Four new *Corydoras* (Callichthyidae) species from Upper Negro River tributaries and a range extension, together with a discussion of *C. bicolor* Nijssen & Isbrücker.

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Abstract

In November 1992, collections were made in Igarape (= stream) Nobua oba near Sao Gabriel da Cachoeira, Brazil (approximately 65° longitude, 0° Latitude), the type locality for *Corydoras adolfoi* Burgess, 1982 and *Corydoras imitator* Nijssen & Isbrücker, 1983. During the journey to Nobua oba several adjoining streams and

Corydoras amandajanea **holotype.**

Corydoras amandajanea **paratype.**

Corydoras amandajanea **paratype.**

Corydoras crypticus.

Corydoras bicolor.

LEFT: ***Corydoras duplicareus*** **holotype.**
ABOVE: ***Corydoras serratus*** **holotype.**

Upper and right fish *C. duplicareus*, middle fish *C. serratus*.

Top left *Brachyramdia* sp., middle fish *C. serratus*, bottom and right fish *C. duplicareus*.

C. crypticus and *C. bicolor* habitat in the upper Rio Negro.

C. amandajanea habitat.

the lower waters of the type locality close to its confluence with the Upper Negro River were also sampled. Collections made at two sites revealed four previously unknown *Corydoras* species, which are described below. The known range of *Corydoras bicolor* is extended.

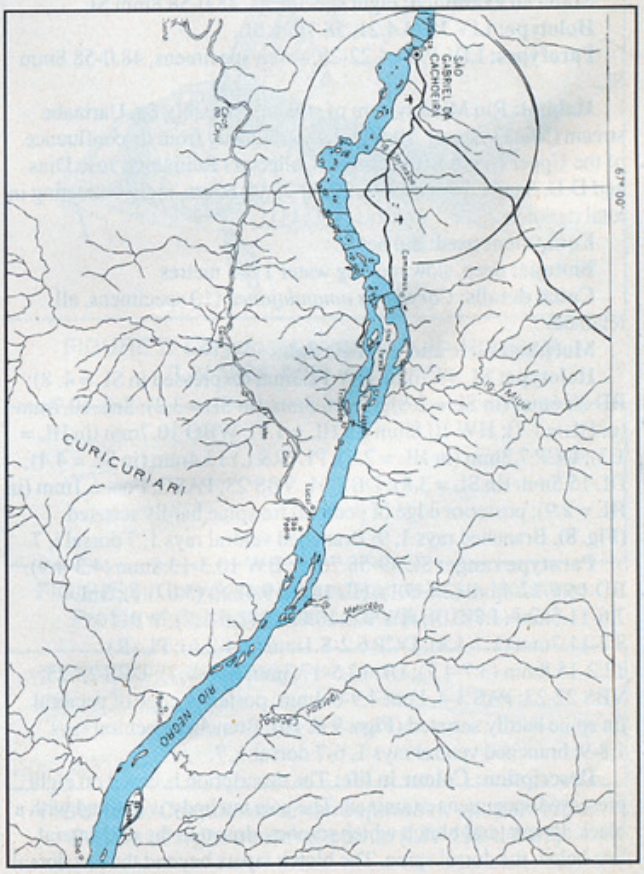
It is hypothesised that the presence of *Corydoras* in the tributary streams of the Upper and Middle Rio Negro rather than the main river is an indication that barriers restrict distribution of the species. It is suggested that significant hydromorphological parameters, pH, and temperature differences between the small streams and the Negro, may prevent the dispersal or migration of populations.

Key words: Callichthyidae, *Corydoras*, Pattern sharing, Upper Rio Negro, tributaries, Brazil.

MATERIAL AND METHODS

Where possible, specimens were photographed after capture before being fixed in formalin. Some specimens retained alive were later fixed and preserved. All specimens were fixed in 10% formalin and preserved in 70% alcohol. Morphometric and meristic data on specimens are as those defined by Nijssen & Isbrücker 1976 (provided for the genus *Aspidoras*). Body and spine measurements were made with the aid of Baty dial callipers and accuracy maintained by repeated checks.

