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A revision of the genus *Docimodus* Boulenger (Pisces: Cichlidae), a group of fishes with unusual feeding habits from Lake Malawi

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The definition of the genus *Docimodus* is revised so that it can accommodate an additional species.

The description of the type species *D. johnstonii* is expanded and a new species, ***D. evelynae***, described and illustrated.

Examination of stomach contents reveal that *D. johnstonii* feeds mainly upon the fins of clariid catfishes and ***D. evelynae*** upon the flank scales of cichlids or cyprinids and the skin of catfishes.

The high proportion of trawl caught catfish bearing wounds characteristic of attack by *Docimodus* suggest that the latter are more abundant than their low catches would suggest.

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INTRODUCTION

The genus *Docimodus* was created by Boulenger (1896) to accommodate a single species, *D. johnstonii*, from Lake Malawi (= Nyasa). The genus was characterized by a massive prognathous lower jaw and a multiseriate dentition composed of a very broad band of compressed sharp edged teeth, those in the outermost row of each jaw being enlarged and nail shaped, sometimes with minute lateral cusps, and those of the inner rows smaller and tricuspid.

Boulenger's description of *D. johnstonii* was based upon two specimens from the upper Shire River, presented by Sir Harry Johnston. Regan (1921) examined a further two specimens collected by Mr Rodney C. Wood and extended the ranges of measurements given by Boulenger.

Between 1953 and 1974 a number of specimens of this species have been captured in gill nets and trawls in Lake Malawi and the neighbouring Lake Malombe. This material has enabled a more comprehensive species diagnosis to be made.

Over the same period 16 specimens of a new species closely resembling *D. johnstonii* have been collected. In most respects, notably the possession of a massive protruding lower jaw, body form, colour pattern, many meristic counts and the possession of very broad tooth bands, the new species conforms with Boulenger's and Regan's description of *Docimodus johnstonii*. However, the teeth of the new species are simple, conical and recurved and this feature alone debars it from the genus *Docimodus* as originally defined.

Since the two species differ mainly in the form of their teeth and are so similar in all other respects we consider that they have a common phyletic lineage and are congeneric. In view of this decision it is necessary to revise Boulenger's diagnosis of the genus *Docimodus* so that it can accommodate both species.

Docimodus Boulenger 1896

Lower jaw massive and prognathous with dentaries widely fused at symphysis. Jaws with very broad bands of stout conical or compressed teeth arranged in 3-5 rows. Outer row in upper jaw composed of less than 40 large teeth. Body moderately elongate and compressed. Scales minutely denticulate or ctenoid. Dorsal fin with 15-18 spines and well developed lappets. Anal fin with 3 (occasionally 4) spines. Basal $\frac{2}{3}$ of caudal fin densely scaled. Pectoral fin pointed, reaching at least to level of vent.

Amongst the fishes of Lake Malawi the possession of a prognathous lower jaw with broad bands of large teeth is not restricted to the genus *Docimodus* but is also characteristic of the monotypic genus *Genyochromis*. The latter however, possesses certain features, notably short rounded pectoral fins and minute scalation of the nape, cheek and chest, which are peculiar to the 'Mbuna' or rockfish complex, a group of fishes which is considered to be of monophyletic origin (Fryer & Iles, 1972). We therefore feel justified in concluding that the similarities between the jaws and dentition of *Docimodus* and *Genyochromis* constitute a case of convergence resulting from adoption of similar feeding habits and do not imply phyletic affinity.

