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A New Species of *Copadichromis* (Cichlidae) from Thumbi West Island, Lake Malawi

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Copadichromis atripinnis, new species, is described from the Cape Maclear Region of Lake Malawi. It is diagnosed primarily by the solid black pigmentation of the pelvic fins, the black anal fin, and the broad black bands on the caudal fin. The presence of a stone in the bower, may indicate that *C. atripinnis* is most closely related to *C. trewavasae, C. geertsi, C. azureus, C. mbenjii* and *C. ilesi*, all of whose bowers contain a stone.

Introduction

Trewavas (1935) originally recognized morphological similarities (e.g., protractile mouth) among six sand-dwelling Lake Malawi species (*Haplochromis eucinostomus* Regan, *H. inornatus* [Boulenger], *H. cyaneus* Trewavas, *H. prostoma* Trewavas, *H. chrysonotus* [Boulenger], *H. quadrimaculatus* Regan). Subsequently, Bertram et al. (1942) referred to these species under the Malawian name 'utaka'. Iles (1960) described another 10 species (*H. flavimanus, H. mloto, H. viginalis, H. boadzulu, H. trimaculatus, H. nkatae, H. jacksoni, H. borleyi, H. pleurostigmoides, H. likomae*) and placed them with the other utaka. Later, Eccles & Trewavas (1989) created *Copadichromis* (type species *H. quadrimaculatus*) to accommodate these species, and diagnosed the genus by its small mouth, weak jaws, small recurved simple or bicuspid teeth, and elongated premaxillary pedicels that can be extended forward forming a protrusible mouth. Konings (1990) described *C. azureus, C. mbenjii*, and *C. verduyni*, and suggested that *C. prostoma, C. eucinostomus*, and *C. boadzulu* be placed in *Nyassachromis* Eccles & Trewavas based on a pigmentation pattern consisting of stripes. Stauffer et. al. (1993) described three species of *Copadichromis (C. conophoros, C. cyclicos, C. thinos)* and provided an artificial key to the described species. Konings (1999) described *C. trewavasae, C. ilesi*, and *C. geertsi*. The purpose of this paper is to describe a new species of *Copadichromis* from Thumbi West Island, Lake Malawi.

Methods and materials

Fishes were collected by chasing them into a monofilament net while SCUBA diving. Fishes were preserved in 10 % formalin and then transferred to 70 % ethanol for permanent storage. Standard

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Fig. 1. *Copadichromis atripinnis*, holotype, PSU 3387, 101.9 mm SL; Lake Malawi: Thumbi West Island.

length (SL) is used throughout. External counts and measurements follow Barel et al. (1977) and Stauffer (1991). The posterior simple ray of the anal fin, if present, was not counted, because it shares the same pterygiophore as the last fully developed ray (Stauffer, 1994). With the exception of gill-raker counts, all counts and measurements were made on the left side of the fish. Overlapping pored scales in the upper and lower lateral lines were not counted. Institutional abbreviations follow Leviton et al. (1985), except UMBC, University of Malawi, Bunda College.

Copadichromis atripinnis, new species
(Fig. 1)

Holotype. PSU 3387, adult male, 101.9 mm SL; Malawi: Lake Malawi, Thumbi West Island (Kache Point), 17-22 m; 2 April 1999, Tetsu Sato (Fig. 1).

Paratypes. PSU 3388, 28; UMBC 0002, 6; 66.9-103.0 mm SL; data as for holotype.

Diagnosis. The completely black pectoral fins, black anal fin, and broad black bands on the caudal fin in breeding males distinguishes *C. atripinnis* from other *Copadichromis* species except *C. jacksoni*, *C. chrysonotus*, *C. verduyni*, *C. mbenji*, *C. trewavasae*, *C. azureus*, *C. quadrimaculatus*, *C. likomae*, *C. gertsi* and *C. ilesi*. *Copadichromis atripinnis* has a supra-anal spot, which is absent in *C. jacksoni*. The dorsal-fin base length of *C. atripinnis* is 56.3-62.45 % SL, while it is 53.0-55.8 in the five syntypes of *C. chrysonotus*. *Copadichromis atripinnis* builds bowers, while *C. chrysonotus* is the only described species in this genus which breeds in the water column and does not build bowers. *Copadichromis atripinnis* is distinct from *C. verduyni* by the position of the supra-pectoral spot; it overlaps the upper lateral line in *C. atripinnis*, but is completely below the upper lateral line in *C. verduyni*. The yellow coloration throughout the flanks of *C. mbenji* is absent in *C. atripinnis*, which is pale blue. The yellow membranes of the caudal fin and, the yellow spots in the rayed portion of the dorsal fin and the yellow marginal band of the anal fin of *C. atripinnis* are absent from *C. trewavasae*. The presence of bright yellow pigmentation patterns on the anal fin of *C. atripinnis* is not seen on *C. azureus*, however, other populations identified as *C. azureus* have some pale yellow in the anal fin. The presence of 14-20 gill rakers on the ceratobranchial of *C. atri-*

