

## Relationships of the Madagascan cichlid genus *Paretroplus*, with description of a new species from the Betsiboka River drainage of northwestern Madagascar

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*Paretroplus tsimoly*, new species, is described from the Akalimilotrabe River, a north bank tributary of the Betsiboka River. The immediate relationships of *P. tsimoly* lie with *P. nourissati* (= *Lamena nourissati*) and *P. dami*, the latter being the type species of the genus *Paretroplus*. For this reason, *Lamena* Allgayer, 1998 is placed in synonymy with *Paretroplus* Bleeker, 1868. As currently recognized, *Paretroplus* comprises a clade of nine species whose closest relatives are the three species of east Asian genus *Etroplus*.

### Introduction

The past decade has seen an intensification of collecting efforts in Madagascar, much of it directed toward triage documentation of an increasingly imperiled ichthyofauna (Stiassny & Raminosoa, 1994; Benstead et al., 2000). Despite alarming rates of human encroachment and habitat conversion, a surprisingly large number of new cichlid taxa are continuing to be discovered (e.g., Reinthal & Stiassny, 1997; Allgayer, 1996, 1998; Sparks & Reinthal, 1999, Sparks & Reinthal, in press). Numerically most noteworthy are an increasing number of species belonging to the endemic genus *Paretroplus* Bleeker, 1868 which, with the inclusion of the new species described herein and synonymy of the genus *Lamena*, comprises nine species. It is unlikely that this tally is complete as there remain a number of additional populations unascrivable to currently described

species (de Rham, 1997; Nourissat, 1998; Sparks & Reinthal, 1999, pers.obs.). In the present paper one of these species from a north bank tributary of the Betsiboka River near Maevatanana in the northwest of the island, is formally described. This species was first collected by Jean-Claude Nourissat and Patrick de Rham in 1997 and informally designated the “*Lamena* noir à lèvres bleues” by Allgayer (1998).

### Material and methods

Institutional abbreviations are: AMNH, American Museum of Natural History, New York; MHNG, Muséum d’Histoire Naturelle, Genève; UMMZ, Museum of Zoology, University of Michigan, Ann Arbor.

The following comparative materials have been examined (alc., alcoholic specimens, c.s.,

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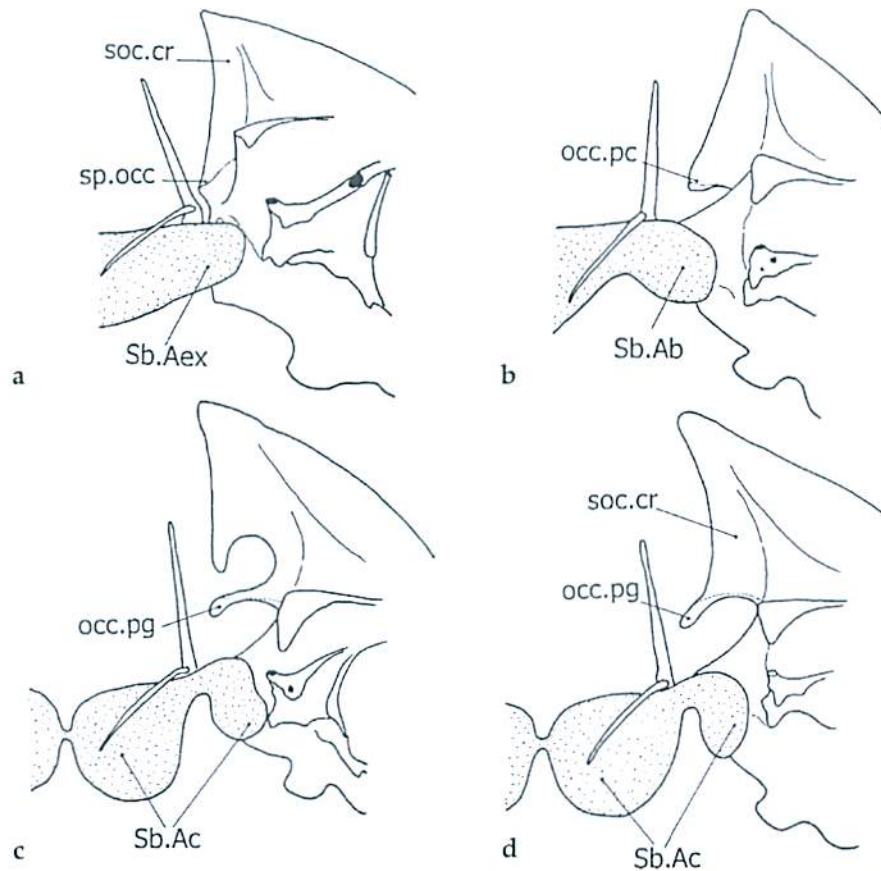


Fig. 1. Posterior neurocranium and associated structures in lateral view of: **a**, *Ptychochromis oligacanthus*, AMNH 88102; **b**, *Etroplus suratensis*, AMNH 217757; **c**, *Paretroplus kieneri*, AMNH 97365; and **d**, *P. tsimoly*, AMNH 229559. Abbreviations: **occ.pc.**, occipital process; **occ.pg.**, occipital prong; **Sb.Ab.**, swimbladder anterior bulb; **Sb.Ac.**, swimbladder anterior chambers; **Sb.Aex.**, swimbladder anterior extension; **soc.cr.**, supraoccipital crest; **sp.occ.**, spina occipitalis.

cleared and double stained for bone and cartilage, skel., dry skeleton, rad. radiograph): *Etroplus maculatus* AMNH 217758 (alc., c.s., rad.), AMNH 217755 (alc.), *E. suratensis* AMNH 217757 (alc., c.s., rad.), *E. canarensis* AMNH 217754 (alc., rad.), *Oxylapia polli* AMNH 97150 (alc., c.s., rad.), *Paratilapia polleni* AMNH 92007 (alc., rad.), AMNH 216067 (c.s.), AMNH 93360 (skel.), *Paretroplus dami* AMNH 229561 (c.s.), MHNG 2537.44 (c.s., alc., rad.), MHNG 2537.45 (alc., rad.), MHNG 2537.46 (alc. rad.), *P. kieneri* AMNH 97365 (c.s., alc., rad.), AMNH 97363 (alc., rad.), MHNG 2537.41 (alc., rad.), MHNG 2537.42 (alc., rad.), MHNG 2537.43 (c.s., alc., rad.), *P. maculatus* AMNH 97362 (alc., rad.), MHNG 2537.47 (c.s., alc., rad.), *P. menarambo* AMNH 97364 (c.s., alc., rad.), MHNG 2537.49 (alc., rad.), *P. nourissati* AMNH 229555 (c.s., alc., rad.), AMNH 229553 (alc., rad.), UMMZ 235205 (alc., rad.), UMMZ 235206 (alc., rad.), *P. petiti* AMNH 97371 (alc.,

rad.), MHNG 2537.48 (c.s., alc., rad.), MHNG 2537.72 (c.s., alc., rad.), *Paretroplus cf. petiti* MHNG 2537.60 (alc., rad.), *P. polyactis* AMNH 88200 (skel.), AMNH 97013 (alc. rad.), AMNH 98171 (c.s.), *Ptychochromis oligacanthus* AMNH 88102 (alc., c.s.), AMNH 88117 (alc., rad.), AMNH 88186 (skel.), *Ptychochromoides katria* AMNH 97095 (alc., c.s., rad.), *P. betsilicanus* AMNH 217753 (alc., rad.)