Abbreviations are as follows: SL = standard length, BW = body width, BD = body depth, HL = head length, SnL = snout length, HW = head width, WBO = width of bony orbit, PL = pectoral length (+R = right and L = left when given), DL = dorsal length, DBS = dorsolateral body scutes, VBS = ventrolateral body scutes, PAS = pre-adipose scutes, Font = fontanelle length, DCP = least depth of



A map of the Upper Rio Negro. (Courtesy of Brazil Institute of Geography Statistics -IBGE)

caudal peduncle, PSR = pectoral fin soft rays (+R = right and L = left), VR = ventral soft rays (+R = right and L = left). Figures in parentheses, given after specimen measurements, are ratios where the data is expressed in the standard, or head, length (as appropriate).

Museum abbreviations are as follows: ZMA - Zoology Museum of Amsterdam, RMNH - Rijksmuseum of Natural History.

All material is deposited in Liverpool Museum (abbreviated LIV), the Department of Zoology, William Brown Street, Liverpool, L3 8EN, England.

INTRODUCTION

A current estimate suggests there are about 120 species and subspecies of *Corydoras* recorded with many more awaiting description. Some sympatric species share a similar cryptic colour pattern that has lead to doubts over identification. This factor, emphasised by the descriptions of the four new species that follow, was first discussed and detailed within an extensive review of the status of *C. adolfoi* Burgess, 1982, and *C. imitator* Nijssen & Isbrücker, 1983 (Sands, 1994b). It was suggested, using this pair of species as an example, that sympatric speciation in *Corydoras* may have occurred through chromosome rearrangement or polyploidy in order to facilitate habitat adaptation (Sands 1994b). It is probable that some new descriptions may prove to be distinct population groups of species already described. It can be erroneous to place a species in synonymy without a thorough review of all specimens and populations. An example is *Corydoras stenocephalus* Eigenmann & Allen, 1942 which was made a junior synonym of *C. acutus* Cope, 1872, but later considered to be valid by the same authors (Nijssen & Isbrücker, 1979 and 1986).

The field survey of the Miuã River system (approximately 65° longitude, 0° Latitude), which flows into the Upper Rio Negro, has revealed new species some of which are clearly different from existing taxa and others that are similar to known species. It seems appropriate to record them all as new species until complete surveys have been made of the Amazonian stream and tributary systems.

Corydoras amandajanea, sp. nov.
(Figures 1-3)

Material examined: eight specimens, 48.0-58.8mm SL.

Holotype: LIV 1994.4.21, 58.7mm SL.

Paratypes: LIV 1994.4.22-28, seven specimens, 48.0-58.8mm SL.

Habitat: Rio Miuã system of streams, possibly the Uarinabe stream (Miuã system), 10-12 kilometres away from its confluence of the Upper Negro River, Brazil. Collectors Raimundo Jose Dias and D.D. Sands, 14-XI-1992, 22.00-23.00 hours, night collecting in total darkness.

Equipment used: dip nets.

Biotope: deep, slow moving water 1.5-3 metres

Catch details: *Corydoras amandajanea* (10 specimens, all retained)

Morphometric and meristic data:

Holotype: SL 58.7mm; BW 12.3mm (expressed in SL = 4. 8); BD 20.6mm (in SL = 2.8); HL 18.5mm (in SL = 3.2); SnL 10.7mm (in HL = 1.7); HW 10.8mm (in HL = 1.7); WBO 10.7mm (in HL = 1.7); DCP 7.3mm (in HL = 2.5); PL (R&L) 13.4mm (in SL = 4.4); DL 15.5mm (in SL = 3.8); DBS 24; VBS 23; PAS 3, Font 6.1mm (in HL = 2.9); posterior edge of pectoral fin spine hardly serrated **(Fig. 8)**, Branched rays 1, 9; Branched ventral rays 1, 7 dorsal i, 7.

Paratype range: SL 49-58.7mm; BW 10.3-13.8mm (4.3-4.9); BD 16.6-22.4mm (2.6-3.1); HL 14.9-19.4mm (3.0-3.1); SnL 7.6-11.5mm (1.7-2.0); HW 9.0-16.6mm (1.6-1.7); WBO 8.7-11.7mm (1.7-1.8); DCP 6.2-8.1mm (2.4-2.6); PL (R) 12.2-15.8mm (3.7-4.7); DL 12.5-17.3mm (3.6-4.7); DBS 23-25; VBS 22-23; PAS 3-4, Font 4.9-6.4mm; posterior edge of pectoral fin spine hardly serrated **(Figs. 9 & 10)**, Branched pectoral rays 1,8-9; branched ventral rays 1, 6-7 dorsal 1, 7.