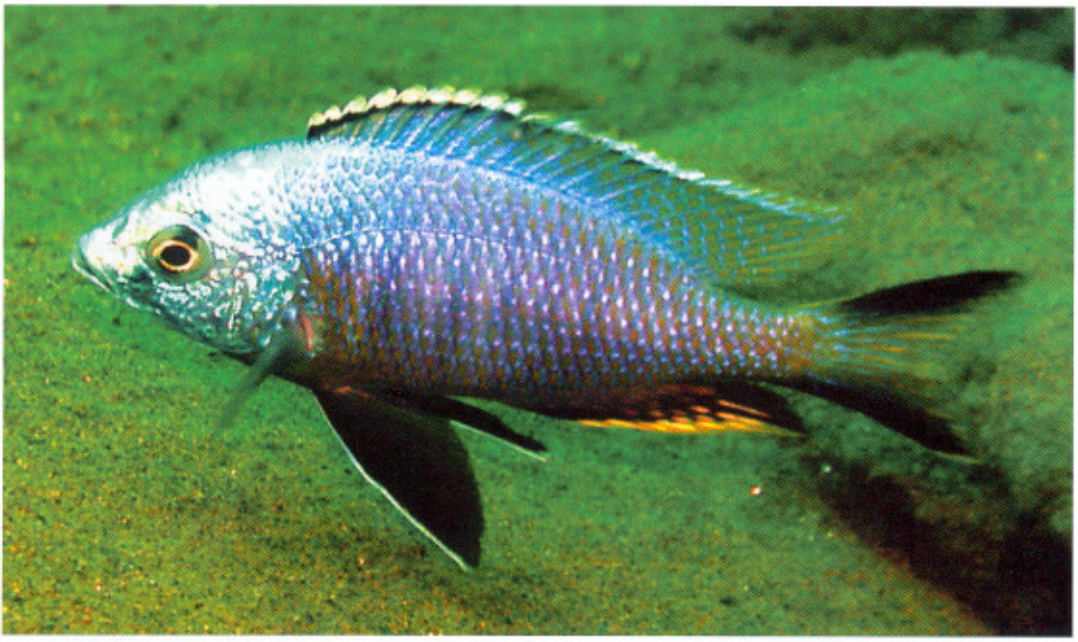

Fig. 2. *Copadichromis atripinnis*, about 100 mm SL; Lake Malawi: Thumbi West Island, Cape Maclear; breeding male, not preserved.

pinnis distinguishes it from *C. quadrimaculatus* (22-26), *C. likomae* (24-28), *C. gertsi* (23-25), and *C. ilesi* (21-25) (Iles, 1960; Konings, 1999).

Description. Morphometric and meristic data are summarized in Table 1. Jaws isognathous (Fig. 1).

Overall body coloration of breeding males pale blue, with 6 or 7 vague dark vertical bars (Fig. 2). Pale yellow dots on scales of abdomen and side of body. Dorsal fin pale blue, with a black submarginal band on anterior half and white marginal band. Tips of dorsal-fin spines yellowish. Pectoral fin transparent; pelvic fin black with white margins along first spine (Fig. 2). Anal fin black with many small yellow egg spots and bright yellow margin along tip of spines. Caudal fin pale blue with yellow stripes; broad black bands with narrow yellow margins along dorsal and ventral margins of fin.

Overall body coloration of females silvery gray with three conspicuous black spots on flank. Supra-pectoral spot overlaps upper lateral line. Series of small diffuse black dots along base of dorsal fin. Dorsal-fin margin white. Margin of pelvic fins white along first spine. Dorsal and ventral margins of caudal fin and margin of anal fin with black hue.