### Etropline Cichlidae

Stiassny (1991) proposed the union of two Madagascan genera, *Paretroplus* and *Oxylapia*, with the east Asian genus *Etroplus* into an expanded etropline clade. However, character support for the inclusion of *Oxylapia* within the etropline group was not provided and recent molecular analyses have either failed to corroborate this placement (Farias et al., 2000; Sparks, pers comm.) or pro-

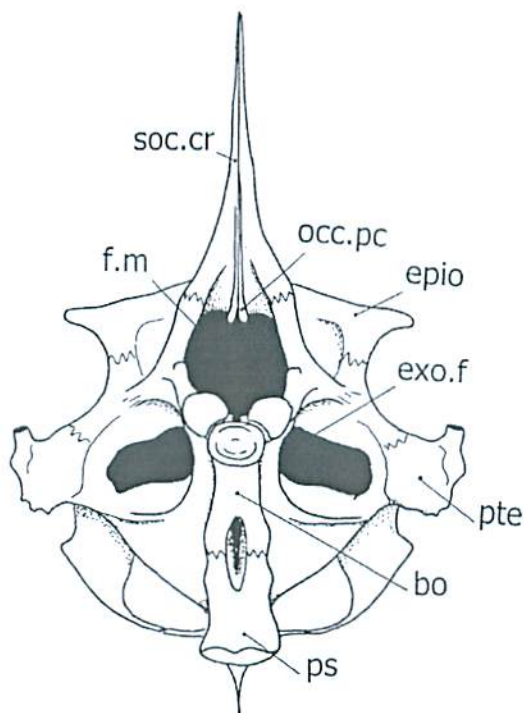


Fig. 2. Neurocranium in posterior view of *Etroplus suratensis*, AMNH 217757. Abbreviations: bo, basioccipital; epio, epioccipital; exo.f, exoccipital foramen; f.m, foramen magnum; occ.pc, occipital process; ps, parasphenoid; pte, pterotic; soc.cr, supraoccipital crest.

vide only weak support (Farias et al., 1999). Regardless of how the final placement of that problematic taxon is finally resolved, molecular evidence strongly supports a sister group relationship between *Etroplus* and *Paretroplus* (e.g., Zardoya et al., 1996; Farias et al., 1999; Farias et al., 2000; Sparks, in prep.) and morphological support is equally impressive (Cichocki, 1976; Stiassny, 1991). Derived anatomical features include a specialized hyoid linkage with the lower jaw, a kinetic palatine and a ligamentous connection between the ectopterygoids and the ethmovomer, an anterior migration of the supraoccipital over the neurocranial lateral line foramina (NLF0), an anterior migration of epaxial musculature over the NLF0, elevated numbers of anal fin spines, a derived swimbladder morphology with associated modification of the foramen magnum and posterior cranial vault. Additional character data for etropline taxa are as follows:

1) Anterior extensions of the swimbladder and an associated excavation of the exoccipital region of the neurocrania are variously developed among

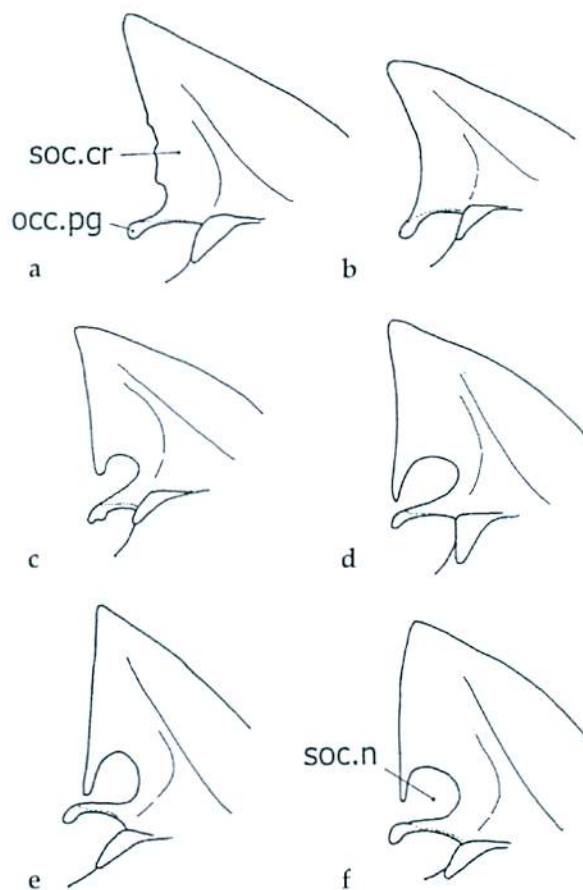


Fig. 3. Supraoccipital crest and associated structures in lateral view of: a, *Paretroplus dami*, AMNH 229559; b, *P. nourissati*, AMNH 229555; c, *P. kieneri*, AMNH 97365; d, *P. menarambo*, AMNH 97364; e, *P. petiti*, MHNG 2537.48; and f, *P. polyactis*, AMNH 98171. Abbreviations: occ.pg, occipital prong; soc.cr, supraoccipital crest; soc.n, supraoccipital notch.

Malagasy genera (Stiassny, 1991; Reinthal & Stiassny, 1997). Stiassny (1991) noted that although excavation of the exoccipital bones of the Malagasy and Asian cichlids (a condition rarely encountered in other percomorphs and lacking in all other cichlids) strongly argues for a monophyletic origin for these taxa, when this character was entered into a phylogenetic analysis with all available morphological data the Malagasy/east Asian genera were resolved as a basal grade rather than a clade.

Whereas swimbladder extension in *Ptychochromis* (Fig. 1a) approaches that of *Etroplus* (Fig. 1b) and *Paretroplus* (Figs 1c,d), the degree of morphological modification is less marked. In *Ptychochromis* thin-walled anterior swimbladder extensions are loosely attached to the exoccipitals and the foramen magnum is not enlarged

