



## Relationships of the New World cichlid genus *Hypsophrys* Agassiz 1859 (Teleostei: Cichlidae), with diagnoses for the genus and its species

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### Abstract

Two monotypic Neotropical cichlid genera, *Hypsophrys* Agassiz 1859 and *Neetroplus* Günther 1867, are well known but poorly diagnosed. The possession of a single supraneural (versus two for most Middle American species), a strongly rounded snout with a small and slightly subterminal mouth (versus straight snout profiles with terminal mouth) provide morphological support for the sister-group relationship of *Hypsophrys* and *Neetroplus* recovered in recent molecular phylogenetic analyses. Based on these shared features *Neetroplus* is synonymized with *Hypsophrys*. In addition, the senior synonym *Hypsophrys unimaculatus* should no longer be improperly suppressed in favor of the more familiar, but junior, *H. nicaraguensis*.

**Key words:** *Cichlasoma*, Middle American Cichlidae, *Hypsophrys nicaraguensis*, *Neetroplus nematopus*, Neotropics, synonymy, taxonomy

### Introduction

Until recently, the vast majority of Mexican and Central American cichlids were traditionally placed in the catch-all *Cichlasoma*, with only a few species placed in other, usually monotypic, genera (Chakrabarty, 2006a); included among these are *Petenia*, *Hypsophrys*, and *Neetroplus*. Although the relationships of Mexican and Central American cichlids have recently been elucidated (Hulsey *et al.* 2004, 2006; Chakrabarty, 2006a,b) and taxonomic reviews have clarified these relationships (Kullander, 2003), many taxonomic problems persist. Here, we diagnose two long-standing genera that lack adequate diagnoses. We also provide corroborative morphological character support for the sister-group relationship recovered in recent molecular phylogenetic studies.

Günther (1867) described *Neetroplus* as differing from *Heros* in “having a front series of flat incisor-like teeth.” This feature was used to simultaneously distinguish the genus and species (*Neetroplus nematopus*) from members of *Heros*. *Heros* at the time included the majority of cichlids from Central America. Subsequently, species of *Heros* were placed in various genera that now comprise the majority of species in the tribe Heroini (Kullander 1983, 1996). Several Central American cichlid taxa including members of *Tomocichla* and *Paraneetroplus* possess spatulate or incisor-like teeth, but these species have never been recovered as closely related to *Neetroplus*.

*Hypsophrys unimaculatus* Agassiz 1859, in the first mention of the genus and species, was described as “resembling *Chrysophrys*,” a genus in Sparidae, and was noted to have a single spot on the flanks with dorsal and anal fins that extend posteriorly over the caudal fin. This species was determined to be a senior synonym of *Hypsophrys nicaraguensis* (Günther 1864); however, Kullander & Hartel (1997) proposed keeping the younger name to preserve familiar nomenclature. There is no type material associated with *Hypsophrys unimaculatus* (Eschmeyer, 2007). Kullander & Hartel (1997) state “*Hypsophrys* is easily identified as being the

same as *Heros nicaraguensis* Günther using Agassiz's description." As was the case with *Neetroplus*, the simultaneous description of genus and species included insufficient diagnoses with vague and non-apomorphic characters. It has been suggested that *Hypsophrys* be considered a *nomen nudum* and made unavailable (Neave 1939-1940; Eschmeyer, 2007; also see comments in Kullander & Hartel 1997). Eschmeyer (2007) comments that *Hypsophrys* should be unavailable because no distinguishing features were provided; however, we argue as Kullander & Hartel (1997) did, that distinguishing features were provided, particularly the pigmentation pattern and fin proportions. Here we attempt to remedy the taxonomic complications associated with these taxa and offer updated diagnoses for both species.

