

## Two New Toadfish Genera (Teleostei: Batrachoididae)

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**The Western Atlantic toadfish species previously known as *Triathalassothia gloverensis* Greenfield and Greenfield is compared to the other two species in *Triathalassothia* and then placed in the new genus *Vladichthys*. The northern Indian Ocean species described by Valenciennes as *Batrachus dussumieri* has in the past been placed in the South African genus *Austrobatrachus* Smith; however, this species is shown not to belong to that genus, and the new genus *Colletteichthys* is described for it.**

While conducting systematic studies of the Batrachoididae over the years, it has become evident that two described species do not share the diagnostic combination of characters of any of the described genera. The first species for which this became evident is the miniature Western Atlantic Glovers Reef toadfish, *Triathalassothia gloverensis* Greenfield and Greenfield, 1973. While examining head musculature of toadfishes, the late Vladimir Walters (unpublished) discovered that the pattern of muscles on the dorsocranium was different in *Triathalassothia argentinus* (Berg, 1897) and *T. gloverensis*. The epaxial trunk musculature extends forward to entirely cover the dorsocranium in *T. argentinus* (Fig. 1B), whereas in *T. gloverensis*, it does not, leaving an area of bone exposed under the skin in the center portion of the dorsocranium posterior to the orbits (Fig. 1A). Greenfield et al. 1994, and Collette 1995 have placed quotation marks around *Triathalassothia* for *T. gloverensis*, indicating that they questioned its generic placement. Menezes and Figueiredo (1998) described *Triathalassothia lambaloti* from Brazil, noting that it shared the head musculature pattern with *T. argentinus*, but not *T. gloverensis*, and thus excluded it from comparison with their new species. A further comparison between *T. gloverensis* and the other two species currently in the genus is made, and a new genus, *Vladichthys*, is described here for *gloverensis*.

Valenciennes, in Cuvier and Valenciennes (1837) described *Batrachus dussumieri* from Malabar, India. The genus *Batrachus* was first used by Klein (1776), but it was published in a work that does not conform to the principle of binominal nomenclature (Eschmeyer 1998). Prior to that, Schaeffer (1760) used the name *Batrachus*, but that publication is on the Official List of rejected works. Walbaum (1792) reprinted in a condensed form the genera of Klein, but did not accept them, and the International Commission on Zoological Nomenclature has ruled that reprinted names subsequent to 1757 are not available. Bloch and Schneider (1801) then used *Batrachus* for *B. surinamensis*, but this is a synonym of *Batrachoides* Lacepède, 1800 (Collette and Russo 1981). *Batrachus* Rafinesque (1814) is a synonym of the amphibian genus *Bufo* Laurenti (1768). Thus, the genus *Batrachus* is not available for *dussumieri*. Smith (1949) described the genus *Austrobatrachus* for the South African species *Pseudobatrachus foedus* Smith, 1947. Menon (1963) then utilized Smith's genus for *B. dussumieri*, and since that time, with the exception of Nagabhushanam and

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Rama Rao (1970) who used *Halophyrne*, the species has been referred to as *A. dussumieri* (Hutchins 1981, 1984; Randall 1995; Carpenter et al. 1997). Hutchins (1981) did comment however, that none of the described toadfish genera were suitable for *dussumieri*, but stated "However, I prefer to tentatively follow Menon (1963) and place *dussumieri* in the genus *Austrobatrachus*." In comparing *dussumieri* with *Austrobatrachus foedus*, it became obvious that there were a number of differences between the two species that have been used at the generic level within the family Batrachoididae. Thus, the genus *Colletteichthys* is described here for the species *dussumieri*.

## METHODS

All counts and measurements follow Hubbs and Lagler (1964) except that the last two fin rays are not counted as one unless it is clear that they are joined at the base. The cleared and stained specimen of *Triathalassothia argentinus* (USNM 214438) became partially disarticulated, so to confirm the absence of an ossified upper pectoral-fin radial, a radiograph was taken of a second specimen (USNM 86687), Figs. 4A–B. Institutional abbreviations are as listed in Leviton et al. (1985). Nomenclatural information on genera from Eschmeyer (1998).