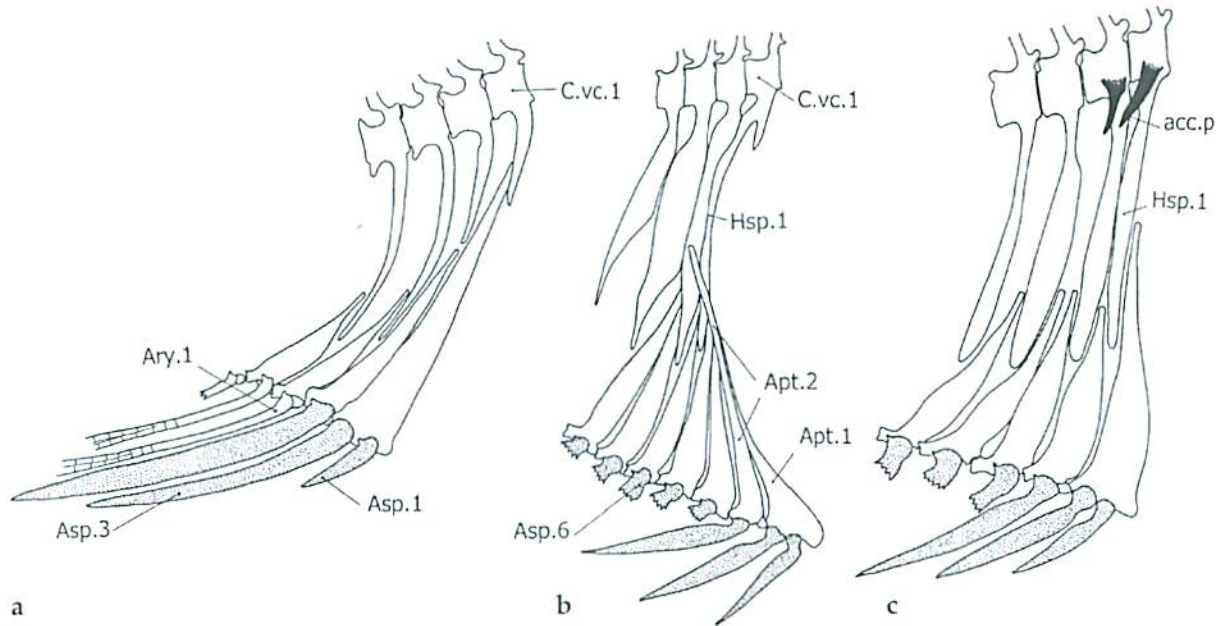


Fig. 4. Anterior caudal vertebrae and associated structures in lateral view of: **a**, *Ptychochromis oligacanthus*, AMNH 88102; **b**, *Etroplus suratensis*, AMNH 217757; and **c**, *Paretroplus tsimoly*, AMNH 229559. Abbreviations: acc.p, accessory parapophyses; Apt1-2, anal pterygiophore 1-2; Ary.1, first anal ray; Asp1-6, anal spine 1-6; C.v.c.1, first caudal vertebral centrum; Hsp.1, first haemal spine.

(Stiassny, 1991: fig. 1.8a). In contrast, both *Etroplus* and *Paretroplus* have thick-walled, bulb-like anterior extensions firmly lodged in elaborate exoccipital foramina by complex connective tissue plugs (Marathe & Khosla, 1958; Stiassny, 1991: fig. 1.8b). Additionally, in both *Paretroplus* (Stiassny, 1991: fig. 1.8a) and *Etroplus* (Fig. 2) the foramen magnum is greatly enlarged. This apparently results from an elevation of the supraoccipital spina occipitalis (Stiassny, 1986) and a portion of the exoccipital, to form a dorsally elevated occipital process above a massively enlarged foramen magnum. The occipital process is heavily ossified and characteristically prong-like in *Paretroplus* (Fig. 1c-d; Fig. 3a-f) and the presence of an 'occipital prong' is interpreted here as a synapomorphy of the genus. An additional synapomorphy of *Paretroplus* is found in the form of the anterior extensions of the swimbladder. These extensions are formed of two bulbous chambers connected via a narrow tube to the main body of the swimbladder (e.g., Fig. 1c-d). *Etroplus* lacks a tripartite swimbladder and instead a simple bilobed chamber is formed by a slight constriction of the main body of the swimbladder (Fig. 1b).

2) Figure 4 illustrates anal fin pterygiophore association with the anterior caudal vertebrae in

*Ptychochromis* (Fig. 4a) representing the condition found in most cichlid taxa, *Etroplus* and *Paretroplus*. Two derived features are illustrated. The first, a synapomorphy of *Etroplus* (Fig. 4b), is an asymmetrical displacement of the first anal pterygiophore to the left of the haemal spine complex and second to the right. The second derived feature is the presence, uniquely in *Paretroplus*, of a variable number of accessory parapophyses borne on the centra of the first 1-5 caudal centra (Fig. 4c, Fig. 5a-c). The first caudal vertebra is interpreted here as the first vertebra through which the caudal artery enters a closed haemal canal and which usually bears a single median haemal spine. The accessory parapophyses are not rib-bearing and no obvious function for them is apparent.

**Phylogenetic relationships of *Paretroplus tsimoly*, and the synonymy of the genus *Lamena* with *Paretroplus*.** Preliminary molecular analyses (Sparks, pers. comm.) indicate that the immediate relationships of *P. tsimoly* lie with *P. nourissati* (= *Lamena nourissati*) and *P. dami*, the latter being the type species of the genus *Paretroplus*, and morphological character evidence that bear on this question are presented here:

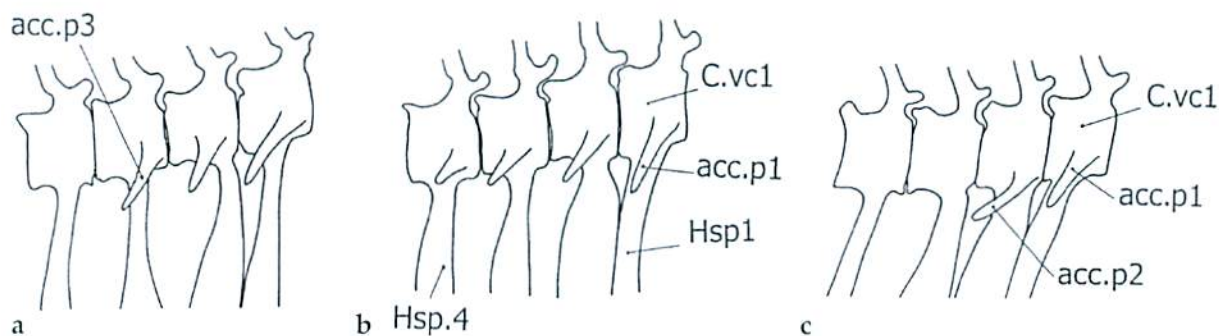


Fig. 5. Anterior caudal vertebral centra and associated structures in lateral view of: **a**, *Paretroplus kieneri*, AMNH 97365; **b**, *P. maculatus*, MHNG 2537.47; and **c**, *P. dami*, AMNH 229560. Abbreviations: **acc.p1-3**, accessory parapophyses 1-3; **C.vc1**, first caudal vertebral centrum; **Hsp1-4**, haemal spine 1-4.

1) As noted above, the presence of accessory parapophyses on anterior caudal vertebral centra is a derived feature of *Paretroplus*. However the number of these structures varies and in *P. tsimoly* (Fig. 4c), *P. dami* (Fig. 5c) and *P. nourissati* accessory parapophyses are restricted to the anterior two caudal vertebral centra. This is not the case in most individuals of other species where accessory parapophyses are regularly present on the first 3-5 caudal centra (e.g., Fig. 4a-b). Interestingly, in *P. polyactis*, a species excluded from the 'deep-bodied clade' of Sparks & Reinthal (1999), two accessory parapophyses are usually present although three occasionally occur (Sparks, pers. comm.). Polarization of this character is problematic, no ontogenetic data are yet available to aid polarity assessment, and in the interim it seems reasonable to interpret both the two, and the three to five, conditions as derived.

2) In *P. tsimoly*, *P. nourissati* and *P. dami* the scales on the chest and belly are markedly reduced in size relative to flank scales and are deeply embedded with few free edges exposed. Scales on the ventrum are also small and deeply embedded. While in *P. maromandia* (Sparks & Reinthal, 1999) and *P. polyactis* chest and belly scales are somewhat reduced in size, they do not approach the condition of the *P. tsimoly*, *P. nourissati*, *P. dami* group. As *Etroplus* have large regularly imbricate scales on the chest and belly, a marked reduction in chest and belly scale size is interpreted here as a derived condition.

3) *Paretroplus* are unique among cichlids in having a single row of teeth in both upper and lower jaws. In most *Paretroplus* median teeth on the

dentary are strongly procumbent and almost horizontally set in the jaw (e.g., Fig. 6c-e). However these median teeth are set more-or-less erect in the jaw in *P. tsimoly* (Fig. 8c), *P. nourissati* (Fig. 6a), and *P. dami* (Fig. 6b). In both *Etroplus suratensis* (Fig. 6f) and *E. canarensis* they are procumbently implanted, while in *E. maculatus* (Fig. 6g) they are set slightly more erect in the jaw. Despite slight variation within *Etroplus*, a more-or-less erect implantation is interpreted here as the derived condition within *Paretroplus*.