Description: Colour in life: The description is based on eight preserved specimens examined. The pale tan body is marked with a black dorsolateral blotch which reaches almost to the mid-lateral line below the dorsal spine. The blotch tapers beyond the last dorsal ray. It is equal to the length of the dorsal fin base, rises to the dorsal spine and covers the lower dorsal rays. All other fins are hyaline and immaculate except in the paratype LIV 1994.4.28 where the caudal and dorsal fins have pigment flecking.

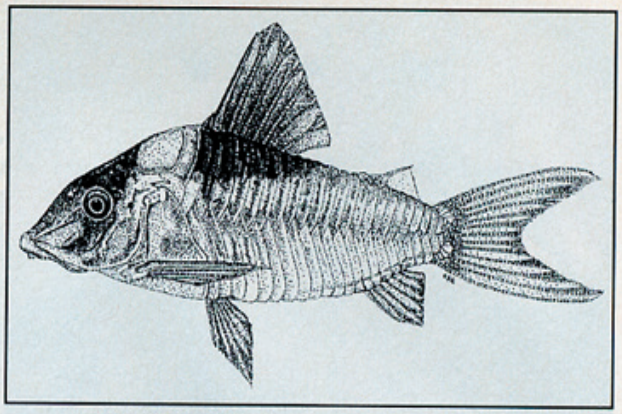


FIGURE 1: *Corydoras amandajanea* n. sp. Holotype (LIV 1994. 4.21) 58.7mm SL.

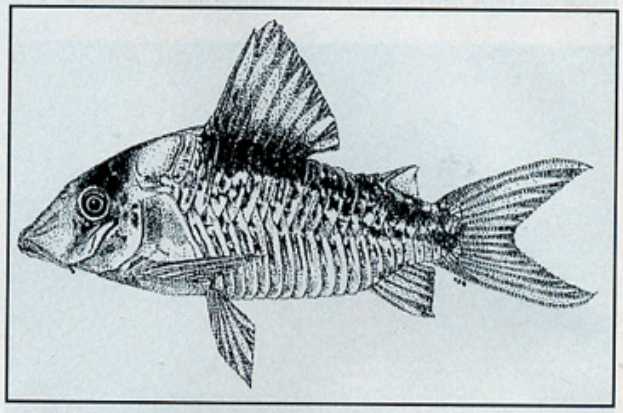


FIGURE 2: *Corydoras amandajanea* n. sp. paratype. (LIV 1994. 4.27) 58.8mm SL. Variation in colour pattern.

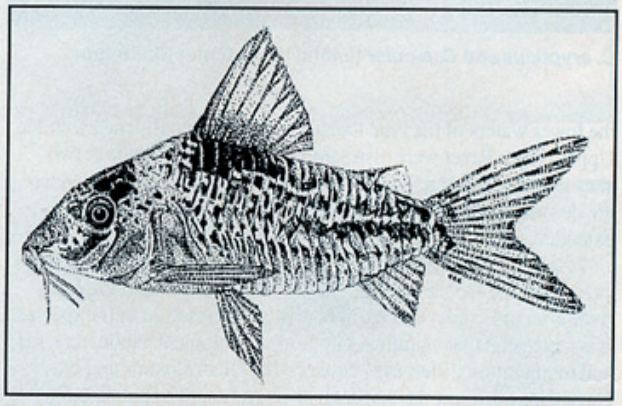


FIGURE 3: *Corydoras amandajanea* n. sp. paratype. (LIV 1994. 4.28) 52.2mm SL. Variation in colour pattern.

Colour in alcohol: Grey, white body marked by a vertical black eye band, dusky dorsal fin rays and a blotch which covers the upper part of dorsolateral scutes directly beneath the dorsal fin, all other fins are hyaline and immaculate.

Colour variability: Two specimens display variation in the colour pattern. Paratype LIV 1994.4.27 **(Fig. 2)** shows the blotch extended into a line marking the upper dorsolateral scutes to the caudal peduncle. This specimen has pigment flecks that cover three quarters of both rows of body scutes. Paratype LIV 1994.4.28 **(Fig. 3)** has pigment flecking across most of the body scutes and the caudal fin rays. Some caudal fin damage occurred after death, however, photographs taken of this paratype immediately following capture were used and allowed the caudal fin to be drawn complete.