## Materials and methods

Measurements and counts were taken on the left side of each specimen. Measurements were taken using dial calipers to the nearest 0.1 mm. Institutional abbreviations are: AMNH, American Museum of Natural History, New York; BMNH, British Museum of Natural History, London; FMNH, Field Museum of Natural History, Chicago; UMMZ, Museum of Zoology, University of Michigan, Ann Arbor. Nomenclature of morphological features, meristics and measurements follow Barel *et al.* (1977).



**FIGURE 1.** Holotype of *Heros nicaraguensis*, BMNH 1867.9.23.37, 135.0 mm SL.

## Results

Examination of the holotypes of *Neetroplus nematopus* and *Hypsophrys nicaraguensis* show that these species share a number of unique derived features (Figure 1–2; see Table 1 for counts and measurements). These features include possession of a single supraneural (Figure 3), a strongly rounded snout profile, and a small and slightly subterminal mouth. On the basis of these shared apomorphic features, and a lack of autapomorphic features attributable to either genus, we place *Neetroplus* Günther 1867 in synonymy with *Hypsophrys* Agassiz 1859. Therefore, *Neetroplus nematopus* Günther 1867 is henceforth *Hypsophrys nematopus* (Günther 1867).

### *Hypsophrys* Agassiz 1859

*Neetroplus* Günther 1867

**Diagnosis.** Members of *Hypsophrys* are distinguished from all other Heroini by the combination of a single supraneural, a strongly rounded snout profile, and a small and slightly subterminal mouth.