4) *Paretroplus* of the 'deep-bodied clade' (i.e., *P. petiti*, *P. maculatus*, *P. menarambo*, and *P. maromandia*, e.g., Fig. 3c-f) recognized by Sparks & Reinthal (1999), as well as *P. polyactis* (Fig. 3c) and *P. kieneri* (Fig. 1c), have a deep, ovoid, excision of the posterior border of the supraoccipital crest (= a supraoccipital notch) above the occipital prong. *Paretroplus tsimoly* (Fig. 1d), *P. nourissati* (Fig. 3b) and *P. dami* (Fig. 3a) usually lack this notch (although individuals of *P. dami* exhibit varying degrees of supraoccipital excavation and in some the condition may approach that of the 'deep-bodied clade'). However, the absence of a supraoccipital notch in all other cichlids and in most percomorphs suggests that presence of the notch is best interpreted as a derived condition for *Paretroplus*, with absence or reduction representing either a plesiomorphy or possibly a secondary loss within the genus.

5) The breeding dress of *Paretroplus dami*, *P. nourissati*, *P. tsimoly* and *P. polyactis* consists of a salmon orange to brick red base color disrupted by contrasting species-specific black vertical markings. The color pattern of sexually inactive individuals is quite different from, and much

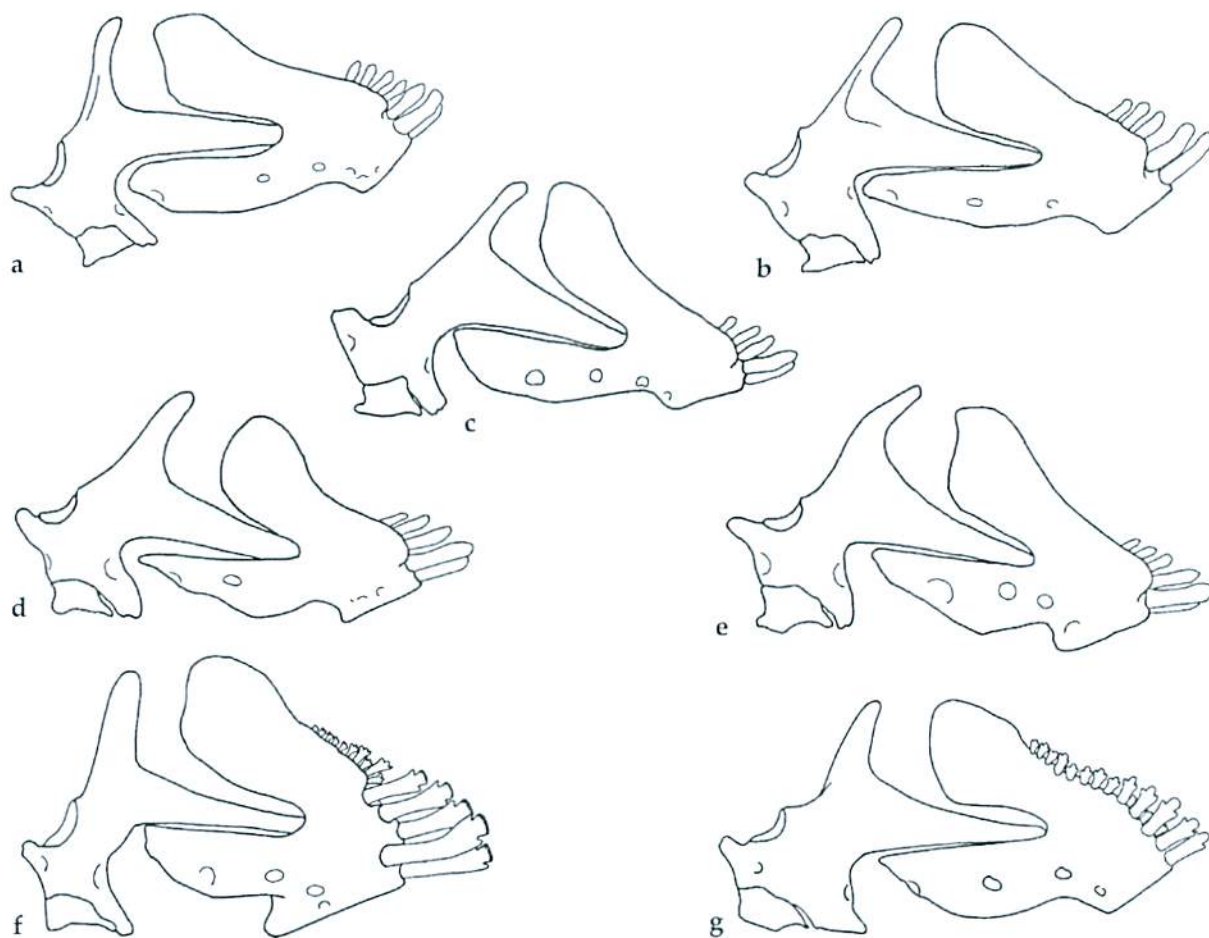


Fig. 6. Isolated right lower jaws of: a, *Paretroplus nourissati*, AMNH 229555; b, *P. dami*, AMNH 229560; c, *P. kieneri*, AMNH 97365; d, *P. menarambo*, AMNH 97364; e, *P. petiti*, MHNG 2537.72; f, *Eetroplus suratensis*, AMNH 217757; and g, *E. maculatus*, AMNH 217758.

drabber than, that of courting or parental fish. In contrast, the color pattern of reproductively active individuals of *Paretroplus* of the 'deep-bodied clade' sensu Sparks & Reinthal (1999), as well as that of *P. kieneri* is simply an intensification of their species-typical coloration.

In sum, the molecular and morphological evidence for a close phylogenetic relationship between *P. dami*, *P. tsimoly* and *P. nourissati* (and possibly also, *P. polyactis*) is convincing. Since *P. dami*, the type species of *Paretroplus*, is included in this clade there is no phylogenetic justification for maintaining a separate genus (*Lamena*) for one of its close relatives. We therefore propose the synonymy of *Lamena* Allgayer, 1998 with *Paretroplus* Bleeker, 1868 and thereby re-establish *Paretroplus* as a monophyletic assemblage.

*Paretroplus tsimoly*, new species  
(Figs. 7, 10)

**Holotype.** AMNH 229558, adult female, 140.3 mm SL; Madagascar: Majunga Province: Akalimilotrabe river (variant spelling, Kalami-lotra) at the village of the same name, ca. 43 km NW of Maevatanana (16°48'08"S 47°00'57"E), 318 m above sea level. The Akalimilotrabe River is a north bank tributary of the Betsiboka River [Foiben-Taosarintanin'i Madagaskara 1:100,000 Sheets 42 (Maevatanana) and 41 (Ambalanjanakomby)]; seine net in isolated pools connected by stretches of flowing water, rocky bottom interspersed with patches of cobble and coarse gravel, no aquatic macrophytes but patches of green algae in inshore areas with reduced water movement; 7 June 1997, P. V. Loiselle.