## GENERIC DESCRIPTIONS

### *Vladichthys* Greenfield, gen. nov.

TYPE SPECIES: *Triathalassothia gloverensis* Greenfield and Greenfield, 1973.

**DIAGNOSIS.**— A toadfish of the subfamily Batrachoidinae with: epaxial trunk musculature not extending forward to cover the entire dorsocranium behind orbits, bone exposed under skin on central portion of dorsocranium posterior to orbits (Fig. 1A.); frontal bones solid, lacking foramen on each side; one spine on subopercle; head and body without scales; no axillary foramen or pit; ventral margin of distal end of maxilla hooked anteriorly and lacking a maxillary flap (Fig. 2A); pectoral fin with distinct glands between rays; gill opening below lower pectoral-fin base; two orbital cirri, anterior with three fringes, posterior with six fringes; all five pectoral-fin radials fully ossified; dorsal-fin elements III-20-21; anal-fin rays 15–17; pectoral-fin rays 18–20; vertebrae 27.

**DESCRIPTION.**— Three solid

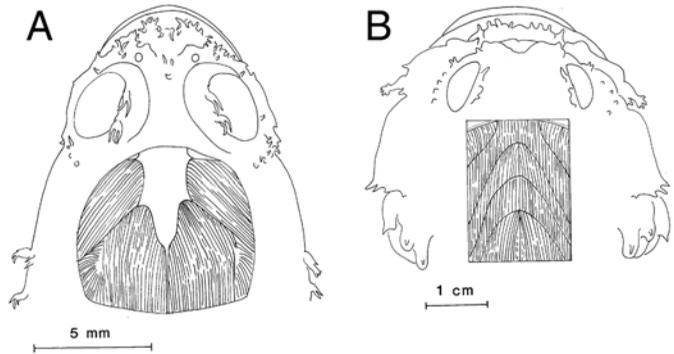


FIGURE 1. Extent of epaxial trunk musculature coverage of dorsocranium: A. *Vladichthys gloverensis* FMNH 91036. B. *Triathalassothia argentinus* USNM 86687.

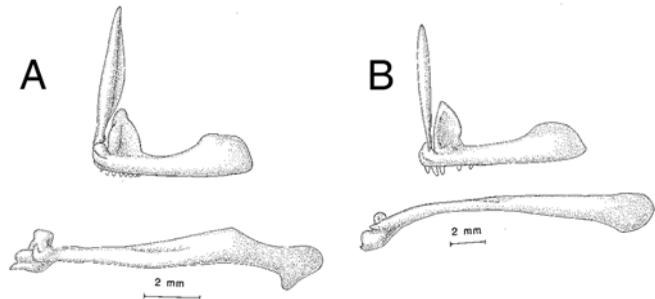


FIGURE 2. Premaxilla (above) and maxilla (below): A. *Vladichthys gloverensis* FMNH 105005. B. *Triathalassothia argentinus* USNM 214438.



FIGURE 3. Pectoral radials of *Vladichthys gloverensis* FMNH 105005.

dorsal-fin spines without venom glands; three solid opercular and one subopercular spines, one subopercular filament; epaxial trunk musculature not extending forward to cover the entire dorsocranium behind orbits, bone exposed under skin on central portion of dorsocranium posterior to orbits (Fig. 1A); frontal bones solid, lacking foramen on each side; upper accessory pectoral-fin radial totally ossified; three lateral lines present, the upper with 15 or 16 pores, the middle with 5 to 7 pores and the lower with 13 to 19 pores, each pore with one or two (usually two) dermal flaps; no photophores; no scales; no axillary foramen or “venetian blind” gland in pectoral-fin axil; pectoral fin with distinct glands between rays; two orbital cirri, anterior with three fringes, posterior with six fringes; two rows of teeth in anterior portion of lower jaw, pointed; sides of lower jaw with a single row of teeth, with broad bases and slightly pointed tips; upper jaw with two rows of pointed teeth, larger anteriorly; vomer with a single row of pointed teeth; palatine with a single row of teeth similar to those in sides of lower jaw; dorsal-fin elements III-20-21; anal-fin rays 15-17; pectoral-fin rays 18-20; vertebrae 27.

**ETYMOLOGY.**— Named for the late Vladimir Walters, known by his colleagues as Vlad, who studied toadfishes for many years and first discovered that the head musculature of this genus differs from that in *Triathalassothia*. Gender is masculine.