Docimodus johnstonii Boulenger

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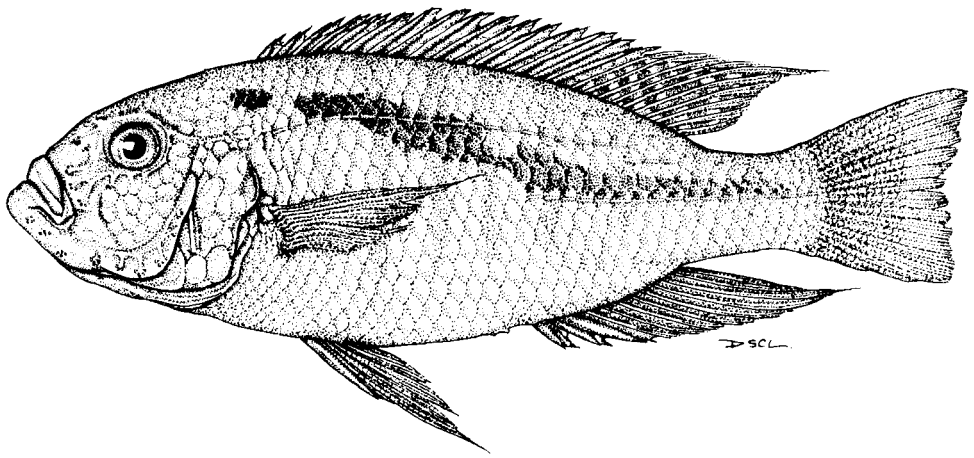

Figure 1. *Docimodus johnstonii.* Male specimen of 212 mm total length.

Description. Based on six females (125-197 mm S.L.) nine males (150-207 mm S.L.) and one juvenile (53.5 mm S.L.) from various parts of Lake Malawi and Lake Malombe.

Proportions. In standard length: body depth 2.5-3.1; head length 2.7-3.2; caudal peduncle length 5.3-6.3; pectoral fin length 2.9-4.0.

In head length: eye diameter 4.0-4.6 (3.3 in juvenile); snout length 2.9-3.4; lower jaw length 2.5-2.9 (3.1 in juvenile); pre-orbital depth 4.5-5.2 (5.9 in juvenile); interorbital width 3.2-3.7 (4.3 in juvenile); pre-maxillary pedicel length 3.6-4.3 (4.6 in juvenile); pectoral fin length 1.0-1.3.

Caudal peduncle 1.4-1.7 times as long as deep.

Fins. Dorsal ray count: XV-XVII, 8(9)-9(10); anal fin ray count III, 8(9)-9(10), dorsal fin with well developed lappets. In females and juvenile dorsal and anal fins rounded posteriorly and extending to approximately mid-point of caudal peduncle; in mature males dorsal and anal fins pointed posteriorly and extending to or almost to base of caudal fin. Pectoral fin extending to beyond level of vent. Pelvic fin shorter than pectoral (except in some mature males) extending to between vent and base of first anal spine. Caudal fin emarginate with lower lobe shorter than upper, longest ray normally 1.2-1.3 times as long as shortest ray (1.5 times in one specimen). Caudal fin densely scaled almost to posterior margin.

Squamation. Scales minutely denticulate.* Lateral line scale count 21-25/13-18, 34-35 scales in longitudinal series; 5-6 scales between first dorsal spine and lateral line; 5-7 scales between bases of pectoral and pelvic fins; 3-5 rows of scales across cheek.

Dentition. Both jaws with broad bands of teeth, 4-5 rows deep anteriorly. Teeth in outer row of each jaw stout, spatulate and tricuspid each possessing a broad central cusp with a sharp cutting edge and two minute lateral cusps. Teeth in inner rows smaller, tricuspid and with sharp cutting edges but with relatively larger lateral cusps. 15-25 teeth in outer row of upper jaw; 19-21 around lower jaw.

Lower pharyngeal bone. Y-shaped with anterior blade slightly deflected; teeth bicuspid and well spaced; no enlarged teeth other than those in the posterior row which are slightly stouter than those in the penultimate row. 22-29 teeth across posterior margin; 6-8 teeth along median longitudinal axis.

Body form. Body compressed with maximum depth at approximately D III-D IV. Lower jaw broad, massive and projecting. Premaxilla heavy with pedicel extending to same level as end of nasal bones. Maxilla largely covered by pre-orbital bone anteriorly but exposed posteriorly and extending to midway between nostril and eye. Snout straight or slightly rounded; inter-orbital region flat or slightly concave in profile.

