

On the identity of *Corydoras arcuatus* Elwin, 1938 and some similarly patterned species (Siluriformes: Callichthyidae)

Steven Grant



Corydoras C020 – the fish known in the hobby and scientific publications as *C. arcuatus*

The name *Corydoras arcuatus* has been given to aquarium fish for many years now. However, the actual true identity of the species described by Elwin in 1938 is not as clear as one may think.



Fig. 2 – CW036

The code number C020 was given to a specimen from Rondônia, Brazil; CW036 was designated for the so called ‘Super Arcuatus’ from Rio Madeira, Brazil; and Britto et al (2009) described *Corydoras urucu* from the Rio Urucu basin, Rio Solimões system, Brazil. Also, C019 (Brazil), C098 (Brazil), C100 (Rio Negro, Brazil), *C. evelynae* Rössel, 1963 (Upper Rio Solimões, Amazonas, Brazil), CW006 (Peru), and *C. narcissus* Nijssen & Isbrücker, 1980 (Rio Purus system, Brazil) all share the similar arched band pattern, although in some the pattern is discontinuous.



Fig. 3 – Holotype of *C. urucu* – image by Wolmar Wosiacki



Fig. 4 – C019



Fig. 5 – C098 – image by Hans Georg Evers



Fig. 6 – C100 – image by Ian Fuller

Fig. 7 – *C. evelynae*

Fig. 8 – CW006

Fig. 9 – *C. narcissus*

There is also a species that has not been assigned a code number yet that has shown up in two shipments from Manaus, Brazil (Fig. 10).

Based on work by Alexandrou et al (2011) and Alexandrou & Taylor (2011) it is clear that not all the above species / code numbers are congeneric. Alexandrou & Taylor (2011) group them as follows:

Corydoras sensu stricto: *C. narcissus*
C. sp. Manaus (inserted by the author)

Lineage 8, sub-clade 4 – undescribed genus: C098, CW006. Lineage 9 – *Hoplisoma* (as *Hoplosoma*): *C. arcuatus*, *C. evelynae*, *C. urucu*, C019, C098, C100, CW036

Fig. 10 – *Corydoras* sp imported from Manaus, Brazil.

The identity of *Corydoras arcuatus* Elwin, 1938

Out of the species / code numbers above this article focuses on the identity of the three species placed in *Corydoras* (*Hoplisoma*) by Alexandrou & Taylor (2011) that exhibit an unbroken arched band from the eye to the caudal fin: *C. arcuatus*, *C. urucu* and CW036.

Since observing an image of the holotype of *C. arcuatus* (Fig. 11) years ago, I have queried whether the fish depicted in scientific papers (e.g. Nijssen & Isbrücker, 1986:Fig. 29; Castro, 1987:Pl. 2, Fig. 1; Britto et al, 2009:fig. 2B) and in aquarium publications (e.g. Glaser et al, 1996:67, 68 (upper); Fuller and Evers, 2005:67, 68 (upper)) are the true *C. arcuatus*.

Fig. 11 – Holotype of *C. arcuatus* – Trustees of Natural History Museum, London

The first step to trying to resolve this issue is to clarify the issue around the type specimens in the original description. Elwin clearly based the description on two specimens. One, the holotype, was said to be an aquarium specimen that had no locality data. The other, a paratype, was another aquarium specimen from a different import and was said to be from “Tefe, Amazon”. Tefe is situated on a lake formed by the Tefe River, which is a right bank tributary of the Rio Solimões; the next main tributary being the Urucu River.

At the time of the description it is clear that one specimen (the holotype) had been deposited in the Natural History Museum in London; as per Elwin: “The following description is based on a specimen, the type, which I have deposited in the British Museum (Natural History)”.

The only traceable deposit by Elwin is BMNH 1939.3.3.1 (Nijssen & Isbrücker, 1986 and Maclaine, personal communication) so appears that the paratype was not deposited, and therefore must be assumed as lost.