**COMPARISONS.**— Besides differing from *T. argentinus* and *T. lambaloti* in head musculature, *Vladichthys* also differs from both species in having more dorsal-fin rays (20-21 versus 14-17); more anal-fin rays (15-17 versus 11-13); fewer upper lateral-line pores (15-16 versus 25-31); and fewer lower lateral-line pores (13-19 versus 23-31). *Vladichthys* also differs from *T. argentinus* in the following osteological characters (*T. lambaloti* was not available for clearing and staining): the ventral margin of the distal end of the maxilla is hooked anteriorly in *Vladichthys*, and the dorsal surface is expanded for attachment of the levator maxillae superioris muscle (Fig. 2A), whereas the end is rounded and the dorsal surface not expanded in *Triathalassothia* (Fig. 2B.). The upper accessory pectoral-fin radial is fully ossified with one fin ray attached to it in *Vladichthys* (Fig. 3), whereas in *Triathalassothia* the upper radial is cartilaginous with a tiny ossified spot at the distal end, with no fin rays attached (Figs. 4A-B). Naercio Menezes (personal communication) has confirmed that *T. lambaloti* also only has four fully ossified radials. The subopercle has a single filament extend-

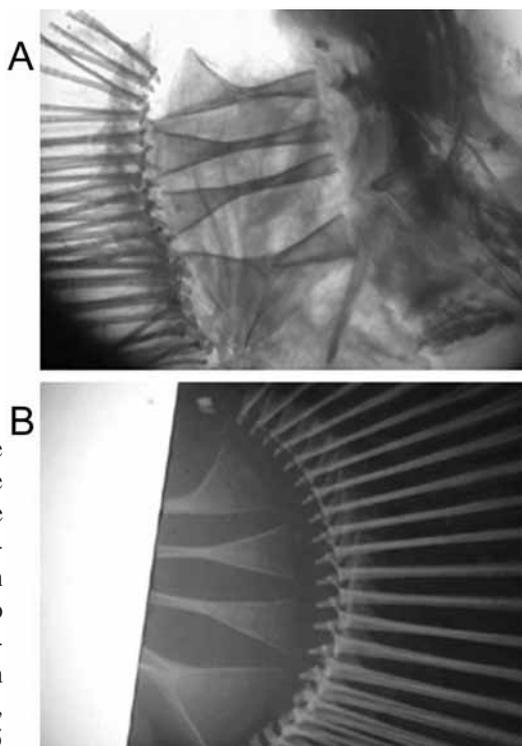


FIGURE 4. Pectoral radials of *Triathalassothia argentinus*. A. Cleared and stained USNM 214438. B. Radiograph USNM 86687.

ing above the spine in *Vladichthys* (Fig. 5A), whereas *Triathalassothia* has two (Fig. 5B). The pelvic bone of *Vladichthys* lacks a hook on the medial surface and has a foramen (Fig. 6A), whereas a distinct hook is present in *Triathalassothia*, and the foramen is absent (Fig. 6B). The general shape of the neurocranium also differs between the two, being narrower and more elongate in *Vladichthys* (Fig. 7B). *Vladichthys* has a medial suture between the ceratohyal and epihyal, whereas in *Triathalassothia* that suture is missing. The only other toadfish genera lacking this suture are two South African genera.

*Vladichthys* is a member of the subfamily Batrachoidinae because it has three solid dorsal-fin spines, one subopercular spine, and no canine-like teeth or photophores. It differs from all other batrachoidin genera except *Sanopus*, *Amphichthys* and some *Halophyrne* species because the epaxial trunk musculature does not extend onto and cover the entire dorsocranium. *Vladichthys*' maxilla differs from all other batrachoidin genera because the ventral margin of the distal end is hooked anteriorly (Fig. 2A). *Vladichthys* differs from *Sanopus* and *Amphichthys* in having distinct pectoral-fin glands and 20–21 dorsal-fin rays versus 28–29 in *Amphichthys* and 29–34 in *Sanopus*. From *Amphichthys*, *Vladichthys* differs by the absence of a distinctive “venetian blind” gland in the pectoral-fin axil (Breder 1925, fig. 1); the upper and lower lateral lines are parallel, gradually approaching the dorsal- and anal-fin bases caudad, whereas they are not parallel and turn to run along the fin bases in *Amphichthys*. From *Sanopus* it differs by the absence of a foramen near the center of the pectoral-fin axil. And lastly, *Vladichthys* differs from *Halophyrne* in having: one rather than two subopercular spines; a single row of large, slightly pointed teeth, versus two to three rows of small, pointed teeth; a more pointed, flattened head with the lower jaw protruding, versus a rounded head with the lower and upper jaws about equally terminal (Greenfield 1999, fig. 2); gill opening extending down to the ventral margin of the pectoral-fin base, instead of reaching down about two-thirds of the pectoral-fin base; and no glandular tissue versus well-developed glandular tissue on the inside of the pectoral-fin axil.