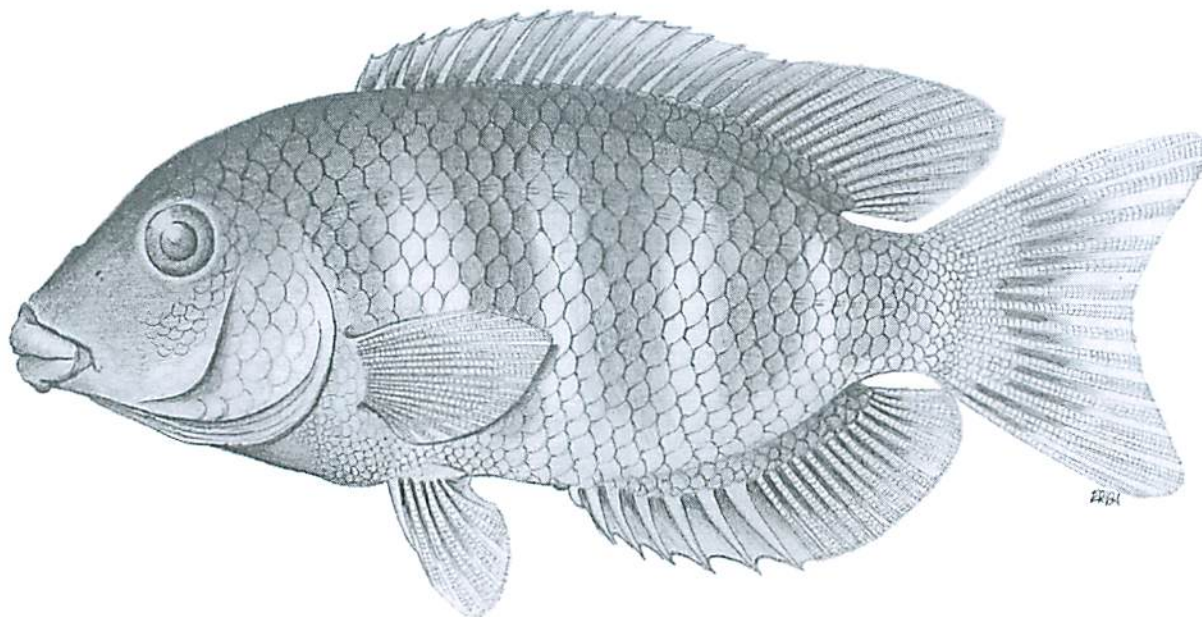


Fig. 7. *Paretroplus tsimoly*, AMNH 229558, holotype, 140.3 mm SL (drawn by Erica Detwiler Dale).

**Paratypes.** Same data as holotype; AMNH 229559, 1 adult female, 137.5 mm SL, 1 c.s. indeterminate sex, 99.3 mm SL; MNHG 2609.44, 1 adult female, 127.2 mm SL; UMMZ 236893, 1 adult female, 123.6 mm SL.

**Non-type material.** AMNH 229557, 1 c.s. juvenile, 52 mm SL; same data as holotype [not included in type series due to poor condition]. – MNHG 2609.45, 2 adult males, 110.5–117.5 mm SL; AMNH 229556, 2 adult males, 109.8–129.0 mm SL; “region of Maevatanana, Betsiboka drainage” but with no precise locality data; J. C. Nourissat.

**Diagnosis.** An elongate *Paretroplus*, unique among congeners in the possession of prominent lobed blue lips in mature specimens. Small, deeply embedded chest and belly scales, absence or reduction of deep excavation of posterior border of supraoccipital, erect implantation of dentary teeth, and accessory parapophyses restricted to the anterior two caudal vertebral centra serve to distinguish *P. tsimoly*, *P. nourissati*, and *P. dami* from congeners. Elevated gill raker number on lower limb of first gill arch (13–14 vs. 10–12), low anal fin spine count (7–8 vs. 9–11), and relatively slender body (40.8–42.9 and 35.5–41.9 % SL vs. 47.8–55.9) distinguishes *P. tsimoly* and its sister species *P. nourissati* from *P. dami*. Presence of rounded soft anal and dorsal fin extensions passing beyond caudal fin origin (vs. extensions not,

or only just, reaching beyond caudal fin origin), 12–14 (vs. 14–20) teeth in upper jaw and 12 (vs. 14) teeth in lower jaw, and coloration both in life and in preservation distinguish *P. tsimoly* from *P. nourissati*.

**Description.** Morphometric and meristic data for the holotype and paratypes are given in Table 1. Largest specimen available is a mature female, 140.3 mm SL; adult lengths of 250 mm SL are reported (Allgayer 1998), and field observation indicates that *P. tsimoly* regularly attains > 200 mm SL. The species is notably shallow-bodied (body depth 40.8–42.9 % SL). Snout is long (39.6–54.6 % HL) with a prominent premaxillary pedicel somewhat interrupting an otherwise straight dorsal head profile. Mouth is relatively large with well-developed, fleshy lips. Individuals of > 125 mm SL have both upper and lower lips expanded into prominent median lobes, while in smaller individuals the median lobes are less well-developed or absent. Buccal jaws are more-or-less isognathous. Scales on chest and belly are deeply embedded and markedly smaller than those on the flanks.

**Teeth** (Fig. 8b-c). Single row of robust unicuspid teeth in both jaws. Upper jaw with a large, somewhat lingually flattened and blunt-tipped tooth on either side of the symphysis and 5 or 6 spatulate, blunt-tipped, smaller teeth along the anterior two thirds of each premaxillary. Medial

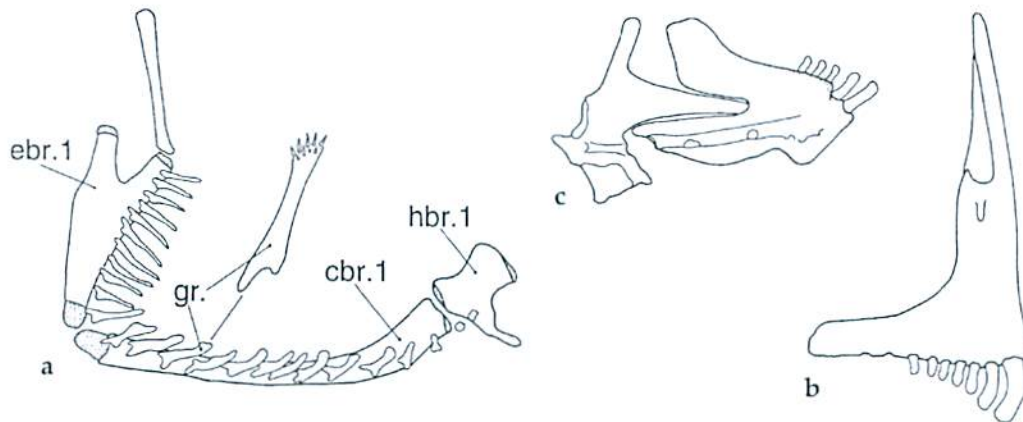


Fig. 8. *Paretroplus tsimoly*, AMNH 229559, 99.3 mm SL, lateral view of: a, first gill arch and rakers; b, isolated right premaxilla; and c, isolated right lower jaw. Abbreviations: cbr.1, ceratobranchial 1; ebr.1, epibranchial 1; hbr.1, hypobranchial 1; gr., gill raker.

upper jaw teeth fit over two similarly shaped but smaller lower jaw teeth when mouth is closed. Medial lower jaw teeth are set more-or-less erect and slightly displaced rostrad on the dental arcade relative to the other teeth. Four or five smaller, spatulate, bluntly-cusped teeth are present on anterior third of the lower dental arcade. Erect implantation of median teeth on the lower jaw is a characteristic shared with *P. nou-rissati* (Fig. 6a) and *P. dami* (Fig. 6b).