The accession entry for BMNH 1939.3.3.1 states “*Corydoras arcuatus* (type), presented by Miss M. Elwin” (Maclaine, personal communication). The reason it is important to clarify that BMNH 1939.3.3.1 (fig11) is the holotype is that I consider that the paratype is not conspecific with the holotype.

In the original description a photograph is provided on Plate III and is labelled on the plate and on page 128 as “type”. Where there are multiple type specimens then the use of the word ‘type’ usually denotes the holotype, and in fact Elwin refers to what was the holotype as “the type” (pg. 128) (and as mentioned above states that was the one deposited in BMNH).

However, I do not consider that specimen shown on the plate is the holotype; I consider that it is the paratype. Having observed thousands of live Corydoradinae over the last twenty five years and some preserved specimens it is quite obvious to me that the specimen in the photograph has a rounded snout whereas the holotype has a snout that is not rounded.

A discussion and description of the snout shape and structure, and why this is important, is provided further on. The holotype is the name bearing specimen for the species. This confusion on identification has led, in my opinion, to *C. arcuatus* being misidentified for the last 75 years.

Nijssen & Isbrücker (1986) noted some differences in meristics and morphometrics between their Peruvian and Ecuadorian specimens and the holotype, but did not make any further observations or comments on this.

Britto et al (2009) described *C. urucu* and compared it to the holotype of *C. arcuatus* and to further specimens identified as *C. arcuatus*. They discuss the records of *C. arcuatus* from several tributary river basins of the Rio Solimões system (e.g., Rio Caquetá, Rio Napo, Rio Purus, Rio Tefé, Rio Ucayali, Rio Yavari; Nijssen and Isbrücker, 1980, 1986; Castro, 1987; Britto, 2007) but state that none have been found in the Rio Urucu or Lago Coari.

Differences given between *C. urucu* and *C. arcuatus*

are that in the former the arc-like stripe terminates posterior to the orbit (vs. extending onto snout), by having fewer free vertebrae (21 vs. 27); the lateral profile of the snout distinctly rounded (vs. nearly straight); a greater preadipose distance (84.0–86.7% SL, vs. 82.9–83.8% SL); and the posterior limit of the cleithrum at a vertical through the dorsal-fin spinelet (vs. between the third and fourth dorsal-fin rays).

Britto et al (2009) recognise that the type locality of *C. urucu* is within the distributional range given for *C. arcuatus*, and that “there is some resemblance between the new taxon and juveniles of the latter species at first inspection. Small specimens of *Corydoras arcuatus* within the size range of *C. urucu* (20.0–27.0 mm) superficially resemble adults of the latter, but differ nonetheless in the characters listed in the diagnosis.

Furthermore, juveniles of *C. arcuatus* that are shorter than this size range do not show the snout portion of the arc stripe, and the body stripe is broken into several irregular, dark blotches (Fuller, 2001:38–39).

Also, specimens of *Corydoras arcuatus* that are up to this size range show dorsolateral body plates not touching their counterparts, leaving a median groove between the last dorsal-fin ray and the first pre-adipose platelet (vs. dorsolateral body plates touching their counterparts in *C. urucu*).

There is a potential problem with some of these comparisons in that there does not appear to be a recognition that the holotype of *C. arcuatus* does not appear to be the same species (or even congeneric) with some (possibly all, barring the holotype) of the specimens they referred to as *C. arcuatus* e.g. the specimen they show in Fig 2B of the description of *C. urucu*. This is where CW036 comes into play.

CW036 is known from the Rio Madeira, in the Humaita region, Brazil (Fuller & Evers, 2011) but has also been imported from the Rio Purus, Brazil. As mentioned earlier, CW036 was designated a code number by Ian Fuller in recognition that the fish known in the trade as ‘Super Arcuatus’ appears morphologically distinct from the specimens referred to in scientific publications and in the hobby as *C. arcuatus*. The main visual difference noted by Ian and by other aquarists is that CW036 gets to a much larger size than ‘*C. arcuatus*’ (75–80 mm SL vs. 50–55 mm SL) and that the profile of the snout in CW036 seems straighter. Having observed live specimens and photographs of CW036 it is my view that CW036 matches the holotype of *C. arcuatus*, as discussed below.