**Remarks.**—The absence of a fully ossified upper accessory pectoral-fin radial in *Triathalassothia* is significant, in that it is fully ossified in all other New World genera, including *Vladichthys*. The illustration of the pectoral girdle of *Batrachoides* by Monod (1960), showing the accessory upper pectoral radial as cartilaginous, was based on the species *didactylus*, which is in

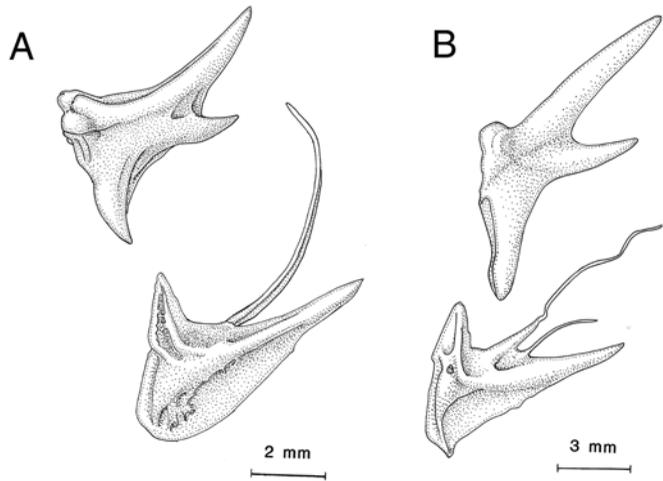


FIGURE 5. Operculum (above) and suboperculum (below): A. *Vladichthys gloverensis* FMNH 105005. B. *Triathalassothia argentinus* USNM 214438.

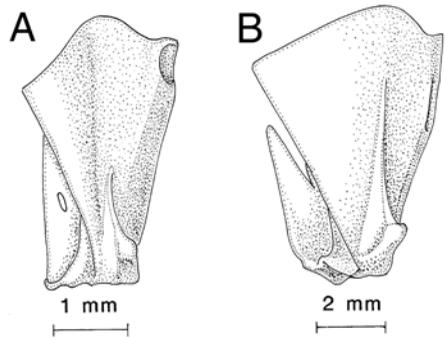


FIGURE 6. Ventral view of left pelvic bone: A. *Vladichthys gloverensis* FMNH 105005. B. *Triathalassothia argentinus* USNM 214438.

fact in the genus *Halobatrachus*, not *Batrachoides*. Based on Monod, both Lauder and Liem (1983, fig. 40) and Markle (1989:72) erroneously reported *Batrachoides* as having a cartilaginous accessory radial. The other genera with a cartilaginous upper radial all are from off the western coast of Africa or the Indian Ocean: *Austrobatrachus foedus*, *Batrachichthys apiatus*, *Halobatrachus didactylus*, *Perulibatrachus elminensis*, and *Riekertia ellisi*. The lack of a medial suture between the epihyal and ceratohyal in *Triathalassothia* also is shared only with South African genera. These shared characters conform with the geographic position of *Triathalassothia* species off the southern coast of eastern South America, closest to South Africa.