Colouration. (Preserved) Snout and dorsal part of head dark; dark spot on operculum; body silvery ventrally and darker dorsally; dark spot on the nape and series of dark blotches often merging to form an oblique band extending from the shoulder to the end of the caudal peduncle: 8 indistinct dark vertical bars beneath dorsal fin. Pectoral fins unpigmented; pelvic, anal and caudal fins darkish; dorsal fin darkish with darker lappets in spinous region, dark with pale spots in rayed region.

In breeding males chin, chest and gular membrane black; dorsal part of body, pelvic, anal and caudal fins dark; dorsal fin with black subterminal bar in spinous region; dorsal lappets white tipped; turquoise iridescence on head.

Docimodus evelynae sp. nov.

Holotype. Female 166 mm S.L. from Nkata Bay, Lake Malawi, caught 28.8.62. Lodged in British Museum (Nat. Hist.) (Catalogue Number 1975.3.10.1.)

Description. Based on the holotype and 15 paratypes (8 males, 126-201 mm S.L. and 7 females, 150-197 mm S.L.) from Nkata Bay and Monkey Bay. (Measurements of holotype italicized.)

Proportions. In standard length: body depth 2.6-*2.7*-2.9; head length *3.0*-3.4; caudal peduncle length 5.3-*5.8*-6.9; pectoral fin length 2.9-*3.1*-3.6.

In head length: eye diameter 4.0-*4.2*-4.3; snout length 2.8-*2.9*-3.4; lower jaw length *2.9*-3.3; pre-orbital depth 4.3-*4.9*-5.2; inter-orbital width 0.7-*0.8*-0.9; premaxillary pedicel length 3.6-*3.9*-4.5; pectoral fin length 0.8-*1.2*.

Caudal peduncle 1.2-*1.4*-1.5 times as long as deep.

* Boulenger in his diagnosis of the genus *Docimodus* describes the scales as being cycloid. However, careful examination of the scales of 16 specimens of *D. johnstonii* revealed that all were minutely denticulate.

Fins. Dorsal ray count: XVII-*XVIII*, 8(9)-*9(10)*; anal fin ray count *III* (IV in one specimen) 8(9)-*9(10)*, dorsal fin with well developed lappets. In females dorsal and anal fins rounded posteriorly and extending to just short of caudal fin base; in mature males dorsal and anal fins pointed posteriorly and extending beyond base of caudal fin. Pectoral fin extending to or beyond level of vent. Pelvic fin shorter than pectoral (except in mature males), extending to between vent and base of second anal spine (to half way along base of anal fin in mature males). Caudal fin slightly emarginate with lower lobe shorter than upper, longest ray 1.1-1.3 times as long as shortest ray. Caudal fin densely scaled almost to posterior margin.

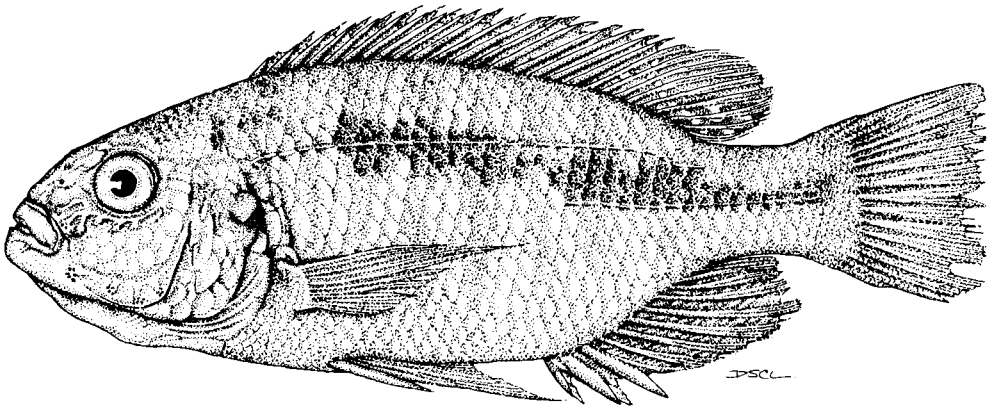

Figure 2. ***Docimodus evelynae*** **sp. nov.** Holotype: a female of 204 mm total length

Squamation. Scales ctenoid. Lateral line scale count 22-*27*-31/14-*16*-17; 34-*36*-37 scales in longitudinal series; *5*-7 scales between first dorsal spine and lateral line; *6*-8 scales between bases of pectoral and pelvic fins; *3*-4 rows of scales across cheek.