Snout, orbital and opercular structures

The holotype of *C. arcuatus* has a head and snout

profile that appears straighter and more extended, giving the snout a longer look (Figs. 12 and 13).



Fig. 12 – Head profile of holotype of *C. arcuatus* – Trustees of Natural History Museum, London

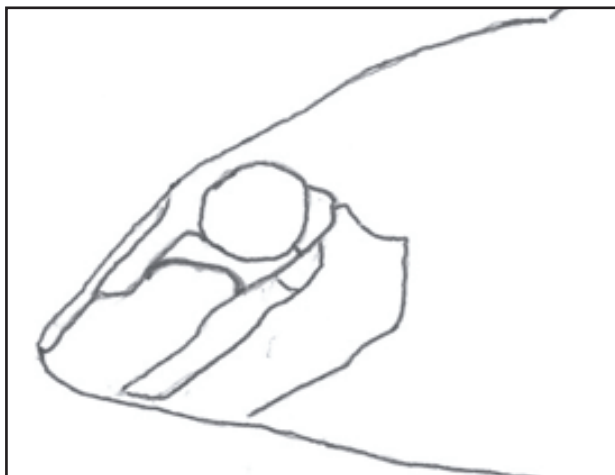


Fig. 13 – Schematic of head of holotype of *C. arcuatus*

This is because of the shape/angle and length of the anterior portion of the mesethmoid. The infraorbital 1¹ is relatively narrow, granulated and possibly has odontodes on its anterior expansion.

The ventral outline of the anterior expansion of infraorbital 1 has a concave margin. The lateral ethmoid is narrow and extends far down the snout. The preopercle appears relatively long and wide. The area between the anterior portions of the mesethmoid and lateral ethmoid (on the anterior portion of the snout), the anterior expansion of infraorbital 1 on the dorsal portion, and the preopercle on the posterior portion is not a bony structure and has no supporting bones underneath, but is composed of thickened skin.

This area is referred to as the 'lateral margin of the snout' by Tencatt et al (2013). On the 'long', 'intermediate' or 'saddle' snouted species this is what

gives the snout a pinched look, as it often looks concave. Because of the relatively long anterior portion of the mesethmoid, and the narrow infraorbital 1, the lateral portion of the snout appears large. CW036 has the exact same shape and morphology of these structures.

In the specimens usually captioned as *C. arcuatus* (including the specimen on the plate of the original description, which I consider to be the paratype) the head and snout has a more rounded or curved angle than the holotype of *C. arcuatus* and CW036, giving the snout a shorter look (Figs. 14 and 15).



Fig. 14 – Head profile of BMNH 1958.6.9.1 (C020) – Trustees of Natural History Museum, London



Fig. 15 – Schematic of head of BMNH 1958.6.9.1 (C020)

¹ This is labelled as lacrymal-antorbital in Huysentruyt & Adriaens (2005), but Britto (2003), Britto & Lima (2003) and Tencatt et al (2013) refer to it as infraorbital 1. Based on the last three aforementioned works I will also refer to it as infraorbital 1.

This is because of the shape/angle and length of the anterior portion of the mesethmoid. The anterior expansion of infraorbital 1 is relatively deep and is thickened, with its ventral margin being straighter than the holotype of *C. arcuatus*/CW036. The expansion of the lateral ethmoid is relatively narrow but does not extend far down the snout. The preopercle appears relatively short and narrow. Because of the relatively short and more curved anterior portion of the mesethmoid, and the deep infraorbital 1, the lateral portion of the snout appears smaller and not as concave as true *C. arcuatus*/CW036.

In the holotype of *C. urucu* the head and snout has an even more rounded or curved angle than holotype of *C. arcuatus* and the specimens usually captioned as *C. arcuatus* (Figs. 16 and 17).