Comparison with similar species: There are similarities between *Corydoras amandajanea, Corydoras imitator* Nijssen &

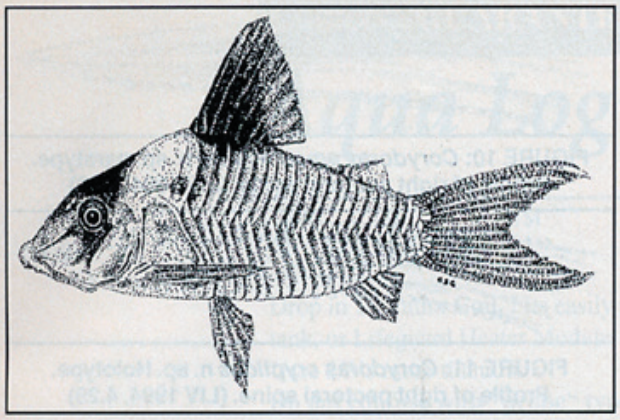


FIGURE 4: *Corydoras crypticus* n. sp. Holotype. (LIV 1994. 4.29) 44.9mm SL.

Isbrücker, 1983 also from a tributary of the Upper Negro, Brazil and *Corydoras ambiacus,* Cope, 1872 which is known from collections made in Peru & Ecuador (in Nijssen & Isbrücker, 1980). There are key visual differences in pigment patterns among the three species, all of which have a vertical black eye-band pattern. *Corydoras amandajanea* has a black dorsolateral blotch that is equal in length to the dorsal fin base. The blotch also covers some of the basal region of the dorsal rays. *Corydoras imitator* has a black dorsolateral line which extends from the front of the dorsal spine base to the caudal fin base. The dorsal and caudal fin rays are hyaline and immaculate.

Corydoras ambiacus, based on Weitzman's illustrations of aquarium specimens (Nijssen & Isbrücker, 1986 — Figs. 5&6), has a black body-dorsal blotch that covers a small dorsolateral area, directly beneath and partly onto the dorsal fin, that is less than the length of the dorsal fin base. *Corydoras amandajanea* differs from *C. imitator* and by having a lesser caudal peduncle depth when expressed in the head length (2.4-2.6 in *C. amandajanea*, 2.7 in holotype of *C. imitator)* and a shorter fontanelle length in the head length, (2.9 in *C. amandajanea*, 2.8 in *C. imitator). Corydoras ambiacus* is 2.5-2.7 (body depth expressed in SL) compared with 2.6-3.1 in *C. amandajanea* and 2.7 in *C. imitator.* The body widths in SL are 4.3-4.9 in *C. amandajanea*, 4.3 in the holotype of *C. imitator*, 3.7-4.1 in *C. ambiacus.* The dorsal and pectoral spine lengths in SL are, in *C. amandajanea* 3.6-4.7 and 3.7-4.7 respectively, in *C. imitator* 4.5-4.9 and 4.0-4.2, and in *C. ambiacus* 3.6-4.4 and 3.3-4.0.

Corydoras amandajanea is, within the genus, a comparatively large species which inhabits similar, deeper and faster part of the stream niche as occupied by *C. imitator* in an adjacent stream. The variability in pigment patterns may reflect the range of stream habitats occupied by this species in the Miuã system. Pigment pattern variability within species populations have been previously recorded with *Corydoras amapaensis* Nijssen, 1972 providing a good example.

Etymology: Named in honour of my wife, Amanda Jane, who gave unending help and assistance during my research.

Corydoras crypticus, sp. nov.
(Figure 4)

Material examined: six specimens, 31.2-44.9mm SL.

Holotype: LIV 1994.4.29, SL 44.9mm, Brazil.

Paratypes: LIV 1994.4. 30-34, 31.2-37.3mm SL with the same collection data as the holotype.

Habitat: Rio Miuã system of streams, possibly the Uarinabe stream, 10-12 kilometres away from its confluence of the Upper Negro River, Brazil. Collectors Raimundo Jose Dias and D.D. Sands, 14-XI-1992, 22.00-23.00 hours, night collecting in total darkness.

Equipment used: dip nets.

Biotope: River banks dense forest edged with tall palms, Substrate: sand, leaf litter/ (dead palm leaves), Shallows 0.5-1 metre deep.