***Colletteichthys* Greenfield, gen. nov.**

TYPE SPECIES: *Batrachus dussumieri* Valenciennes, 1837

**DIAGNOSIS.**— A toadfish of the subfamily Batrachoidinae with: the dorsocranium under the skin completely covered by epaxial trunk muscles; frontal bones solid, lacking a foramen on each side; one short subopercular spine, often with a small second point below; head and body without scales; a funnel-shaped pit at top of pectoral-fin axil, with glandular tissue inside and extending from ventral pit margin onto axil; no maxillary flap; lower gill opening well below lower pectoral-fin base; head into SL 2.4 to 2.8 times; supraorbital tentacles present above posterior half of eye; and all five pectoral-fin radials ossified.

**DESCRIPTION.**— Three solid dorsal-fin spines without venom glands; three solid opercular and one short subopercular spine, often with a small second point below; two subopercular filaments; dorsocranium completely covered by epaxial trunk muscles; frontal bones solid, lacking foramen on each side; upper accessory pectoral-fin radial totally ossified; three lateral lines present, the upper with 43–53 pores, the middle with about six, and the lower with 26–30; no photophores; no scales; a funnel-shaped pit at top of pectoral-fin axil, with glandular tissue inside and extending from ventral pit margin onto axil; interorbital area not crossed by conspicuous skin ridges; head into SL 2.4 to 2.8 times; two rows of pointed teeth in anterior portion of lower jaw; sides of lower jaw with a single row of pointed teeth; upper jaw with three rows of pointed teeth anteriorly, two rows on side, grading into a single row posteriorly; vomer and palatine with a single row of pointed teeth; dorsal-fin elements III-19-22; anal-fin rays 15–17; pectoral-fin rays 21–24; vertebrae 27.

**ETYMOLOGY.**— This genus is named in honor of Bruce B. Collette who has contributed greatly to toadfish systematics over the years. Gender is masculine.

**COMPARISONS.**— *Colletteichthys dussumieri* differs from *Austrobatrachus foedus* in a number of features. *Colletteichthys* has a tentacle above the eye, whereas *Austrobatrachus* lacks a tentacle. *Austrobatrachus* has a long tentacle on the anterior nostril that is absent in *Colletteichthys*, as are the conspicuous skin ridges in the interorbital area found in *Austrobatrachus*. *Austrobatrachus* is more elongate, so that the head goes into SL more than three times, whereas in *Colletteichthys* it

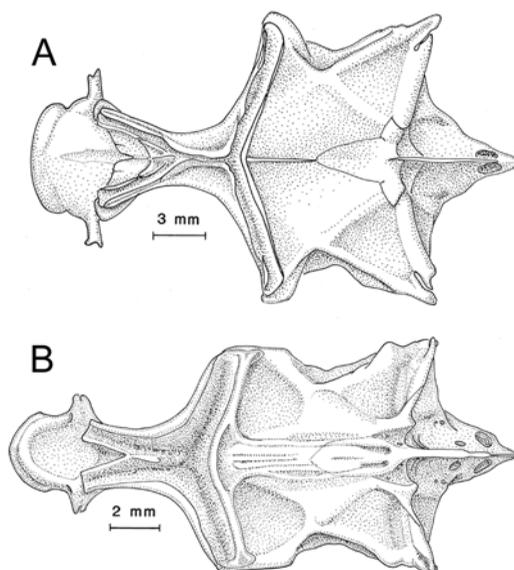


FIGURE 7. Dorsal view of neurocranium. A. *Triathalassothia argentinus* USNM 214438. B. *Vladichthys gloverensis* FMNH 105005.