Fig. 16 – Head profile of holotype of *C. urucu* – image by Wolmar Wosiacki

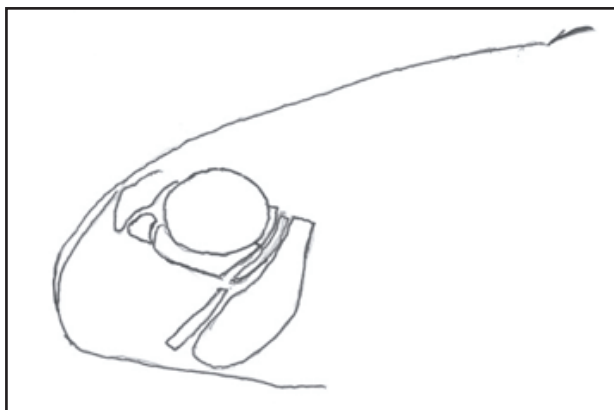


Fig. 17 – Schematic of head of holotype of *C. urucu*

This is because of the shape/angle and length of the anterior portion of the mesethmoid. However, any visible difference could be due to the smaller size of the holotype of *C. urucu*.

The anterior expansion of infraorbital 1 is relatively narrow and not thickened, with its ventral margin being straighter than the holotype of *C. arcuatus*/CW036, and it appears fragmented, but this could

be due to skin coverage. The lateral ethmoid is hard to delineate but appears relatively small.

The preopercle appears relatively short and narrow. Because of the relatively short and more curved anterior portion of the mesethmoid, the lateral portion of the snout appears not as concave as true *C. arcuatus*/CW036 or of the specimens usually captioned as *C. arcuatus* (although the latter could be due to the relatively larger eye size, which is possibly due to the smaller specimen size of *C. urucu* when compared with the specimens usually captioned as *C. arcuatus*).

There are other differences between *C. arcuatus*/CW036 and the fish normally known as *C. arcuatus* in additions to those above e.g. in the former the intercoracoid and ventral area is covered in small odontodes, whereas in the latter there are relatively large platelets of varying sizes. Based on the snout structures that I have observed it is also possible that *C. arcuatus*/CW036 may not actually fall into the genus/subgenus *Hoplisoma*, but into Lineage 8, sub-clade 4 (undescribed genus).

To summarise, based on the osteology of the head of the holotype of *C. arcuatus* it is my opinion that CW036 is the true *C. arcuatus*.

Also, that the paratype of *C. arcuatus* matches the fish known in the hobby as *C. arcuatus*, which in my opinion should be referred to as C020 for the foreseeable future, so that the confusion is not perpetuated.

Notwithstanding the differences given by Britto et al (2009) it is possible that *C. urucu* are smaller specimens of C020. However For the time being they should be classed as distinct from each other.

A specimen was imported along with *C. evelynae* by Pier Aquatics (Wigan) which could represent an adult *C. urucu* (Fig. 18), and this did appear somewhat different to C020 from Peru.



Fig. 18 – Possible adult *C. urucu*

Further comparisons of *C. urucu* specimens with definite C020 specimens from the various localities listed previously would be useful.

Acknowledgements

Thanks to James Maclaine of the Natural History Museum (BMNH), London for the images of preserved specimens (the trustees of the Natural History Museum, London retain copyright of them) and information on the holotype; to Wolmar Wosiacki, Museu Goeldi (MPEG), Brazil for the images of the holotype of *C. urucu* (MPEG retain copyright of them) and information on the holotype; Ian Fuller and Hans Georg Evers for use of their photographs; and to Luiz Tencatt for clarification on nomenclature of snout osteology of *Corydoras*.