**Type species.** *Hypsophrys unimaculatus*; type by monotypy.

**Included species.** *H. unimaculatus*, *H. nematopus*.



**FIGURE 2.** Holotype of *Neetroplus nematopus*, BMNH 1865.7.20.35, 81.4 mm SL.

**TABLE 1.** Meristic and morphometric data for holotype of *Heros nicaraguensis* and *Neetroplus nematopus*.

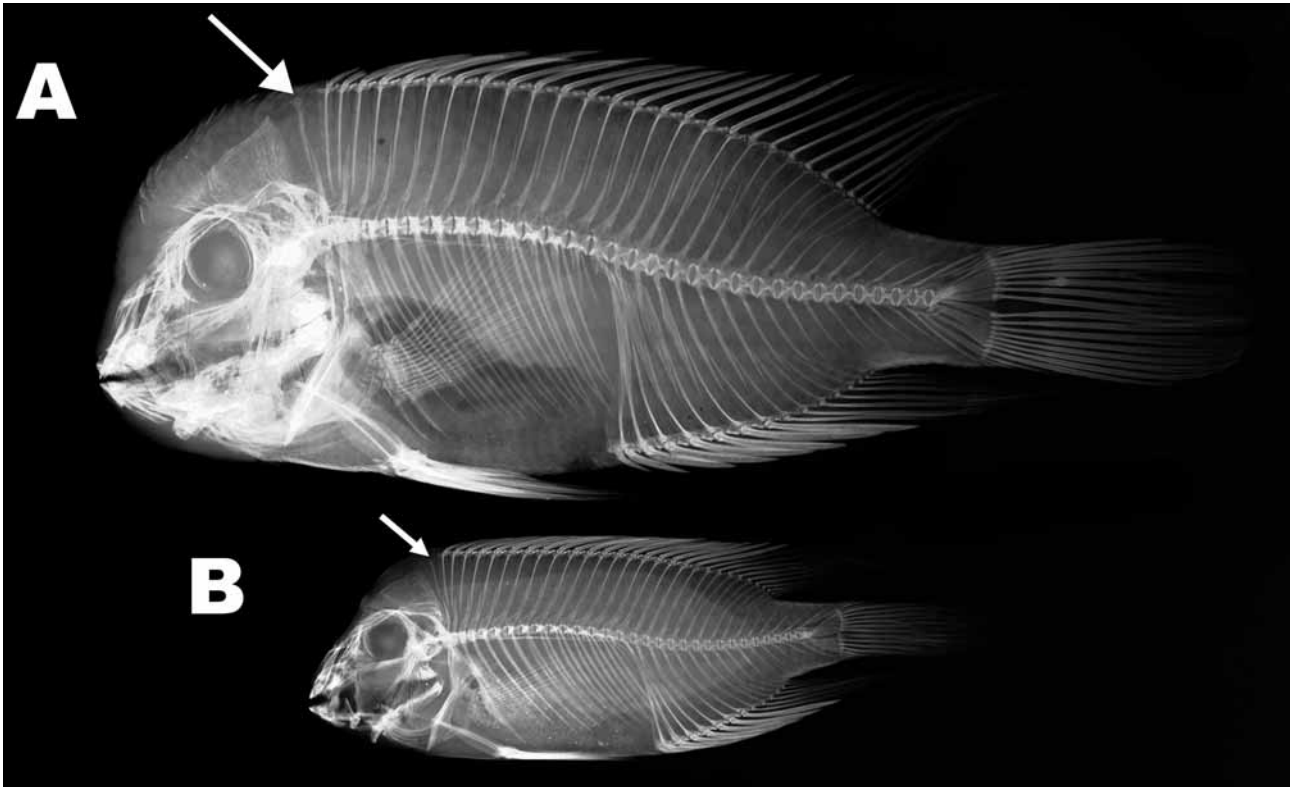
	Holotype <i>Heros nicaraguensis</i> BMNH 1867.9.23.37	Holotype <i>Neetroplus nematopus</i> BMNH 1865.7.20.35
Standard length mm	135.0	81.4
<b>Percentage of standard length</b>		
Head length	33.9	29.4
Body Depth	44.7	37.7
Caudal peduncle length	14.7	12.3
Caudal peduncle depth	15.2	12.7
Pectoral-fin length	25.7	27.4
Pelvic-fin length	32.0	36.9
<b>Percentage of head length</b>		
Snout length	51.0	58.2
Orbit diameter	27.1	28.9
Upper jaw length	30.9	27.6
Interorbital width	38.9	36.0
Preorbital depth	32.6	41.9
<b>Meristics</b>		
Gill rakers, lower limb of 1 <sup>st</sup> arch	8	7
Lateral line scales	35	36
Vertebrae (precaudal+caudal)	13+17	14+15
Dorsal-fin formula	XVIII 11	XVIII 10
Anal-fin formula	VIII 8	VIII 7

### ***Hypsophrys unimaculatus* Agassiz 1859**

*Heros nicaraguensis* Günther 1864.

**Diagnosis.** *Hypsophrys unimaculatus* is diagnosed as the only *Hypsophrys* with a centrally positioned spot on the flank (Figure 4; versus a bar or no marking) and caniniform teeth (versus spatulate).

**Remarks.** We agree with Kullander & Hartel (1997) that *Hypsophrys nicaraguensis* (Günther 1864) is a junior subjective synonym of *Hypsophrys unimaculatus* Agassiz 1859 but find their suggested suppression of the senior synonym in violation of ICZN Article 23. Therefore, this species should be recognized under its valid name *Hypsophrys unimaculatus* despite the relative familiarity of the junior synonym.



**FIGURE 3.** Radiographs of the holotype of (A) *Heros nicaraguensis* and (B) *Neetroplus nematopus* with arrows indicating the single supraneural bone in each specimen.



**FIGURE 4.** Female of *Hypsophrys unimaculatus*, UMMZ 188994, 94.5 mm SL. Note the prominent flank spot.

***Hypsophrys nematopus* (Günther, 1867)**

*Neetroplus nematopus* Günther, 1867.

**Diagnosis.** *Hypsophrys nematopus* is diagnosed as the only *Hypsophrys* with spatulate teeth (versus canini-form) and a dark bar or no marking (versus a round spot) positioned centrally on the flank.