Bower-shape. We found the bowers on a sand slope near the rocky area at the depth of 16 to 25 m. The bowers were densely packed, with distances between bowers approximately 3-7 m. The bowers were circular or oval in shape, with a slight depression in the center and a surrounding sand mound. The bowers contained a stone usually at the deeper margin of the sand mound. The stone could be small enough to be inside the bower, or a part of large rocks. The depression was usually deepest near the stone, and spawning took place at this deepest part. The mean (SD) of the longer and shorter diameters of the bowers were 29.6 (3.1) and 20.1 (3.7) cm respectively, and the mean height of the sand mound at its highest part from the surrounding sand bottom was 10.4 (2.0) cm ($n = 17$). The sizes of stones in the bower were highly variable. The smallest measured 9×14 cm in diameter that was entirely inside the bower, while some were the edges of large boulders measuring a few meters. The distance that stones extended into the border of bowers ranged from 0 to 9 cm. In 1998, the bowers were already present in the end of November, and active spawning was observed until May. The bowers and courting males disappeared in the dry season.

Distribution. *Copadichromis atripinnis* appears to be restricted to the Cape Maclear region of southern Lake Malawi at depths ranging from 12-25 m. All specimens collected for the description where from the northern tip of Thumbi West Island (Kache Point) at depths of 17 to 22 m.

Etymology. The name *atripinnis*, from Latin, meaning 'black fin' was chosen to reflect the solid black pigmentation of the pelvic fins, the black anal fin, and the broad black bands on the caudal fin (Fig. 2); treated as a noun in apposition.

Discussion

The presence of distinct lateral spot in females and non-breeding males anterior to hypural plate distinguishes *C. atripinnis* from *C. boadzulu*,

Table 1. Morphometric and meristic characters of *Copadichromis atripinnis*. Range and mean include holotype and 34 paratypes.

	holotype	mean	stand. dev.	range
Standard length	101.9	87.1	12.5	66.9-103.0
Head length	30.5	26.7	3.6	19.9-31.1
Percent of standard length				
Head length	29.9	30.6	0.9	28.2-32.9
Snout to dorsal-fin origin	35.5	35.1	1.2	33.5-38.9
Snout to pelvic-fin origin	36.6	36.5	1.3	33.7-39.8
Dorsal-fin base length	58.2	59.2	1.5	56.3-62.4
Anterior dorsal to anterior anal	49.8	51.4	1.6	48.9-54.9
Posterior dorsal to posterior anal	16.1	16.4	0.7	15.1-17.8
Anterior dorsal to posterior anal	61.6	62.5	1.4	59.7-65.4
Posterior dorsal to anterior anal	34.4	33.8	1.3	30.8-36.2
Posterior dorsal to ventral caudal	19.1	20.0	0.9	18.1-21.9
Posterior anal to dorsal caudal	23.7	22.7	0.8	20.7-24.6
Anterior dorsal to pelvic-fin origin	38.7	38.5	1.3	35.8-40.8
Posterior dorsal to pelvic-fin origin	58.9	58.9	1.6	55.8-63.4
Caudal peduncle length	20.0	18.0	1.2	15.1-20.0
Least caudal peduncle depth	12.3	12.0	0.4	11.2-13.1
Percent of head length				
Horizontal eye diameter	35.5	36.0	2.3	31.7-41.6
Vertical eye diameter	34.6	35.7	2.7	30.7-40.9
Snout length	30.7	29.4	2.4	24.6-36.4
Postorbital head length	38.9	37.9	1.1	35.0-40.5
Preorbital depth	17.7	17.2	1.2	14.5-19.8
Lower-jaw length	40.8	40.1	2.1	34.6-44.4
Cheek depth	23.3	20.5	2.0	16.3-25.1
Head depth	101.1	99.7	6.0	88.3-111.0
Counts	holotype	mode	% freq.	range
Lateral-line scales	35	34	42.8	31-35
Pored scales posterior to lateral line	2	2	68.6	0-4
Scale rows on cheek	3	3	71.4	2-3
Dorsal-fin spines	16	16	54.3	14-17
Dorsal-fin rays	12	11	51.3	10-12
Anal-fin rays	10	9	65.7	8-10
Pectoral-fin rays	12	14	48.6	12-15
Gill rakers on first ceratorbranchial	19	15	28.6	14-20
Gill rakers on first epibranchial	5	6	45.7	4-7
Teeth in outer row of left lower jaw	9	12	22.8	9-16
Teeth rows on upper jaw	3	3	97.1	3-4
Teeth rows on lower jaw	3	3	97.1	3-4

C. conophoros, C. cyaneus, C. cyclicos, C. eucinostomus, C. flavimanus, C. inornatus, C. mloto, C. thinos, and *C. virginalis*. The short intestine of *C. atripinnis* (<4 times SL) distinguishes it from *C. trimaculatus*. The presence of a supra-anal spot in *C. atripinnis* separates it from *C. nkatae, C. pleurostigmoides, C. pleurostigma,* and *C. prostoma*. The breeding of *C. borleyi* differs from *C. atripinnis*. *Copadichromis borleyi* males defend spawning sites on large boulders and spawn along the vertical face of the boulder or construct a small bower of fine sand on top of the boulder (Konings, 2001). The distance between the posterior insertion of the dorsal fin and the posterior insertion of the anal fin in the holotype of *C. borleyi* is 14 % SL, while it is 15.1-17.8 in *C. atripinnis*.