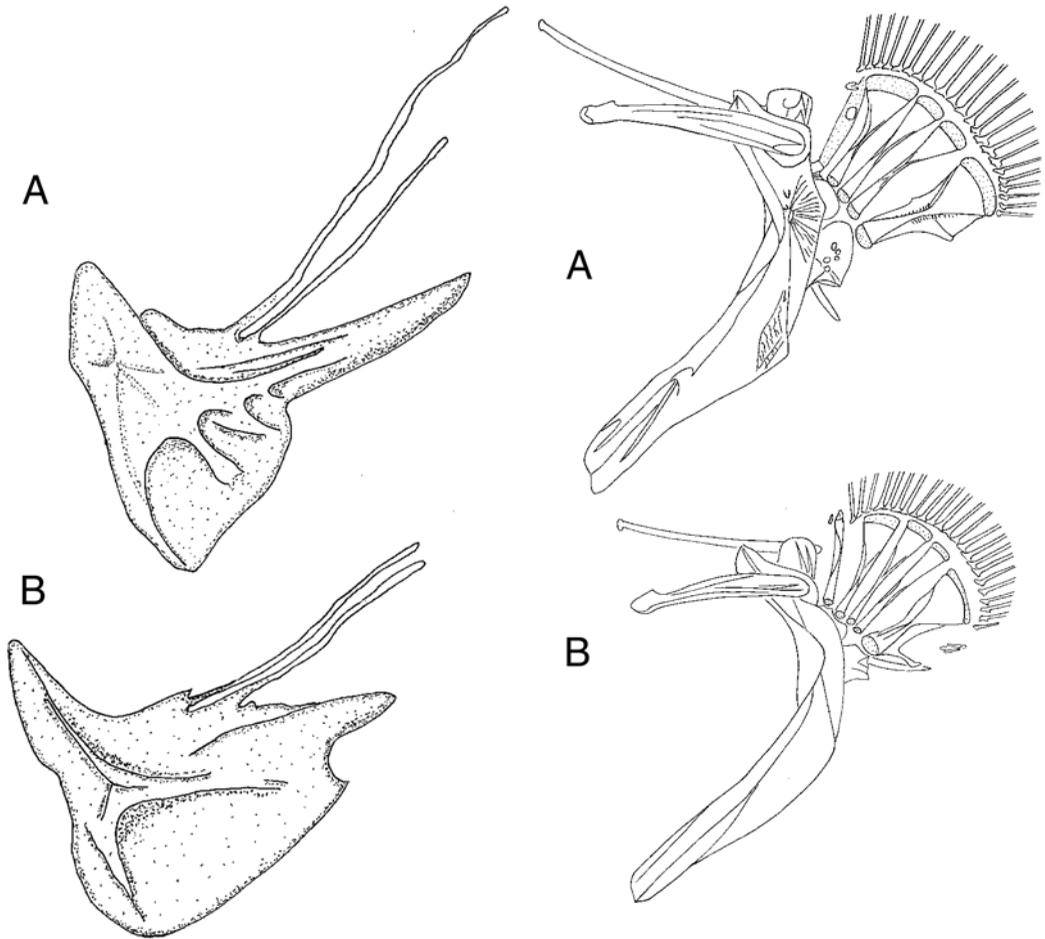


FIGURE 8 (left). Suboperculum: A. *Austrobatrachus foedus* RUSI 12748. B. *Colletteichthys dussumieri* USNM 147914.

FIGURE 9 (right). Pectoral girdle: A. *Austrobatrachus foedus* RUSI 12748. B. *Colletteichthys dussumieri* USNM 147914.

goes in 2.4 to 2.8 times. *Austrobatrachus* has a single, long subopercular spine (Fig. 8A), whereas *Colletteichthys* has a shorter spine, sometimes with a second small point below (Fig. 8B). The upper accessory pectoral–fin radial is totally ossified in *Colletteichthys* (Fig. 9B), whereas it is almost all cartilage with only a small ossified area in *Austrobatrachus* (Fig. 9A). The expanded distal end of the premaxilla is highest at the posterior end of the bone in *Colletteichthys* (Fig. 10B), whereas it is highest at the anterior end of the expansion in *Austrobatrachus* (Fig. 10A). The pelvic bone has a short, wide process on the medial surface in *Colletteichthys* (Fig. 11B), whereas it is longer and narrower in *Austrobatrachus* (Fig. 11A). Epibranchial I has a wide projection for the attachment of pharyngobranchial I, and pharyngobranchial I is long and bent in a boomerang shape in *Austrobatrachus* (Fig. 12A). Pharyngobranchial I is missing in *Colletteichthys*, and there is just a small rounded bump where it should attach (Fig. 12B). Hypobranchial III has a distinct curved point at its anterior end in *Colletteichthys* (Fig. 13B), whereas in *Austrobatrachus* the anterior end is rounded and there is an additional point on the lateral side (Fig. 13A). The ceratohyal is more slender in *Colletteichthys* than in any other toadfish genus, its narrowest depth going 13.7 times into the