Dentition. Both jaws with broad bands of well spaced teeth; all teeth conical, sharp and recurved with orange-brown tips. Upper jaw with 3-4 rows anteriorly; 30-*32*-39 teeth in outer row; teeth in second row only slightly smaller than those in outer row; posterior teeth in outer row only slightly reduced. Lower jaw with four rows anteriorly; 24-*28*-36 teeth in outer row; teeth in first and second rows approximately same size at centre.

Lower pharyngeal bone. Y-shaped with anterior blade straight; teeth bicuspid and well spaced; no enlarged teeth other than those in the posterior row which are slightly stouter than those in the penultimate row. *23*-29 teeth across posterior margin; 6-*8* teeth along median longitudinal axis.

Body form. Body compressed with maximum depth at approximately D IV-D VII. Lower jaw broad, massive and projecting. Premaxilla heavy with pedicel shorter than nasal bones. Maxilla almost completely covered by preorbital bone but just exposed posteriorly and extending to just past level of nostril. Snout with slightly convex dorsal profile; interorbital region slightly concave in profile.

Colouration. (Preserved) Snout and dorsal surface of head darker than sides; large dark spot on operculum; dark spot on nape and series of dark blotches

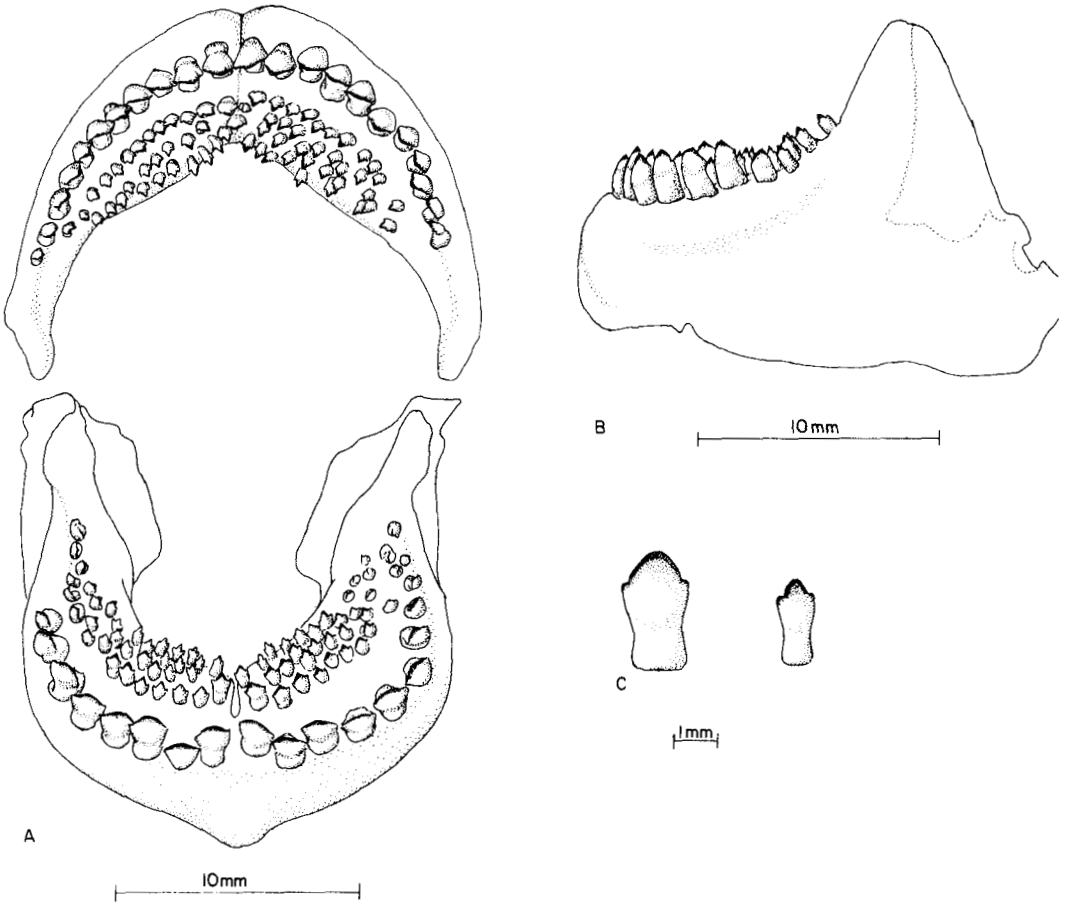