Copadichromis as it is currently diagnosed is most certainly a polyphyletic genus (Konings 1990, 1999; Stauffer 1993). Observations by McKaye (1991) and Stauffer et al. (1995) have demonstrated that taxa within many Lake Malawi genera of haplochromines have similarly shaped bowers and exhibit similar courtship dances. Three species *(C. conophoros, C. cyclicos, C. thinos)* build similarly shaped bowers over the open sand and lack a stone as part of the construction (Stauffer, 1993). Stauffer et al. (1995) confirmed that these three species were more closely related to each other than to *C. atripinnis*, whose bowers contain a stone. The presence of a stone in the bower, may indicate that *C. atripinnis* is closely related to *C. trewavasae, C. geertsi, C. azureus, C. mbenjii* and *C. ilesi*, all of whose bowers contain a stone.

In the original description of *C. conophoros* (Stauffer et al., 1993), the specific epithet was spelled both as *conophoros* and *conophorus*. *Conophoros* was the first spelling used in the manuscript and designated the types, and it is designated here as the correct original spelling (International Code of Zoological Nomenclature, art. 32.2.1).

Comparative material. *C. chrysonotus*: BMNH.1908.10.27.49-57, 9 syntypes, 95.5-104.7 mm; Lake Nyasa; Rhoades. *C. borleyi*: BMNH.1962.10-18.92, holotype, 76.8 mm; Nkata Bay, Lake Malawi; Iles.

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Book reviews – Books received

Ancient lakes – Their cultural and biological diversity. H. Kawanabe, G. W. Coulter & A. C. Roosevelt (eds.). 1999.
Kenobi Productions, Hofstraat 25, B-9000 Ghent, Belgium, 340 pp., ISBN 90-804341-2-4, EUR 71.39.

A collection of papers based on presentations made at an "International Conference on Ancient Lakes: their biological and cultural diversities", held at Lake Biwa Museum, Japan, in 1997. The articles are of very unequal interest and quality, some even do relate with the title of the volume only with difficulty. The main theme is the long-term interaction between people and nature in and around ancient lakes. The geographical coverage is biased towards Lake Biwa and African rift lakes and some important ancient lakes (Lake Ohrid or the lakes of Sulawesi) are mentioned neither in the overview of ancient lakes pp. 4-5 nor in the volume. As a whole, this book presents some sort of introduction to lacustrine biology but the content is so heterogeneous that it is difficult to find what the targeted audience is.

Seepferdchen, Seenadeln, Fetzenfische und ihre Verwandten – Syngnathiformes. Rudie H. Kuiter. 2001.
Verlag Eugen Ulmer, Wollgrasweg 41, D-70599 Stuttgart (Hohenheim), Germany, 240 pp., ISBN 3-8001-3244-3, DM 78.00.

A German translation of "Seahorses, pipefishes and their relatives: Syngnathiformes". A unique collection of 1120 colour photographs of syngnathiform fishes, mostly of live specimens in nature and of very high quality, many very spectacular, with some very interesting spawning series. A quite crowded layout. Although most people will probably buy the book for the photographs, I regret that the text is not always up to the quality of the pictures. The title mentions only Syngnathiformes, but Pegasiformes and Gasterosteiformes are also included and their treatment (especially of Gasterosteidae) is very incomplete; families Hypoptychidae and Indostomidae, listed p. 236, are not mentioned in the text.

Freshwater fishes of northern Vietnam. Maurice Kottelat. 2001.
Available from Tony Whitten, Environment and Social Development Unit, East Asia and Pacific Region, EASES, Room MC8-209, The World Bank, 1818 H St NW, Washington, DC 20433, USA, 144 pp., 15 col. pls., no ISBN.

Report prepared under World Bank Swiss Consultant Trust Fund for the Freshwater Biodiversity Overlay to Support the Vietnam National Hydropower Study as part of the World Bank Environment Department's Global Overlays Program. The main part of the text is an annotated check-list of fishes known from northern Vietnam, with discussion of many taxonomic problems relating to the fish fauna of southern China. Appendices include a translation of selected part of Mai (1978), a discussion of nomenclatural problems associated with a work by "Hao & Hoa" (1969), a reproduction of that work, and colour photographs of 162 species.