Gill rakers (Fig. 8a). Thirteen or 14 closely-set gill rakers along lower limb of first gill arch (count excludes the raker in the angle of the arch). First 1 or 2 (hypobranchial) rakers are small and bulb-like, ceratobranchial rakers are progressively longer and more slender. Nine or 10 slender epibranchial rakers. The head of each ceratobranchial raker bears a patch of medially situated denticles that are clearly visible in cleared and stained specimens.

Table 1. Morphometric and meristic data for *Paretroplus tsimoly* type series.

	holotype	N	range of paratypes	mean
Standard length (mm)	140.3	4	99.3-137.5	125.8
<b>Percentage of standard length</b>				
Head length	35.3	4	33.6-36.4	34.9
Body depth	42.9	4	40.8-42.9	41.2
Caudal peduncle length	7.8	4	7.5-11.7	9.1
Caudal peduncle depth	15.0	4	14.9-15.9	15.2
Pectoral fin length	22.2	4	18.7-22.4	21.0
Pelvic fin length	19.4	4	18.7-21.0	19.8
<b>Percentage of head length</b>				
Snout length	51.2	4	39.6-54.6	49.7
Orbit diameter	19.2	4	18.9-26.9	21.8
Upper jaw length	32.1	4	27.1-32.1	29.8
Interorbital width	32.8	4	29.7-32.8	31.3
Preorbital depth	29.4	4	29.1-32.8	31.7
			frequencies	
Gill rakers on first arch	13	4	13(3), 14(1)	
Lateral line scales	39	3		
Scales from lat.line to dorsal origin	7.5	3		
Vertebrae (precaudal+caudal)	14+17	4	14+17(3), 14+18(1)	
Dorsal fin formula	XVI 14	4	XVI 14(3), XVII 13(1)	
Anal fin formula	VII 12	4	VII 11(1), VIII 11 (3)	



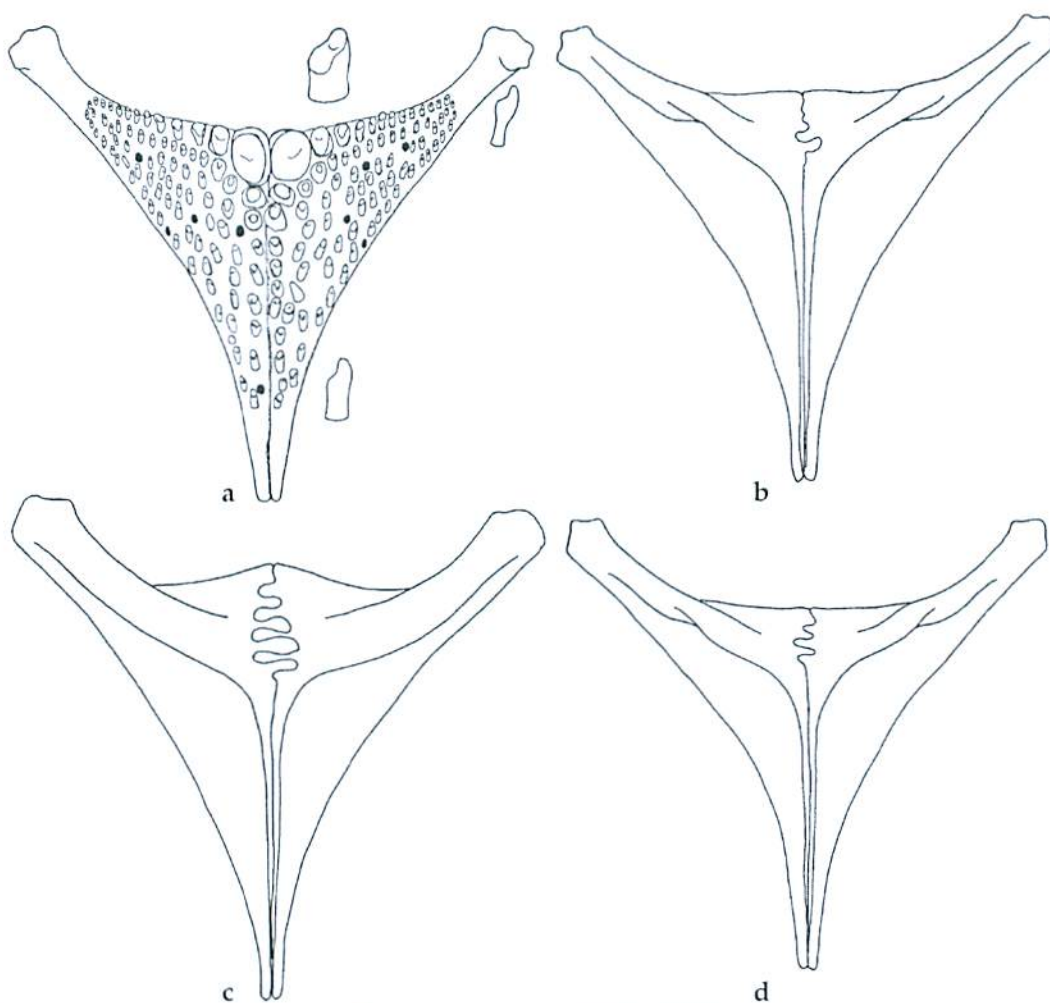


Fig. 9. Lower pharyngeal jaw of: a, *Paretroplus tsimoly*, AMNH 229559, in dorsal view; b, in ventral view; c, *P. dami*, AMNH 229560, in ventral view; d, *P. nourissati*, AMNH 229555, in ventral view.

**Scales.** Body is covered from mid-orbit to the caudal fin with regularly imbricate, cycloid scales. Scales on chest and belly are markedly reduced in size and deeply embedded with few free edges exposed. Scales are small and deeply embedded on the ventrum to the origin of the anal fin. Four to 5 rows of small irregularly set scales on the posterodorsal cheek; remaining facial region, including lachrymal and interorbital, are naked. Operculum is fully scaled. Suboperculum with two or three large scales. Upper and lower lateral lines are well-developed with 35-36 scales in the entire series. Scale rows between upper lateral line and dorsal fin origin 7.5. Dorsal and anal scaly sheaths are well-developed, and the caudal fin is heavily scaled to about half of its length.

**Fins.** Dorsal with 16-17 stout spines and 13-14 soft rays. Origin of the dorsal is slightly anterior to the pelvic insertion. Anal with 7-8 spines and

11-12 soft rays. Soft dorsal and anal fins are bluntly rounded, and extend beyond the point of caudal flexure over the caudal fin. Caudal fin is emarginate with bluntly rounded tips. Pectoral and pelvic fins are short and bluntly rounded. Pelvic fins cover the genital papilla when adducted but do not reach the anal fin origin.