References

- Alexandrou, M. A. et al, 2011.
Competition and phylogeny determine community structure in Müllerian co-mimics.
Nature, vol. 469, p 84-89, Supplementary Information 1-27.
- Alexandrou, M. A. and M. I. Taylor, 2011. Evolution, Ecology and Taxonomy of the Corydoradinae Revisited. Pp. 104-117. In: Fuller, I. A. M. & H. G. Evers. 2011. Identifying Corydoradinae catfish. Supplement 1. Ian Fuller Enterprises Worcestershire, 141p.
- Britto, M. R., 2003.
Phylogeny of the subfamily Corydoradinae Hoedeman, 1952 (Siluriformes: Callichthyidae), with a definition of its genera.
Proceedings of the Academy of Natural Sciences of Philadelphia v. 153: 119-154.
- Britto, M. R. and F. C. T. Lima, 2003.
Corydoras tukano, a new species of corydoradine catfish from the rio Tiquié, upper rio Negro basin, Brazil (Ostariophysi: Siluriformes: Callichthyidae).
Neotropical Ichthyology v. 1 (no. 2): 83-91.
- Britto, M. R. , W. B. Wosiacki and L. F. A. Montag, 2009.
A new species of Corydoradinae catfish (Ostariophysi: Siluriformes: Callichthyidae) from Rio Solimões Basin, Brazil.
Copeia 2009 (no. 4): 684-689.
- Castro, D. M., 1987.
The fresh-water fishes of the genus *Corydoras* from Colombia, including two new species (Pisces, Siluriformes, Callichthyidae).
Boletín Ecotrópica. No. 16: 23-57, Pls. 1-11.
- Elwin, M. G., 1938.
Corydoras arcuatus sp. n., an Amazonian catfish.
Annals and Magazine of Natural History (Series 11) v. 3 (no. 13): 126-128, Pl. 3.
- Eschmeyer, W. N. (ed).
CATALOG OF FISHES: GENERA, SPECIES, REFERENCES
(<http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>).
Electronic version accessed 6 October 2014.
- Fuller, I. A. M. 2001.
Breeding Corydoradine Catfishes.
Ian Fuller Enterprises, Worcestershire, U.K.
- Fuller, I. A. M. and H. G. Evers. 2005.
Identifying Corydoradinae catfish. *Aspidoras-Brochis-Corydoras-Scleromystax* & C-numbers.
Ian Fuller Enterprises/A.C.S. GmbH (Aqualog), Worcestershire/Rodgau, 384p.
- Fuller, I. A. M. and H. G. Evers. 2011.
Identifying Corydoradinae catfish. Supplement 1.
Ian Fuller Enterprises
Worcestershire, 141p
- Glaser, U, F. Schäfer and W. Glaser, 1996.
Aqualog - all *Corydoras*.
A.C.S, Germany. 142 pp.
- Huysentruyt, F. and D. Adriaens, 2005.
Descriptive osteology of *Corydoras aeneus* (Siluriformes: Callichthyidae).
Cybium 2005, 29(3): 261-273.
- Nijssen, H. and I. J. H. Isbrücker, 1980.
A review of the genus *Corydoras* Lacépède, 1803 (Pisces, Siluriformes, Callichthyidae).
Bijdragen tot de Dierkunde v. 50 (no. 1): 190-220.
- Nijssen, H. and I. J. H. Isbrücker, 1986.
Review of the genus *Corydoras* from Peru and Ecuador (Pisces, Siluriformes, Callichthyidae).
Studies on Neotropical Fauna and Environment v. 21 (no. 1-2): 1-68.
- Slobodian, V. and F. A. Bockmann, 2013.
A new *Brachyrhamdia* (Siluriformes: Heptapteridae) from Rio Japurá basin, Brazil, with comments on its phylogenetic affinities, biogeography and mimicry in the genus.
Zootaxa 3717 (no. 1): 1-22.
- Tencatt, L. F. C. , H. S. Vera-Alcaraz, M. R. Britto and C. S., Pavanelli, 2013.
A new *Corydoras* Lacépède, 1803 (Siluriformes: Callichthyidae) from the rio São Francisco basin, Brazil.
Neotropical Ichthyology v. 11 (no. 2): 257-264.