## Discussion

There is sufficient justification to synonymize *Neetroplus* and *Hypsophrys* because of their monotypic status and sister-group relationship, even though they do not share the features that originally delimited the taxa (e.g., spatulate teeth of *Neetroplus* and the single midbody spot of *Hypsophrys*). These features were sufficient to diagnose the included species at the time of their description, but because the original diagnostic features occur in subsequently described taxa, updated diagnoses are warranted and the synonym is justified. A sister-group relationship for these taxa was originally recovered in the molecular phylogeny of Hulsey *et al.* (2004) with parsimony bootstrap and Bayesian posterior probabilities of 100%. Hulsey *et al.* (2004) recovered a large clade of nominal *Archocentrus*, *Parachromis* and *Amphilophus* species as the sister-group to the *Neetroplus* + *Hypsophrys* clade (now just *Hypsophrys*). All species of *Archocentrus*, *Parachromis*, and *Amphilophus* have two supraneural bones except *Archocentrus spilurus*, which has one. The most closely related taxa to *Archocentrus spilurus* within this clade all have two supraneurals. Possession of two supraneurals is derived in most of the other outgroup Heroine taxa (Chakrabarty 2006b); therefore, the sister group to *Hypsophrys* would also optimize to possession of two supraneurals. Among other Heroine taxa the majority have two supraneurals; only “*Cichlasoma*” *istlanum*, “*C.*” *salvini*, and *Thorichthys meeki* have been reported to occasionally have one supraneural, but this feature is polymorphic (Cichocki 1976; Chakrabarty 2006b). Therefore, the diagnostic feature of a single supraneural is a synapomorphy of *Hypsophrys*.

It may be worthwhile in the future to investigate the taxonomic status of *Cichlasoma spilotum* Meek 1912, which was synonymized under *Hypsophrys unimaculatus* by López (1974). The synonym was presented without data from the type series or type locality. The types of *Cichlasoma spilotum* have a much narrower head profile than that of the holotype of *Heros nicaraguensis*. The paratypes of *C. spilotum* are the general shape of females of *Hypsophrys unimaculatus*. The holotype of *C. spilotum* (FMNH 7686; comments here are based on a photograph of the specimen) and the holotype of *H. nicaraguensis* are both males with nuchal humps, but the holotype of *C. spilotum* has a less developed hump. Nevertheless, additional material from the type locality of *Cichlasoma spilotum* should be obtained for study. Female specimens of *Hypsophrys unimaculatus* from Costa Rica presented in López (1974) generally agree in body shape to the types of *C. spilotum*; Miller (1966) also noted that these species may be synonyms.

Several novel behavioral features of these species are noteworthy. Coleman (1999) noted that *Hypsophrys unimaculatus* create horizontal tunnel nests and have non-adhesive eggs (an apparent autapomorphic feature for this species among Central American cichlids). Individuals of *Hypsophrys nematopus* do not build their own tunnels but have been observed occupying hollow logs and holes dug by other species (Coleman 1999). McKaye (1977) observed individuals of *Hypsophrys unimaculatus* guarding the fry of the piscivorous cichlid *Parachromis dovii*. The implication of this altruism is that survival of the predatory species would be detrimental to the altruist's chief competitor *Hypsophrys nematopus*. This remains a controversial interpretation (McKaye 1979; Coyne & Sohn 1978). With the taxonomic changes presented here, these putative competitive interactions should be henceforth discussed as occurring between congeners; not merely among sympatric species of the same family.

## Material examined

*Hypsophrys nematopus*: BMNH 1865.7.20.35, Nicaragua, Lake Managua (holotype of *Neetroplus nematopus*); UMMZ 166475, Costa Rica, Laguna del Misterio; UMMZ 181824, Nicaragua, Lake Jilola

*Hypsophrys unimaculatus*: BMNH 1867.9.23.37, Nicaragua, Lake Nicaragua (holotype of *Heros nicaraguensis*); UMMZ 181826, Nicaragua, Lake Jiloa; UMMZ 188994, Costa Rica (paratypes of *Cichlasoma spilotum*)

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