Lower pharyngeal jaw and dentition (Figs. 9a-b). Lower pharyngeal jaw is relatively gracile, and wider than long. Two median teeth in posterior row are enlarged, flattened molars surrounded in the posteromedial field by a few somewhat enlarged bluntly molariform teeth. The remaining dental field is covered with relatively small, recurved unicuspid. The dentigerous area is wider than long, with a length to width ratio of 0.86. *Paretroplus tsimoly* shares with *P. nourissati* (Fig. 9) two derived features of the lower pharyngeal jaw; a reduced number of interdigitations on

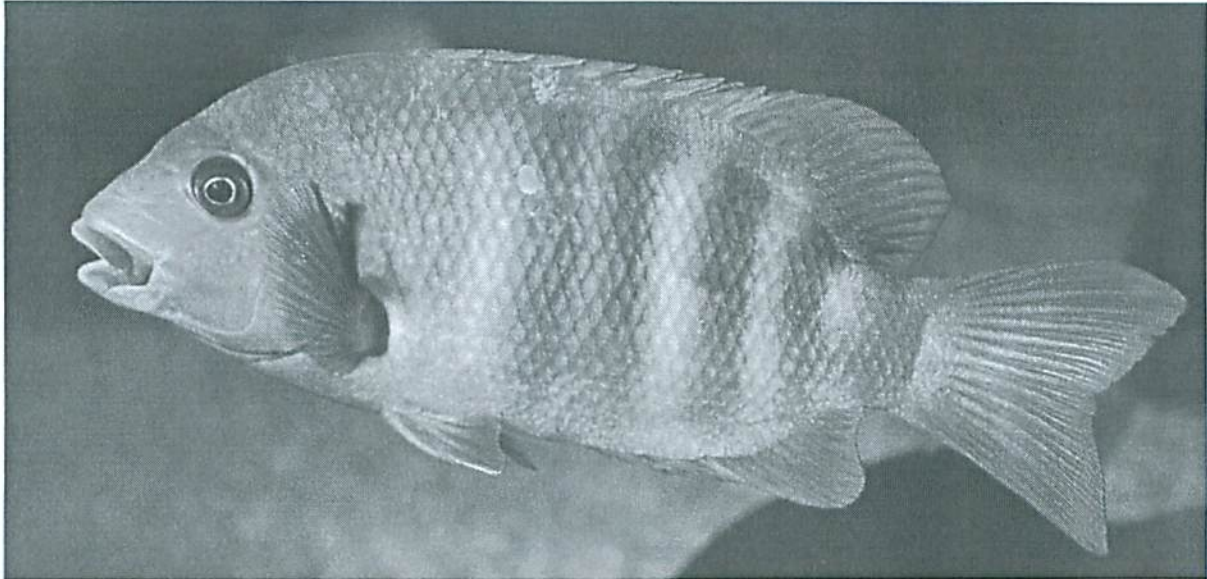


Fig. 10. *Paretroplus tsimoly*, aquarium-held F1 young adult, about 120 mm SL (photograph P. de Rham).

the ventral suture and the presence of an indentation on the ventral face of the posterior horns (compare Figs. 9a,c with Fig. 9d).

**Vertebrae.** Vertebral count of 31-32, most commonly with the formula 14+17 (14+18 in one individual). Accessory parapophyses are restricted to the anterior two caudal vertebral centra.

**Coloration.** Sexually quiescent individuals. Upper half of the head is pale beige, a faint narrow grey interorbital stripe is present and the snout has a distinct pale orange hue in large adults. Lips, lower jaw, lower cheek, branchiostegal membranes and chest bluish grey to dusky purple. Dorsum and flanks are pale beige, lightening towards the ventrum. Each flank scale is edged in grey. Flanks are traversed by five or six dark grey bars extending from the dorsum to the ventrum. The first bar is two scale rows wide and is the faintest of the series. The last bar is four to five scale rows wide and covers most of the caudal peduncle. The remaining bars are three to four scale rows wide. The second and third bars are fused below the midlateral line, as are the fourth and fifth bars in some individuals. A dark spot in the axil of the pectoral fin noted by Nourissat (1998) is not always clearly visible. Vertical and ventral fins are smoky beige, and broadly edged in bright red. Pectorals are uniformly smoky red and the iris of the eye is ringed in red.

**Parental individuals.** Upper half of the head, nape and body are brilliant golden orange, and

the vertical bars are an intense blue-black. Lips, lower jaw, lower cheek, branchiostegal membranes and chest are also blue-black. Vertical fins are smoky grey, with broad vermilion margins. Ventrals are black, with a narrow iridescent white margin along the leading edge, and vermilion margin along the trailing, edge. Pectorals are smoky grey suffused with dark red. Iris of the eye is silvery white and broadly ringed with bright red.

**Preserved specimens.** Lips, lower half of the head, branchiostegal membranes and chest are dusky grey, while the upper half of the head, nape and body are dark greyish brown. Each flank scale has a lighter center. Lateral bars are faded but usually are still discernable. Fins are a clear grey.

**Reproductive behavior.** *Paretroplus tsimoly* is a biparental substratum-spawner that practices long-term care of its fry. Breeding pairs guarding fry were observed by Nourissat, and by Loiselle, in the Akilimotrabe river. Nourissat (1998) makes particular mention of the "luminous yellow-orange" breeding color in both sexes that contrasts with the dull brown of sexually inactive individuals. Loiselle observed courting and parental pairs only in deep pools over bare rock bottoms. No more than one pair was observed per pool which they shared with adult *P. kieneri* and sub-adult *Cyprinus carpio*.

**Viscera and diet.** Gut short; intestinal length difficult to determine with accuracy due to poor preservation but approximately equal to SL. Contents were mainly crushed insects, most of which appear to be nymphal odonates and hemipterans. The species is apparently somewhat opportunistic as guts also contained significant amounts of fibrous plant material. An essentially insectivorous diet accords well with the relatively gracile lower pharyngeal jaw of the species and contrasts with the apparently durophagous diet of all other species except *P. nourissati* which, based on examination of gut contents, appears also to be an opportunistic insectivore.

**Distribution and habitat.** The type series of *P. tsimoly* was collected from the Akalimilotrabe River at the village of the same name. The village and bridge are located on RN-4 approximately 43 km NW of the town of Maevatanana. The Akalimilotrabe is a north bank tributary of the Betsiboka River. It does not empty directly into the main channel of the river but flows into Lake Bekopoly. This flood plain lake is connected to a second, Lake Amparahibe, which in turn drains into the Betsiboka.

Adult specimens of *P. tsimoly* were observed but not collected in the main channel of another north bank tributary of the Betsiboka, the Boinakely River, where it is crossed by RN-4, some 33 km NW of Maevatanana [16°51'49"S 46°57'80"E]. Residents of Antanimbary, a village located on the Ikopa River, a major tributary of the Betsiboka c. 35 km SE of Maevatanana, immediately recognized live specimens of this species and indicated that *tsimoly* could also be found in small lateral tributaries of the Ikopa both north and south of the village.

In 1992, Loiselle and Morris visited Lake Kinkony to collect breeding stock of *Paretroplus petiti* and *P. kieneri*. While examining color photographs of Malagasy freshwater fishes, the chief of the fishing camp whose services they engaged came across a photo of *P. nourissati*. He referred to the fish as *trondro gasy malagasy* [the Malagasy red fish], in contradistinction to *trondro gasy vazaha* [the foreign red fish = *Carassius auratus*] and indicated that it could be found in the tributaries of the Betsiboka River as well as in the headwaters of small streams flowing directly into Lake Kinkony. Given the distance between the upper Sofia River basin, type locality of *P. nourissati*, and the lower reaches of the Betsiboka, not to



Fig. 11. Type locality of *Paretroplus tsimoly*. Akalimilotrabe River, ca. 43 km northwest of Maevatanana, Majunga Province, Madagascar (photograph P.V. Loiselle).

mention Lake Kinkony, these observations were not initially deemed credible. In retrospect, it appears that the 'red fish' of the Betsiboka drainage to which the chief alluded was not *P. nourissati* but rather *P. tsimoly*. In light of the subsequent discovery of *P. tsimoly* in the lower Betsiboka, the possibility that either this or a closely related rheophilic *Paretroplus* also occurs in the Lake Kinkony basin should not be discounted.