Figure 3. Jaws and teeth of *Docimodus johnstonii*. A. Occlusal aspect of upper and lower jaw. B. Lateral aspect of lower jaw. C. Frontal aspect of 1st row and 2nd row teeth from lower jaw.

often merging to form an irregular oblique band extending from the shoulder to the end of the caudal peduncle; 7-8 indistinct dark vertical or slightly oblique bars beneath dorsal fin. Pectoral fins unpigmented; pelvic, anal and caudal fins darkish; dorsal fin darkish with pale spots in rayed region.

Breeding males much darker and with more prominent vertical bars than females and non-breeding males; dorsal part of body dark; outer rays of pelvic, anal and caudal fins dark, dorsal fin dark with darker upper margin.

We have pleasure in naming this species after Mrs Evelyn Axelrod who, in conjunction with her husband Dr Herbert R. Axelrod, have done so much to promote interest in the fishes of Lake Malawi.

THE FEEDING HABITS OF *DOCIMODUS JOHNSTONII* AND *DOCIMODUS EVELYNAE*

The feeding habits of both species of *Docimodus* are unusual. It was suggested by Bertram, Borley & Trewavas (1942) and Fryer & Iles (1972) that

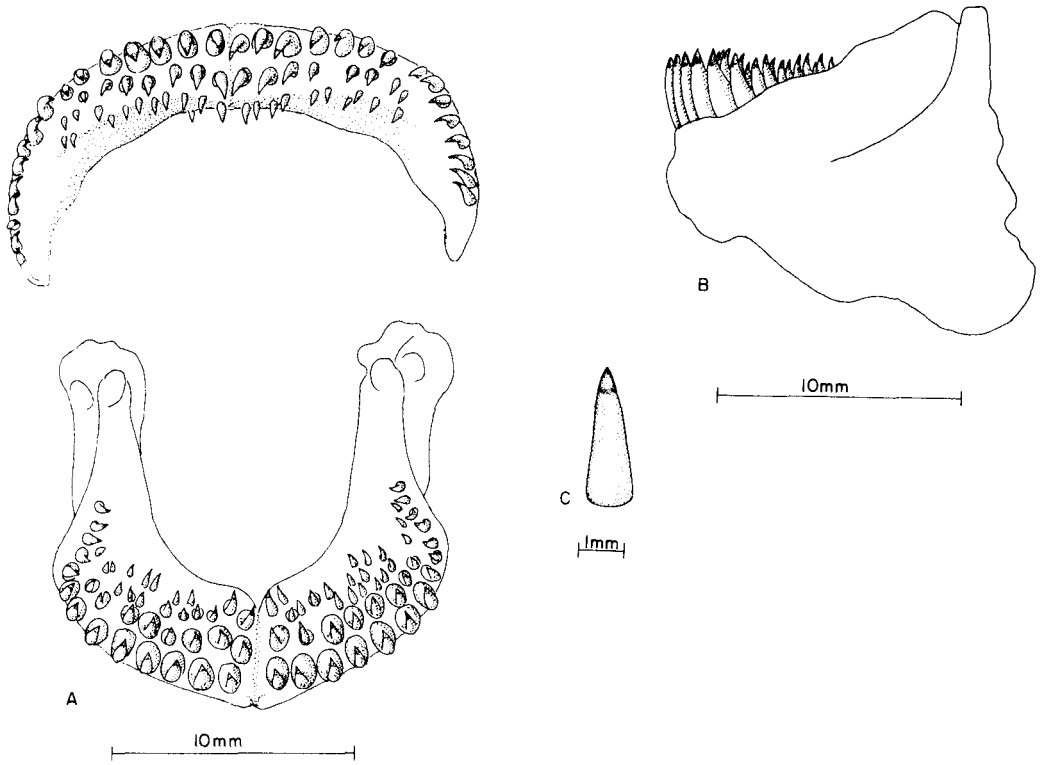

Figure 4. Jaws and teeth of ***Docimodus evelynae*** sp. nov. A. Occlusal aspect of upper and lower jaw. B. Lateral aspect of lower jaw. C. Frontal aspect of 1st row tooth from lower jaw.