Catch details: Ten out of eighteen *Corydoras crypticus* (in a mixed group with *Corydoras bicolor*— moving beneath and between plant litter in an area approximately 1 metre square) retained: 7 *Corydoras crypticus*, 3 *Corydoras bicolor.*

Morphometric data, Holotype: SL 44.9mm; BW 9.5mm (4.7);

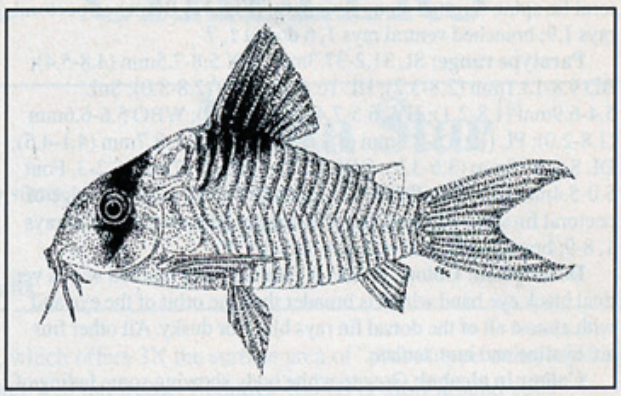


FIGURE 5: *Corydoras bicolor* Miuã specimen. (LIV 1994. 4.35) 35.9mm SL.

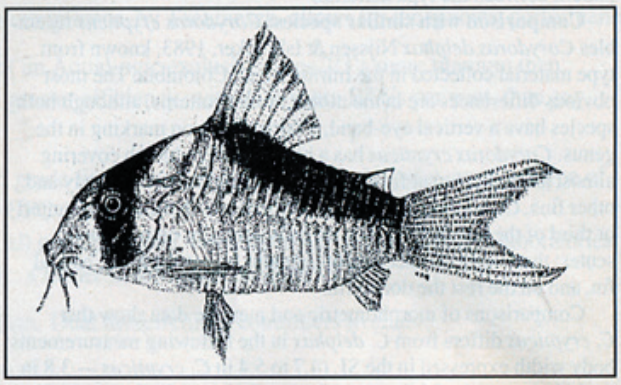


FIGURE 6: *Corydoras duplicareus* n. sp. Holotype. (LIV 1994. 4.36) 37.9mm SL.

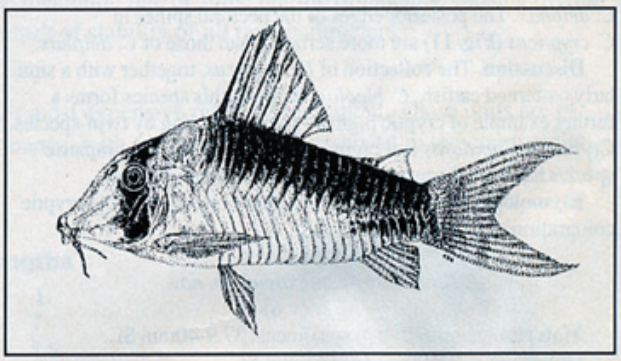


FIGURE 7: *Corydoras serratus* n. sp. Holotype. (LIV 1994. 4.38) 48.8mm SL.

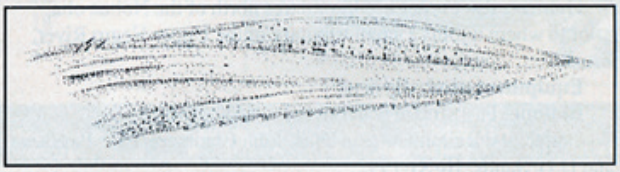


FIGURE 8: *Corydoras amandajanea* n. sp. Holotype. Profile of right pectoral spine. (LIV 1994. 4.21)

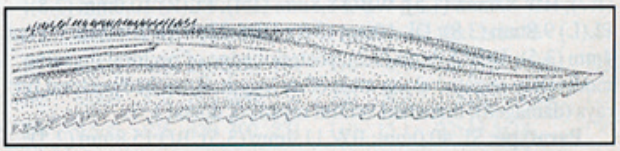


FIGURE 9: *Corydoras amandajanea* n. sp. paratype. Profile of right pectoral spine. (LIV 1994. 4.27)

BD 15.6mm (2.9); HL 14mm (3.2); SnL 8.0mm (1.8); HW 8.5mm (1.6); WBO 7.5mm (1.9); PL(R) 5.9mm (7.6) (possibly damaged or aberrant); PL(L) 6.4mm (3.7); DL 12mm (3.7); DBS 24; VBS 22; PAS 3, Font 6.3mm (2.2); DCP 5.8mm (2.4); posterior edge of pectoral fin spine serrated along its length; **(Fig. 11)** Branched pectoral rays 1,9; branched ventral rays 1, 6 dorsal 1, 7