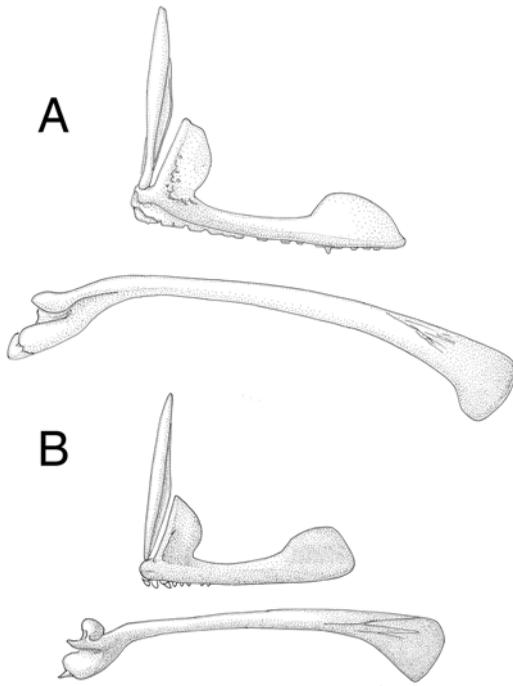


FIGURE 10. Premaxilla (above) and maxilla (below): A. *Austrobatrachus foedus* RUSI 12748. B. *Colletteichthys dussumieri* USNM 147914.

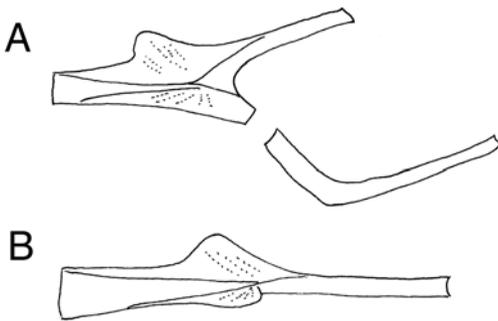


FIGURE 12. Ventral view of left epibranchial I and pharyngobranchial I of *Austrobatrachus foedus* RUSI 12748 (A), and of epibranchial I of *Colletteichthys dussumieri* USNM 226512 (B).

length of the ceratohyal with its ventral hyohyal at its end, versus only 8.2 times in *Austrobatrachus*. These many differences are greater than found between any two species within a described toadfish genus, and the characters under consideration are ones that have been utilized to define other toadfish genera.

*Colletteichthys* is a member of the subfamily Batrachoidinae because it has three solid dorsal-

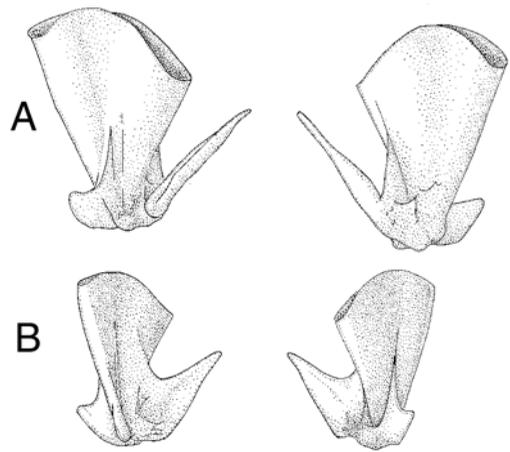


FIGURE 11. Pelvic bone (left side): dorsal view (left); ventral view (right) A. *Austrobatrachus foedus* RUSI 12748. B. *Colletteichthys dussumieri* USNM 147914.

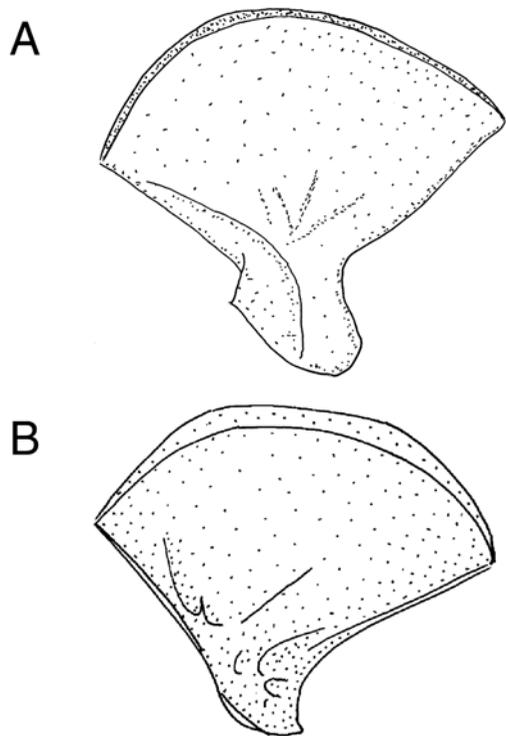


FIGURE 13. Ventral view of left hypobranchial III: A. *Austrobatrachus foedus* RUSI 12748. B. *Colletteichthys dussumieri* USNM 147914.