D. johnstonii may feed by biting pieces from the fins of other fishes. Our observations confirm this view.

Of the 16 specimens of *D. johnstonii* examined 10 had recognizable stomach contents. In all but two individuals the stomach contents consisted of pieces of fin or fragmentary fin rays which, in most cases, possessed the thick epidermal covering characteristic of clariid catfish fins. A few fin ray fragments of possible cyprinid or cichlid origin were recorded in two stomachs, though these may equally well have been pieces of catfish fin ray, the epidermal layer of which had been digested.

Of the two stomachs with contents other than fins, one contained numerous pieces of catfish branchiostegal membrane and the other the remains of aquatic insect nymphs, copepods and cladocerans. It is difficult to envisage how pieces of branchiostegal membrane could have been bitten from a living catfish under normal conditions as the membranes are ventral and normally closely applied to the body surface. It is considered to be more likely that in this instance the catfish had become caught in a gill net and had been attacked when dead or in a moribund condition. The fact that this particular specimen of *D. johnstonii* was itself caught in a gill net and that its stomach contents were in an undigested state gives credence to this theory. The presence of small planktonic

organisms in the stomach of a fish whose feeding apparatus is not in the least adapted to utilizing such a diet is perplexing and we can provide no ready explanation for this finding.

Only four of the 16 specimens of ***D. evelynae*** examined possessed stomachs with identifiable contents. Of these, three contained scales thought to be from the flanks of cichlids and the fourth, a number of strips of deeply pigmented tissue believed to be skin from the flanks of a catfish. As noted above *Genyochromis mento* Trewavas, a species of cichlid not closely related to *Docimodus,* which also feeds by rasping scales from the flanks of other fish, has developed a dentition very similar to that of ***D. evelynae.***

It is noteworthy that a large proportion of the specimens of *Bathyclarias* caught in trawls from the southern part of Lake Malawi show evidence of attack by *D. johnstonii* in the form of semicircular indentations in their fins. A number of specimens of *Bathyclarias* bearing on their flanks scars where strips of skin have been removed have also been recorded. Although these wounds cannot, with certainty, be correlated with attacks by ***D. evelynae*** such an explanation seems likely.

DISTRIBUTION AND ABUNDANCE

The incidence of capture of specimens of both *D johnstonii* and ***D. evelynae*** has been too low to enable detailed pictures of the distribution of the two species to be constructed, though in general it would appear that ***D. evelynae*** is more of a deep water species than *D. johnstonii.* Most of the specimens of ***D. evelynae*** examined were captured in bottom set gill nets in water of up to 50 fathoms (91 m) off Monkey Bay and Nkata Bay, whereas the majority of specimens of *D. johnstonii* were taken in bottom trawls in much shallower water. The largest single catch of *D. johnstonii* (five breeding males) was made in 10 fathoms (18 m) over a soft mud bottom. Specimens of *D. johnstonii* have been caught in the shallow Lake Malombe, the upper Shire River, a shallow lagoon connected to Lake Malawi and Lake Malawi itself.

The large number of specimens of *Bathyclarias* with characteristic fin lacerations which are caught suggests that *D. johnstonii* may be more abundant than the low catches of the species suggest. The fishing gears most commonly employed have been bottom trawls and bottom set gill nets, both of which are efficient only for the capture of those species which are closely associated with the bottom. If, as is possible, both species of *Docimodus* spend a considerable proportion of their time in midwater preying upon the numerous semipelagic *Bathyclarias* and *Tilapia* species, bottom sampling alone will give an underestimate of their abundance.

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