Paratype range: SL 31.2-37.3mm; BW 5.8-7.5mm (4.8-5.4); BD 9.8-13.1mm (2.8-3.2); HL 10.4-12.6mm (2.8-3.0); SnL 5.4-6.9mm (1.8-2.1); HW 6.5-7.4mm (1.6-1.7); WBO 5.6-6.6mm (1.8-2.0); PL (R) 6.5-8.8mm (4.2-5.6); PL (L) 7.6-8.7mm (4.1-4.5); DL 8.0-10.0mm (3.6-3.9); DBS 22-23; VBS 21-23; PAS 2-3, Font 5.0-5.4mm (2.1-2.3); DCP 4.2-5.3mm (2.4-2.5); posterior edge of pectoral fin spine serrated along its length. Branched pectoral rays 1, 8-9; branched ventral rays 1, 6 dorsal 1, 7.

Description: Colour in life: A pale tan body marked with a vertical black eye band which is broader than the orbit of the eye and with almost all of the dorsal fin rays black or dusky. All other fins are hyaline and immaculate.

Colour in alcohol: Grey to white body showing some fading of pigment in the dorsal and black eye-band.

Colour variability: There is little variability in the colour pattern between the type material.

Comparison with similar species: *Corydoras crypticus* resembles *Corydoras delphax* Nijssen & Isbrücker, 1983, known from type material collected in the Inirida River, Colombia. The most obvious differences are in the monochrome patterns, although both species have a vertical eye-band, a fairly common marking in the genus. *Corydoras crypticus* has a black pigment blotch covering almost all of the dorsal fin and there is no pigment in the body and other fins. *C. delphax* has a black pigment blotch on only the anterior third of the dorsal fin which extends ventrally onto the body scutes; there are also speckles of pigment across the body, caudal fin, and on the rest the dorsal fin.

Comparisons of morphometric and meristic data show that *C. crypticus* differs from *C. delphax* in the following measurements: body width expressed in the SL (4.7 to 5.4 in *C. crypticus* — 3.8 in the holotype of *C. delphax*) and fontanelle length in the head length (found to be a reliable ratio when comparing similar species, Sands, 1994b) which is 2.1-2.3 in *C. crypticus* and 2.5 in the holotype of *C. delphax*. The posterior edges of the pectoral spines in *C. crypticus* **(Fig. 11)** are more serrated than those of *C. delphax*.

Discussion. The collection of *C. crypticus*, together with a similarly patterned catfish, *C. bicolor*, suggests this species forms a further example of cryptic pigment pattern-sharing by twin-species. Crypsis in *Corydoras* and pigment pattern sharing by sympatric species has been discussed in some detail (Sands, 1994a).

Etymology: From the Latin, as a direct reference to the cryptic colouration of this species.

Corydoras duplicareus, sp. nov.
(Figure 6)

Material examined: two specimens, 37.9-40mm SL.

Holotype: LIV 1994.4.36, 37.9mm SL.

Paratype: LIV 1994.4.37, 40.0mm SL, same collection data as holotype.

Habitat: Rio Poranga, 8 kilometres north of the Nobua oba, prior to where it joins a small tributary of the Upper Negro River, Brazil.

Equipment used: dip nets.

Biotope: Fast stream water over a sand substrate.

Collectors: Raimundo Jose Dias, John Chalmers, Luiz Pavarette, and D.D. Sands, 16-XI-1992.

Morphometric and meristic data, Holotype: SL 37.9mm; BW 11.0mm (3.4); BD 15.2mm (2.5); HL 12.6mm (3.0); SnL 7.5mm (1.7); HW 8.6mm (1.5); WBO 8.8mm (1.4); PL(R) 10.0mm (3.8); PL(L) 9.8mm (3.8); DL 10mm (3.8); DBS 22; VBS 20; PAS 3; Font 4mm (3.5); DCP 5.8mm (2.2); posterior edge of pectoral fin spine moderately serrated along most of its length. Branched pectoral fin rays (damaged); branched ventral rays 1, 6, dorsal 1, 7.