During the latter part of the dry season, when the type series was collected, the Akalimilotra consists of a series of isolated pools 0.3-1.6 m in depth connected by stretches of flowing water that rarely exceed 0.3 m in depth. The channel varies from 1.5-3.0 m in width. The bottom is rocky, interspersed with patches of cobble and coarse gravel. Individual rocks range from the size of an apple up to that of a small automobile. In quieter stretches, the bottom is overlain with a layer of fine sand and flocculent reddish detritus up to 0.3 m deep. No aquatic macrophytes were present, but patches of green algae were observed inshore in areas of reduced water movement.

In the Boinakely River, *Pachypanchax* cf. *omalotus*, *Paretroplus kieneri*, *Tilapia rendalli*, *Oreochromis* cf. *niloticus*, *Awaous macrorhynchus* and *Glossogobius giuris* were also observed.

**Etymology.** *Tsimoly* [pronounced in English as tsee-MOOL] is the name of this fish in the Sakalava dialect spoken by the people of the Akalimilotrabe region. It is to be treated as a noun in apposition.

**Conservation status.** Extensive deforestation of its watershed and the widespread occurrence of exotic species in the lower Betsiboka drainage notwithstanding, *P. tsimoly* is reasonably abundant in both its type locality and the neighboring Boinakely River. This appears due in large measure to the fact that unlike its lacustrine congeners, it has never been targeted by local gill net fishermen. While neither known population of this species appears under immediate threat, little more can be said of its conservation status until its range is more precisely delimited and the status of other populations has been determined.

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### Literature cited

- Allgayer, R. 1996. Description d'une espèce nouvelle du genre *Paretroplus* Bleeker (Teleostei: Cichlidae) de Madagascar. *Rev. Fr. Cichlidophiles*, 159: 6-20.
- 1998. Descriptions de *Lamena nourissati* sp. n. genre et espèce nouveaux endémiques de Madagascar (Teleostei: Etroplinae). *Rev. Fr. Cichlidophiles*, 179: 7-17.
- Benstead, J. P., M. L. J. Stiassny, P. V. Loiselle, K. J. Riseng & N. Raminosoa. 2000. River conservation in Madagascar. Pp. 203-229 in P. J. Boon, B. R. Davies & G. E. Pots (eds), *Global perspectives on river conservation: science, policy and practice*. Wiley, Chichester, UK.
- Bleeker, P. 1868. Description de trois espèces inédites de Chromidoïdes de Madagascar. *Versl. Akad. Amsterdam, Ser. 2*, 2: 307-314.
- Cichocki, F. P. 1976. Cladistic history of cichlid fishes and reproductive strategies of the American genera *Acarichthys*, *Biotodoma* and *Geophagus*. Vol. 1., Unpubl. Ph.D. thesis, University of Michigan, Ann Arbor.
- de Rham, P. 1997. Main results of October 1997 collecting trip to Madagascar. *Bull. Aquatic Conserv. Network*, 6 (4): 1-11.
- Farias, I. P., G. Orti & A. Meyer. 2000. Total evidence: molecules, morphology, and the phylogenetics of cichlid fishes. *Mol. Dev. Evol.*, 288: 76-92.
- Farias, I. P., G. Orti, I. Sampaio, H. Schneider & A. Meyer. 1999. Mitochondrial DNA phylogeny of the family Cichlidae: monophyly and fast molecular evolution of the Neotropical assemblage. *J. Mol. Evol.*, 48: 703-711.
- Marathe, G. & R. Khosla. 1958. The cranial osteology of *Etroplus suratensis* Bloch. *J. Univ. Bombay, New Ser. B.*, 27: 37-45.
- Nourissat, J.-C. 1998. New surprises from Madagascar. *Cichlid News* 7 (3): 6-14.
- Reinthal, P. N. & M. L. J. Stiassny. 1997. Revision of the Madagascar genus *Ptychochromoides* (Teleostei: Cichlidae), with description of a new species. *Ichthyol. Explor. Freshwaters*, 7: 353-368.
- Sparks, J. & P. N. Reinthal. 1999. *Paretroplus maromandia*, a new cichlid fish from the northwest of Madagascar. *Occ. Pap. Mus. Zool., Univ. Mich.*, 727: 1-18.
- 2001. A new species of *Ptychochromoides* from south-eastern Madagascar (Teleostei: Cichlidae), with comments on the relationships of the ptychochromine cichlids. *Ichthyol. Explor. Freshwaters*, 12: 115-132.
- Stiassny, M. L. J. 1986. The limits and relationships of the acanthomorph teleosts. *J. Zool., London, Ser. B*, 1: 411-460.
- 1991. Phylogenetic intrarelationships of the family Cichlidae: an overview. Pp. 1-35 in M. H. A. Keenleyside (ed.), *Cichlid fishes: behaviour, ecology and evolution*. Chapman & Hall, London.
- Stiassny, M. L. J. & N. Raminosoa. 1994. The fishes of the inland waters of Madagascar. *Ann. Mus. Roy. Afr. Centr., Zool.*, 275: 133-149.
- Zardoya, R., D. M. Vollmer, C. Craddock, J. T. Streebman, S. Karl & A. Meyer. 1996. Evolutionary conservation of microsatellite flanking regions and their use in resolving the phylogeny of cichlid fishes (Pisces: Perciformes). *Proc. R. Soc. Lond., Ser. B.*, 263: 1589-1598.

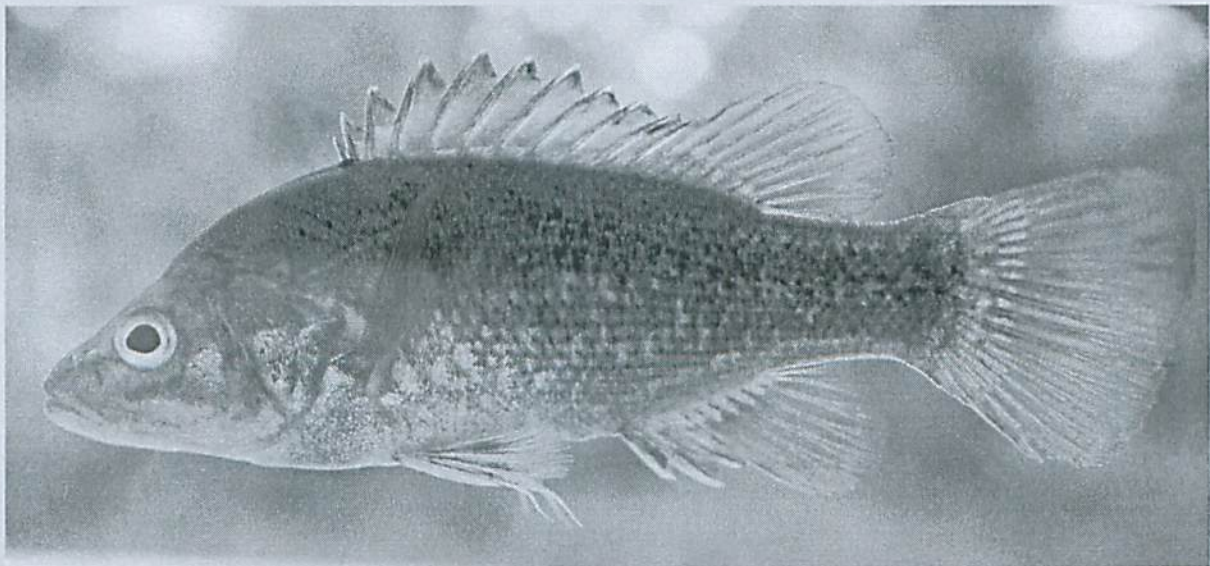
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Cover photograph:

*Guyu wujalwujalensis*, holotype (photograph by M. J. Kennard)  
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