fin spines, one subopercular spine, and no canine-like teeth or photophores. It differs from other genera in the subfamily as follows: from *Riekertia*, *Halobatrachus*, *Perulibatrachus*, *Batrachoides*, *Chatrabus* and *Barchatus* by lacking scales, whereas these genera have scales; from *Bifax* by lacking a flap with an eye spot at the end of the maxilla on each side of the mouth; from *Potamobatrachus* by having one or two subopercular spines instead of three; from *Amphichthys* by having fewer than 24 dorsal-fin rays and lacking a venetian blind gland in the pectoral-fin axil; from *Triathalassothia*, *Vladichthys*, *Batrachichthys*, *Halophryne*, and *Allenbatrachus* by having a funnel-shaped pit at the top of the pectoral-fin axil, with glandular tissue inside and extending from ventral pit margin onto the axil; from *Opsanus* and *Sanopus* by having the axillary pocket at the top of the pectoral-fin axil rather than a foramen near the center of the axil; from *Batrachomoeus* by having a funnel-shaped pit rather than a foramen that is a distinct round hole, and by having the lower gill opening well below the lower pectoral-fin base rather than at the lower pectoral-fin base.

### MATERIAL EXAMINED

**CLEARED AND STAINED SPECIMENS.**— *Allenbatrachus grunniens*, CAS-SU 26909; *Allenbatrachus reticulatus*, CAS-SU 30658; *Amphichthys cryptocentrus*, USNM 144888; *Aphos porosus*, CAS 65051; *Austrobatrachus foedus*, RUSI 12748; *Barchatus cirrhosus*, HUI 13711; *Batrachoides gilberti*, FMNH 84549; *Batrachomoeus trispinosus*, CAS 69938; *Batrachichthys apiatus*, RUSI 75-25; *Batrachichthys felinus*, RUSI 75-25; *Bifax lacinia*, BPBM 35843; *Chatrabus hendersoni*, RUSI 8611; *Chatrabus melanurus*, RUSI 12749; *Colletteichthys dussumieri*, USNM 147914; *Daector reticulatus*, GCRL 16194; *Halobatrachus didactylus*, USNM 205066; *Halophryne diemensis*, NTMS 10005-019; *Halophryne hutchinsoni*, CAS-SU 20462; *Opsanus tau*, CAS 223821; *Perulibatrachus elminensis*, MNHN 1970-43; *Potamobatrachus trispinosus*, USNM 330064; *Porichthys notatus*, CAS 223822; *Riekertia ellisia*, RUSI 12738; *Sanopus barbatus*, SIO 67-45; *Thalassophryne maculosa*, USNM 199524; *Thalassophryne megalops*, FMNH 66907; *Triathalassothia argentius*, USNM 214438.

**OTHER SPECIMENS.**— *Vladichthys gloverensis*, FMNH 71575 (holotype), Paratypes- FMNH 71576 (1), FMNH 71577 (2), FMNH 71578 (2), FMNH 71579 (1), FMNH 71580 (1), FMNH 91036 (1), USNM 318691 (1), USNM 208239 (3), ANSP 120499 (5), CAS 15409 (3), BMNH 197.10.10.97 (1). *Triathalassothia argentinus*, USNM 86687 (1), ANSP 70373 (1). *Colletteichthys dussumieri*, USNM 333284 (3), USNM 333281 (1), USNM 196473 (1), USNM 221342 (5), USNM 226512 (1), USNM 147913 (7), USNM 147915, CAS 23719 (1), CAS 29743 (1), BPBM 30509 (1), BPBM 29525, AMS B.8115 (1), AMS B.8112

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