Paratype: SL 40.0mm; BW 11.4mm (3.5); BD 15.8mm (2.5); HL 13.5mm (3.0); SnL 7.1mm (1.9); HW 11.3mm (1.2); WBO 9.2mm (1.5); PL(R) 10.4mm (3.8); PL (L) 10.7mm (3.7); DL 10.3mm (3.9); DBS 21; VBS 20; PAS 3; Font 4.1mm (3.3); DCP 5.7mm (2.4); posterior edge of pectoral fin moderately serrated along most of its length. Branched pectoral rays (damaged); branched ventral rays 1,6-7, dorsal 1, 7.

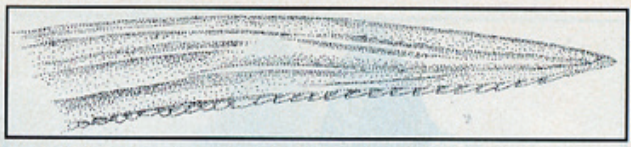


FIGURE 10: *Corydoras amandajanea* n. sp. paratype. Profile of right pectoral spine. (LIV 1994. 4.28)

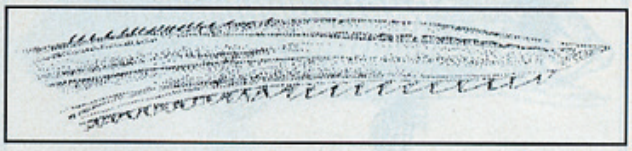


FIGURE 11: *Corydoras crypticus* n. sp. Holotype. Profile of right pectoral spine. (LIV 1994. 4.29)

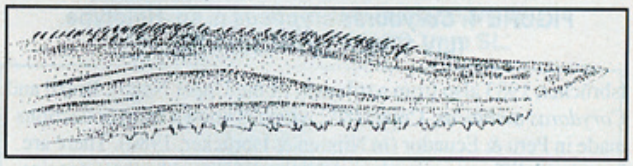


FIGURE 12: *Corydoras bicolor* Miuã specimen. Profile of right pectoral spine. (LIV 1994. 4.35)

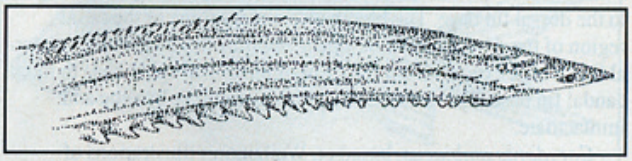


FIGURE 13: *Corydoras duplicareus* n. sp. Holotype. Profile of right pectoral spine. (LIV 1994. 4.36)

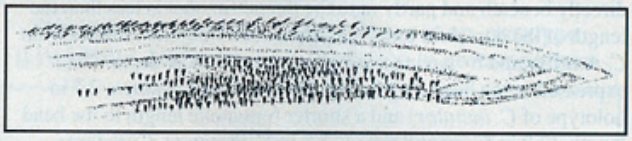


FIGURE 14: *Corydoras adolfoi* Burgess. Aquarium specimen. Profile of right spine.

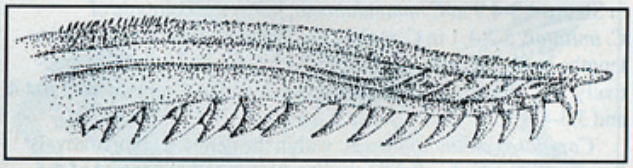


FIGURE 15: *Corydoras serratus* n. sp. Holotype Profile of right pectoral spine. (LIV 1994. 4.38)

Description: Colour in life: A black eye-band and upper dorsolateral body band, from below the base of the dorsal spine to the upper caudal fin base, that is conspicuous on the pale tan body background colour. The bright orange post orbital fleck of *C. duplicareus* is very distinctive in all live specimens.

Colour in alcohol: The colour is the same as in life, however, except the orange post orbital fleck which is absent in the preserved specimens.

Colour variability: None observed.

Comparison with similar species: The black eye-band, upper dorsolateral body band and orange post orbital fleck of *C. duplicareus* are remarkably similar to the pattern and colouration found in *C. adolfoi*. The holotype of *C. duplicareus* differs, in a number of measurements, from the holotype of *C. adolfoi* (given in parentheses) in the following ratios: BW 3.4 (3.8), BD 2.5 (2.8), HL 3.0 (2.8), WBO 1.4 (2.3), Font 3.5 (3.0), PL 3.8 (3.4), and DL 3.8 (4.6). The anterior edge of the pectoral spines are moderately serrated in *C. duplicareus* **(Fig. 13)** whereas, in all specimens of