of lower Central American cichlids inferred from analysis of cytochrome b gene sequence. – *Molecular Phylogenetics and Evolution*, **9**: 192–203.
- MAYR, E. & ASHLOCK, P.D. (1991): *Principles of systematic biology*. 2nd edition. – McGraw-Hill, New York. 475 pp.

- MCMAHAN, C.D., GEHEBER A.D. & PILLER, K.R. (2010): Molecular systematics of the enigmatic Middle American genus *Vieja* (Teleostei: Cichlidae). – *Molecular Phylogenetics and Evolution*, **57**: 1283–1300.
- MCMAHAN, C.D., MURRAY, C.M., GEHEBER, A.D., BOECKMAN, C.D. & PILLER, K.R. (2011): *Paraneotroplus synspilus* is a junior synonym of *Paraneotroplus melanurus* (Teleostei: Cichlidae). – *Zootaxa*, **2833**: 1–14.
- MEEK, S.E. (1902): A contribution to the ichthyology of Mexico. – *Field Columbian Museum, Zoological Series*, **3**: 63–128.
- MEEK, S.E. (1904): The fresh-water fishes of Mexico north of the isthmus of Tehuantepec. – *Field Columbian Museum, Zoological Series*, **5**: 1–252.
- MILLER, R.R. (2006): *Freshwater fishes of México*. – University of Chicago Press, Chicago: 1–490.
- PAEPKE, H.-J. & MEYER, M.K. (1995): On the identity of *Molinesia fasciata* MÜLLER & TROSCHER, 1844 and *M. surinamensis* MÜLLER & TROSCHER, 1844 (Teleostei: Poeciliidae). – *Ichthyological Exploration of Freshwaters*, **6**: 283–287.
- PELLEGRIN, J. (1904): Contribution à l'étude anatomique, biologique et taxinomique des poissons de la famille des Cichlidés. – *Mémoires de la Société Zoologique de France*, **16**: 41–400.
- PFÜLLER, H., JAHN, I. & LÜBCKE, S. (1980): Traditionen des Museums für Naturkunde der Humboldt-Universität zu Berlin in der naturhistorischen Erforschung und Erschließung lateinamerikanischer Länder im 19. Jahrhundert und ihre gegenwärtige Bedeutung. – *Neue Museumskunde, Theorie und Praxis der Museumsarbeit*, **23**: 183–192.
- REGAN, C.T. (1905): A revision of the fishes of the American cichlid genus *Cichlosoma* and of the allied genera. – *Annals and Magazine of Natural History (Series 7)*, **16**: 60–77, 225–243, 316–340, 433–445.
- REGAN, C.T. (1906–1908): *Biologia Centrali-Americana. Pisces*. – London. ixxxii + 203 pp
- ŘIČAN, O., ZARDOYA, R. & DOADRIO, I. (2008): Phylogenetic relationships of Middle American cichlids (Teleostei, Cichlidae, Heroini) based on combined evidence from nuclear genes, mtDNA, and morphology. – *Molecular Phylogenetics and Evolution*, **49**: 941–958.
- ŘIČAN, O., PIÁLEK, L., ZARDOYA, R., DOADRIO, I. & ZRZAVÝ, J. (2013): Biogeography of the Mesoamerican Cichlidae (Teleostei: Heroini): colonization through the GAARlandia land bridge and early diversification. – *Journal of Biogeography*, **40**: 579–593.
- SCHIEDE, C.J.W. (1829): *Botanische Berichte aus Mexico*. – *Linnaea*, **4**: 205–212, 212–236, 554–283
- SCHIEDE, C.J.W. (1830): *Botanische Berichte aus Mexico*. – *Linnaea*, **5**: 463–477
- SCHIFTER H., BAUERNFEIND E. & SCHIFTER T. (2007): Die Typen der Vogelsammlung des Naturhistorischen Museums Wien. Teil I. Nonpasseres. – *Kataloge der wissenschaftlichen Sammlungen des Naturhistorischen Museums in Wien*, **20**: 1–376
- STAWIKOWSKI, R. & WERNER, U. (1985): *Die Buntbarsche der Neuen Welt, Mittelamerika*. – Edition Kernen, Essen: 271pp.
- STAWIKOWSKI, R. & WERNER, U. (1987): Corrienteros – Die Gattung *Paraneotroplus* REGAN, 1905. – *Deutsche Cichliden Gesellschaft-Informationen*, **18**: 209–219.
- STAWIKOWSKI, R. & WERNER, U. (1998): *Die Buntbarsche Amerikas. Band 1*. – Verlag Eugen Ulmer, 540 pp.
- STEINDACHNER, F. (1864): Beiträge zur Kenntniss der Chromiden Mejico's und Central-Amerika's. – *Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Classe*, **23**: 57–74.
- STRESEMANN, E. (1954): Ferdinand DEPPE's Travels in Mexico, 1824–1829. – *The Condor, Journal of the Cooper Ornithological Society*, **56**: 86–92.
- TAYLOR, J.N. & MILLER, R.R. (1980): Two new cichlid fishes, genus *Cichlasoma*, from Chiapas, Mexico. – *Occasional Papers of the Museum of Zoology University of Michigan*, **693**: 1–16.
- TAYLOR, J.N. & MILLER, R.R. (1983): Cichlid fishes (genus *Cichlasoma*) of the Rio Panuco basin, eastern Mexico, with description of a new species. – *Occasional Papers of the Museum of Natural History University of Kansas*, **104**: 1–24.
- TOBLER, M. (2005): The systematic status of *Herichthys geddesi*. – *The Cichlid Room Companion*. Retrieved on 4 December 2013, from: <http://www.cichlidae.com/section.php?id=31>.
- Additional sources: Files of Ferdinand DEPPE stored in the Historische Arbeitsstelle of the Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin.