

Online Supplementary Material

***Feroxichthys yunnanensis* gen. et sp. nov. (Colobodontidae, Neopterygii), a large durophagous predator from the Middle Triassic (Anisian) Luoping Biota, eastern Yunnan, China**

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1. Taxa and principal sources of data

FMNH, Field Museum of Natural History, Chicago, USA

IVPP, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, China

NHMUK, Natural History Museum, London, UK;

PIMUZ, Paläontologisches Institut und Museum, Universität Zürich, Zürich, Switzerland

Moythomasia durgaringa: Gardiner, 1984

Australosomus kochi: Nielsen, 1949; NHMUK P17141–17143, 17156, 17157, 17160, 17161, 20940–20945

Acipenser brevirostrum: Hilton et al., 2011

Amia calva: Grande and Bemis, 1998

Boreosomus piveteaui: Nielsen, 1942

Brookvalia gracilis: Hutchinson, 1973b

Caturus furcatus: FMNH UC2057; Patterson, 1975; Grande and Bemis, 1998

Chondrosteus acipenseroides: Hilton and Forey, 2009

Cleithrolepidina minor: Hutchinson, 1973b

Cleithrolepis granulate: Wade, 1935; Hutchinson, 1973b

Colobodus bairdii: Sun et al., 2008; IVPP V19974

Colobodus bassanii: Mutter, 2002, 2004

Colobodus giganteus: Cartany et al., 2015

Crenilepis sandbergeri: Mutter, 2002, 2004

Ctenognathichthys bellottii: B ürgin, 1992

Daedalichthys higginsii: Hutchinson, 1973b

Dipteronotus olgiatii: Tintori, 1990

Elops hawaiiensis: Forey, 1973

Fuyuanperleidus dengi: Geng et al., 2012; Sun et al., 2012

Gigantopterus teller: Griffith, 1977

Habroichthys minmius: B ürgin, 1992; PIMUZ T196, 233, 2917, 2883, 2884

Helichthys browni: Hutchinson, 1973b

Helmolepis cyphognathus: Neuman & Mutter, 2005

Lepisosteus osseus: Grande, 2010

Leptolepis coryphaenoides: Patterson, 1975; Arratia, 1999, 2013

Luganoia lepidosteoides: B ürgin, 1992

Luganoia fortuna: Xu, 2020b

Luopingichthys bergi: Sun et al., 2009

Louwoichthys pusillus: Xu, 2020a

Meidiichthys browni: Brough, 1931; Hutchinson, 1973b

Perleides altolepis: Lombardo, 2001

Peipiaosteus pani: Zhou, 1992

Peltopleurus rugosus: B ürgin, 1992; PIMUZ T2904

Peltopleurus nitidus: Xu and Zhao, 2016

Peltopleurus tyrannos: Xu et al., 2018

Peltoperleides ducanensis: B ürgin et al., 1991

Peltoperleides macrodontus: B ürgin, 1992

Peripeltopleurus hypsisomus: B ürgin, 1992; PIMUZ T1211, 2150, 2869

Pseudobeaconia elegans: Hutchinson, 1973a; López-Arbarello and Zavattieri, 2008

Platysiagum sinensis: Wen et al., 2019

Plesiofuro mingshuica: Xu et al., 2015a

Polzbergia brochatus: Griffith, 1977

Potanichthys xingyiensis: Xu et al., 2012

Pteronisculus stensioi: Nielsen, 1942; NHMUK P16282, 16283, 16300, 163001, 16307–16308

Redifieldius gracilis: Schaeffer and McDonald, 1978

Semionotus elegans: Olsen and McCune, 1991; Cavin, 2010; Grande, 2010; López-Arbarello, 2012

Teffichthys ('*Perleides*') *madagascariensis*: NHMUK P16247, 16248, 19580–19584, 19587–19592, 19595–19599, 19603–19620, 19622, 19623; Lehman, 1952; Patterson, 1975; Marram et al., 2017

Thoracopterus niederristi: Griffith, 1977; Lehman, 1979; NHMUK P1098

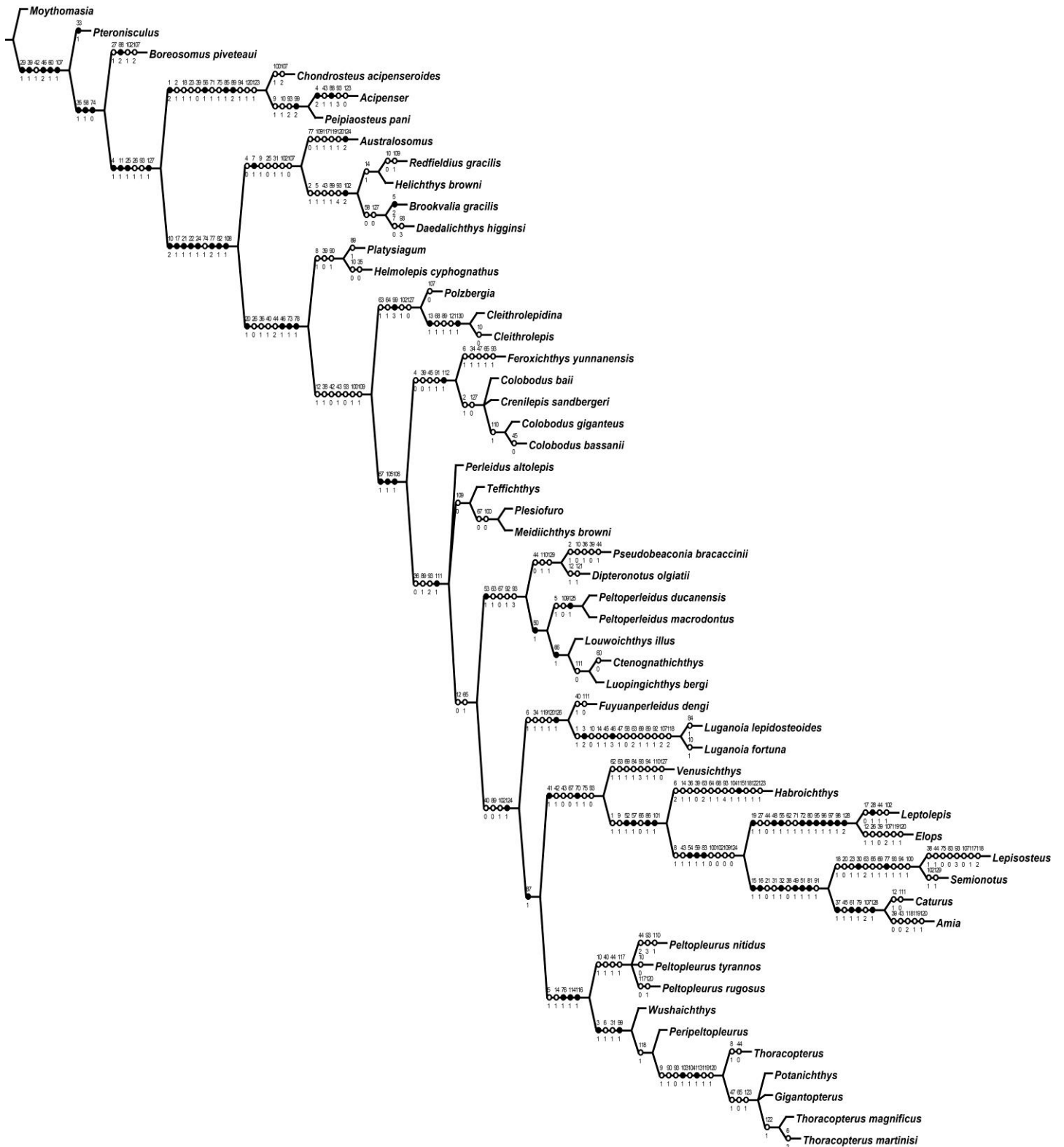
'*Thoracopterus*' *magnificus*: Tintori and Sassi, 1992

'*Thoracopterus*' *martinisi*: Tintori and Sassi, 1992

Venusichthys comptus: Xu and Zhao, 2016

Wushaichthys exquisitus: Xu et al., 2015b

Supplementary Figure



Supplementary Figure S1. Strict consensus of 24 MPTs (tree length = 341 steps, consistency index = 0.4663, retention index = 0.7708), illustrating phylogenetic position of *Feroxichthys yunnanensis* sp. nov. Character changes indicated with solid circles are unique.

2. Character list

The characters are mainly adopted or modified from previous publications on the phylogenetic relationships of the Neopterygii (A, Arratia, 2013; C, Coates, 1999; CA, Cloutier and Arratia, 2004; GS, Gardiner and Schaeffer, 1989; GML, Gardiner, Maisey and Littlewood, 1996; GSM, Gardiner, Schaeffer and Masserie, 2005); GB, Grande and Bemis, 1998; G, Grande, 2010; LZ, López-Arbarello and Zavattieri, 2008; L, López-Arbarello, 2012; P, Pinna, 1996; XG, Xu and Gao, 2011; XW, Xu and Wu, 2012; X, Xu et al., 2012; XGF, Xu, Gao and Finarelli, 2014; XZS, Xu, Zhao and Shen, 2015b; XGC, Xu, Gao and Coates, 2015a; XZ, Xu and Zhao, 2016; XM, Xu and Ma, 2016; XMZ, Xu, Ma and Zhao, 2018; XA, Xu, 2020a).

Skull Roof

- (1) Rostral: large, shield-like or cap-like (0); small, much reduced or lost by fusion with other elements (1); irregularly shaped and anamestic (2). (Modified from GML19; XW17; XGC51; XM1; XMZ1; XA1)
- (2) Postrostral: absent (0); present (1). (XA2)
- (3) Frontal(s): elongate (0); laterally expanded (1); well constricted above orbit (2). (X33; XGC6; XM3; XMZ3; XA3)
- (4) Contact relationships of frontals: anterior portions of frontals partly separated by median rostral bone (0); fully contact each other medially (1); completely separated by rostral bones (2).
- (5) Supraorbital sensory canal: ending in parietal (0); ending in frontal (1); ending in dermopterotic (2). (Modified from X34; XGC7; XZS34; XM4; XMZ4; XA4)
- (6) Distinct parietal: present (0); absent, fused with dermopterotic (1); absent, fused with frontal and dermopterotic (2). (Modified from XZS28; XM5; XMZ5; XA5)

Remarks: Based on personal observation of the holotype, the parietal is fused with the dermopterotic in *Fuyuanperleidus dengi* from the Middle Triassic (Anisian) of Luoping, Yunnan.

- (7) Number of parietals: one pair (0); three or more (1). (Modified from XA6)
- (8) Nasal bones: completely separated from each other by median rostral or rostral bones (0); joined or nearly joined in midline (1). (XM6; XMZ6; XA7)
- (9) Nasal bone forming part of orbital margin: present (0); absent (1). (XZ55; XM7; XMZ7; XA8)
- (10) Number of extrascapulars: two pairs or more (0); three (1); one pair (2). (Modified from X16; XGC8; XM23; XMZ23; XA9)
- (11) Intertemporal: present (0); absent (1). (Modified from GSM17; XGC10; XM24; XMZ24; XA10)

- (12) Ratio of dermopterotic length to parietal length: less than two (0); two or more (1).
- (13) Accessory dermopterotic: absent (0); present (1). (XGC59; XM25; XMZ25; XA11)
- (14) Dermopterotic/preopercle contact: present (0); absent (1). (XM26; XMZ26; XA12)

Neurocranium

- (15) Sphenotic with small dermal component: absent (0); present (1). (G23; XW16; XM8; XMZ8; XA13)
- (16) Pterotic: present (0); absent (1). (GML2; GMC47; XM9; XMZ9; XA14)
- (17) Opisthotic: present (0); absent (1). (G33; XGC48; XM10; XMZ10; XA15)
- (18) Intercalar: present (0); absent (1). (GML4; XM11; XMZ11; XA16)
- (19) Supraoccipital: absent (0); present (1). (G28; XGC49; XM12; XMZ12; XA17)
- (20) Post-temporal fossa: absent (0); present (1). (GS28; XGC1; XM13; XMZ13; XA18)
- (21) Sub-temporal fossa: absent (0); present (1). (GS29; XGC2; XM24; XMZ14; XA19)
- (22) Dilator fossa: absent (0); present (1). (GS31; XGC3; XM15; XMZ15; XA20)
- (23) Posterior myodome: present (0); absent (1). (Modified from GS10; GSM6; XM16; XMZ16; XA14; XA21)
- (24) Anterodorsal myodome: present (0); absent (1). (XGF8; XZ8; XM17; XMZ17; XA14; XA22)
- (25) Parasphenoid: short, terminates at otic fissure (0); long, extends across otic fissure (1). (Modified from GSM8; XGC4; XM18; XMZ18; XA23)
- (26) Basipterygoid process: present (0); absent (1). (GSM12; XGC5; XM19; XMZ19; XA24)
- (27) Internal carotid foramen on parasphenoid: absent (0); present (1). (GML14; XGC53; XM20; XMZ20; XA25)
- (28) Efferent pseudobranchial foramen on parasphenoid: absent (0); present (1). (GML15; XGC54; XM21; XMZ21; XA26)
- (29) Pineal foramen: present (0); absent (1). (XGF113; XA27)

Circumorbital Bones

- (30) Anterior infraorbital bone(s): absent (0); present (1). (Modified from G21; XW24; XGC40; XM27; XMZ27; XA28)
- (31) Antorbital (when it is not fused with premaxilla): small, shorter than nasal (0); enlarged, nearly equal to or deeper than nasal (1). (Modified from XA29)
- (32) Tube-like canal bearing anterior arm of antorbital: absent (0); present (1). (G12; XW19; XGC43; XM28; XMZ28; XA30)

(33) Anterior part of lacrimal bearing teeth: absent (0); present (1). (Modified from XA31)

(34) Lacrimal: independent (0); fused with maxilla (1).

Remarks: Based on personal observation on the holotype, the lacrimal is fused with the maxilla in

Fuyuanperleidus dengi from the Middle Triassic (Anisian) of Luoping, Yunnan.

(35) Dermosphenotic/nasal contact: present (0); absent (1). (Modified from GS19; XGC11; XM29; XMZ29; XA32)

Remarks: In *Helmolepis cyphognathus*, the triangular ‘supraorbital’ is better interpreted as a dermosphenotic because its shape and position (Neuman & Mutter, 2005).

(36) Dermosphenotic/preopercle contact: absent (0); present (1). (XA33)

(37) Dermosphenotic attachment to skull roof in adult-sized individuals: loosely attached on the skull roof or hinged to the side of skull roof (0); firmly sutured into skull roof, forming part of it (1). (GB56; XGC13; XM31; XMZ31; XA34)

(38) Position of dermosphenotic relative to dermopterotic (intertemporal plus supratemporal): located at nearly same horizontal level of dermopterotic (0); located below dermopterotic (1).

(39) Suborbital(s): absent (0); present (1). (Modified from GS9; XM35; XMZ35; XA35)

Remarks: The coding (1) for *Australosomus* is based on personal observation on NHMUK 17157.

(40) Positions of suborbital(s): extending below dermosphenotic (0); located posterior to dermosphenotic only (1). (Modified from XA36 and 37)

(41) Number of infraorbitals between antorbital and dermosphenotic: three or less (0); four or more (1). (Modified from GS21; XGC16; XM33; XMZ33; XA38)

(42) Postinfraorbital(s): absent (0); present (1). (XA39)

(43) Supraorbital: absent (0); present (1). (Modified from GS14; XGC17; XM34; XMZ34; XA40)

(44) Number of supraorbital bones: single (0); two (1); three or more (2). (Modified from GS14; XGC17; XM34; XMZ34; XA41)

Remarks: Based on personal observation, four supraorbital bones are present in *Luopingichthys bergi* from the Middle Triassic (Anisian) of Luoping, Yunnan.

(45) Multiple supraorbital bones arranged in more than one horizontal rows: absent (0); present (1).

Jaws and dentation

(46) Premaxilla: fused with antorbital, bearing sensory canal (0); present as distinct elements, lacking sensory canal (1); lost (2); fused with rostral, bearing sensory canal (3). (Modified from X30; XM36;

XMZ36; XA42)

Remarks: Personal reexaminations on the type specimens confirm that a pair of small, toothed premaxillae lacking sensory canal is present in *Platysiagum sinensis*.

- (47) Premaxilla(e): present as a pair of elements (0); fused as a median element (1). (Modified from X30; XM36; XMZ36; XA43)
- (48) Mobile premaxilla: absent (0); present (1). (Modified from GS24; XM37; XMZ37; XA44)
- (49) Premaxilla immovably attached to braincase by means of a deep nasal process tightly sutured to frontals: absent (0); present (1). (G6; XW30; XGC45; XM38; XMZ38; XA45)
- (50) Number of marginal teeth on premaxilla: three or more (0); one or two (1). (XA46)
- (51) Foramen for olfactory nerve on premaxilla: absent (0); present (1). (Modified from G8; XW20; XGC46; XM39; XMZ39; XA47)
- (52) Maxilla/preopercle contact: present (0); absent (1). (C15; XM40; XMZ40; XA48)
- (53) Ventral portion of preopercle anteriorly extended, contacting maxilla anteriorly: absent (0); present (1). (Modified from XA49)
- (54) Supramaxilla: absent (0); present (1). (Modified from GS22; XM41; XMZ41; XA50)
- (55) Number of supramaxilla: single (0); two (1). (XZ28; XM42; XMZ42; XA51)
- (56) Maxilla: present (0); absent (1). (XM43; XMZ43; XA52)
- (57) Mobile maxilla in cheek: absent (0); present (1). (C16; XM44; XMZ44; XA53)
- (58) Suborbital/maxilla contact: present (0); absent (1). (Modified from CA88; XGC56; XM45; XMZ45; XA54)
- (59) Expanded dorsal lamina of maxilla: present (0); absent (1). (Modified from CA18; XA55)
- (60) Depth of dorsal lamina of maxilla: no smaller than orbital length (0); smaller than orbital length (1). (XA56)
- (61) Posterior margin of maxilla: slightly convex or straight (0); concave with a posterior maxillary notch (1). (GB62; XW46; XGC57; XM46; XMZ46; XA57)
- (62) Oral margin of maxilla: concave or nearly straight (0); convex (1). (XA58)
- (63) Posterior end of maxilla relative to orbit: well behind orbit (0); ending below (or nearly below) posterior orbital margin (1); ending nearly below orbital center or even anteriorly located (2). (XA59)
- (64) Teeth on maxilla: present (0); much reduced or lost (1). (Modified from LZ11; XM47; XMZ47;

XA60)

- (65) Distribution of teeth on maxilla: most of oral margin of maxilla (0); only anterior portion of oral margin of maxilla (1). (XA61)
- (66) Extraordinarily long, fang-like teeth on both jaws: absent (0); present (1). (XA62)
- (67) Molariform teeth on coronoid(s), prearticular and pterygoids: absent (0); present (1).
- (68) Teeth on dentary: present (0); absent (1). (XM48; XMZ48; XA63)
- (69) Quadratomandibular articulation: well behind orbit or below posterior orbit margin (0); nearly below the orbital center or even anteriorly located (1). (Modified from LZ2; X56; XGC58; XM49; XMZ49; XA64)
- (70) Coronoid process: absent (0); present (1). (GS17; XGC23; XM50; XMZ50; XA65)
- (71) Supra-angular bone in lower jaw: present (0); absent (1). (A67; XM51; XMZ51; XA66)

Palatoquadrate, Hyoid Arch, and Operculo-gular Series

- (72) Vomers in adults: paired (0); fused (1). (XZS32; XM22; XMZ22; XA67)
- (73) Suspensorium angle: acute (0); nearly vertical (1). (Modified from GSM29; XGC24; XM52; XMZ52; XA68)
- (74) Hyomandibula with canal for hyoid branch of nerve VII: absent (0); present (1). (Modified from C22; XGC25; XM53; XMZ53; XA69)
- (75) Dermohyal: present (0); absent (1). (Modified from GSM24; XM54; XMZ54; XA70)
- (76) Postspiracle: absent (0); present (1). (XM55; XMZ55; XA71)
- (77) Quadratojugal: plate-like (0); splint-like (1); much reduced or lost (2). (Modified from GSM26; C20; XGC26; XM56; XMZ56; XA72)
- (78) Symplectic: absent (0); present (1). (Modified GSM13; XGC27; XM57; XMZ57; XA73)
- (79) Symplectic involvement of jaw joint: absent (0); present (1). (GB61; G49; XW37; XGC28; XM58; XMZ58; XA74)
- (80) Elongated posteroventral process of quadrate: absent (0); present (1). (Modified from GML24; XGC29; XM59; XMZ59; XA75)
- (81) Number of hypobranchials: three (0); four (1). (G99; XW42; XGC60; XM60; XMZ60; XA76)
- (82) Uncinate processes on epibranchials: absent (0); present (1). (C25; XGC30; XM61; XMZ61; XA77)
- (83) Interopercle: absent (0); present (1). (GS18; XGC31; XM62; XMZ62; XA78)
- (84) Two or more preopercular elements on each side of skull: absent (0), present (1). (XZ39; XM63;

XMZ63; XA79)

- (85) Preopercle: present (0); absent (1). (XA80)
- (86) Shape of preopercle: boomerang-shaped or irregular (0); crescent-shaped or L-shaped (1). (Modified from XZ40; XM64; XMZ64; XA81)
- (87) Ventral end of preopercle located well above posterior end of oral margin of maxilla (when the ventral part of preopercle contacts maxilla): present (0); absent (1). (Modified from XA82)
- (88) Opercle: present (0); absent (1). (XA83)
- (89) Size of opercle: significantly larger than subopercle (0); nearly equal to or smaller than subopercle (1); much reduced (2). (Modified from XW43; XGC65; XM65; XMZ65; XA84)
- (90) Suture between opercle and subopercle: slightly inclined or horizontal (0); greatly inclined (1). (XM66; XMZ66; XA85)
- (91) Prominent anterodorsal process of subopercle: absent (0); present (1).
- (92) Prominent anteroventral extension of subopercle: absent (0); present (1). (XA86)
- (93) Number of branchiostegal rays: ten or more (0); seven to nine (1); four to six (2) two or three (3); single (4). (Modified from XA87)
- (94) Gular bone(s): present (0); absent (1). (Modified from C11; XGC58; XM67; XMZ67; XA88)

Vertebrate and Caudal Skeleton

- (95) Solid vertebral centra of adult-sized individuals: absent (0); present (1). (Modified from GB4; XGC68; XM68; XMZ68; XA89)
- (96) Epipleural intermuscular bones: absent (0); present (1). (A103; XM69; XMZ69; XA90)
- (97) Uroneural: absent (0); present (1). (XW56; XM70; XMZ70; XA91)
- (98) Division of hypurals into dorsal and ventral groups (a gap between hypurals 2 and 3): absent (0); present (1). (XZS69; XM71; XMZ71; XA92)

Girdles and Fins

- (99) Posttemporal: contacting extrascapular posteriorly (0); contacting extrascapular posterolaterally and separating this bone from contact with its counterpart (1); contacting extrascapular medially, and being incorporated into the skull roof (2); lost (3). (Modified from X27; XGC9; XM72; XMZ72; XA93)
- (100) Width of posttemporals: broad, nearly as wide as extrascapular (0); relatively narrow, about half width of extrascapular series (1). (XA94)

Remarks: Based on personal observations, the posttemporals are relatively narrow in *Teffichthys*

madagascariensis. As such, the coding for this taxon is revised from '0' to '1'.

- (101) Clavicle: present as a broad plate (0); much reduced or lost (1). (Modified from GML37; XGC39; XM73; XMZ73; XA95)
- (102) Supracleithrum relative to posterior margin of opercle in depth: supracleithrum nearly as deep as posterior margin of opercle (0); supracleithrum shorter than posterior margin of opercle (1); supracleithrum well deeper than posterior margin of opercle (2).
- (103) Pectoral fins enlarged as wings: absent (0); present (1). (X66; XM74; XMZ74; XA96)
- (104) Pelvic fins enlarged as auxiliary wings: absent (0); present (1). (X70; XM75; XMZ75; XA97)
- (105) Number of dorsal and anal fin rays relative to radials: rays more numerous than radials (0); rays and radials nearly equal in number (1). (GSM31; XGC34; XM76; XMZ76; XA98)

Remarks: In *Cleithrolepis granulate*, the rays are more numerous than the radials in both the dorsal (19 radials corresponding to 27 rays) and anal (9 radials corresponding to 19 rays) fins (Wade, 1935). The similar condition is also present in *Polzbergia brochatus*, in which, the rays are also more numerous than the radials in the dorsal fin (Griffith, 1977).

- (106) Dorsal and anal fin rays: segmented throughout the length (0); segmented distally (1). (XG62; XGC35; XM77; XMZ77; XA99)
- (107) Origin of dorsal fin: nearly opposite to the origin of anal fin, well posterior to the origins of pelvic fins (0); between origins of anal and pelvic fins (1); anterior to origins of pelvic fins (2). (XA100)
- (108) Caudal fin rays: terminate at caudal extremity of body axis (0); extend beyond termination of body axis (1). (Modified from GSM32; XGC36; XM78; XMZ78; XA101)
- (109) Segmented procurrent rays in dorsal lobe of caudal fin: absent (0); present (1). (Modified from LZ19; XA102)
- (110) Number of segmented procurrent rays in dorsal lobe of caudal fin: four or more (0); one to three (1).
- (111) Number of principal caudal fin rays: 25 or more (0); 24 or less (1). (XA104)
- (112) Principal rays of caudal fin ornamented with rounded ganoid tubercles: absent (0); present (1).
- (113) Dense lepidotrichial segments of pectoral fin rays between innermost principle pectoral fin ray and body: absent (0); present (1). (X71; XGC37; XM79; XMZ79; XA105)
- (114) Dense brush-like rays proximally articulating several stout segments at posterior portion of male anal fin: absent (0); present (1). (Modified from XZS74; XM80; XMZ80; XA106)
- (115) Modification of male anal fin into unsegmented rays with tiny hooklets along anterior margin of

- longest leading ray: absent (0); present (1). (XM81; XMZ81; XA107)
- (116) Enlarged and posteriorly extended lateral scutes associate with anal fin: absent (0); present (1).
(Modified from XM82; XMZ82; XA108)
- (117) Anal fin relative to dorsal fin in size: anal fin smaller than or equal to dorsal fin (0); anal fin larger than dorsal fin (1). (XM83; XMZ83; XA109)
- (118) Caudal fin: forked, lower lobe slightly shorter than or largely equal to upper lobe (0); forked, lower lobe longer than upper lobe (1); unforked (2). (Modified from X76; XGC74; XM84; XMZ84; XA110)
- (119) Fringing fulcra on caudal fin: present (0); absent (1). (XM85; XMZ85; XA111)
- (120) Fringing fulcra on pectoral fins: present (0); absent (1). (XM86; XMZ86; XA112)

Body shape and scales

- (121) An apparent dorsal hump between head and dorsal fin: absent (0); present (1). (XW50; XA113)
- (122) Scales: present (0); absent (1). (Modified from XGF67; XM87; XMZ87; XA114)
- (123) Anterior flank scales: present (0); much reduced or absent (1). (Modified from XZS83; XM89; XMZ89; XA115)
- (124) Lateral line scales: the lateral line scales as deep as or slightly deeper than those scales above and below (0); greatly deepened, 30% or more of the greatest depth of the body (1). (Modified from XZS83; XM89; XMZ89; XA116)
- (125) Two horizontal rows of scales notably deepened in anterior flank region (lateral line scales notably deepened and nearly equal to the scales ventral to them): absent (0); present (1).
- (126) Greatly deepened anterior flank scales corresponding to two or three horizontal rows of relatively shorter scales posteriorly: absent (0); present (1).
- (127) Rhombic scales in anterior flank region: ornamented with ganoid ridges and tubercles (0); nearly smooth (1).
- (128) Type of scales: ganoid or lepisosteoid type (0); elasmoid of amioid type (1); elasmoid of cycloid type (2). (A156; X80; XGC71; XM90; XMZ90; XA117)
- (129) A posteriorly directed spine on dorsal ridge scale anterior to dorsal fin: absent (0); present (1).
(GML36; LZ22; XW58; XA118)
- (130) Posteriorly inclined scales in pectoral region: absent (0); present (1). (LZ24; XM92; XMZ92; XA119)

3. Data matrix

Moythomasia

0000000000-0-0----0000000000-00000000-000--00000000-00-0000000000000001000000000000
00000000000000000000000000000000-0000000000000000000000

Pteronisculus

0000000000-0-0----000000000100010000010010--2-00-0000-00001000000000000001000000000000
000000000000000000000000100-0000000000000000000000

Boreosomus piveteaui

0000000000-0-0----000000010100000100010010--2-00-0000-00101000000000000000?00000000
0200000000000000010000200-0000000000000000000000

Acipenser

21020000111-0-0001000010110010?0?-10000---1002-00----0-1-----0-001-0010000000001-
-1--00310000200-0000100-0000000001000----000

Chondrosteus acipenseroides

2?010000001-0-0???0?????1?0?1????-10000---0--2-00----0-1-----0-001-00100000??001-
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Peipiaosteus pani

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Peltoerleidus_ducanensis

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Peltoerleidus_macrodonatus

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Pseudobeaconia_bracaccinii

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Dipteronotus_olgiatii

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Louwoichthys_illus

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Ctenognathichthys

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Luopingichthys_bergi

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Colobodus_giganteus

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Colobodus_bassanii

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Colobodus_baii

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Crenilepis_sandbergeri

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Feroxichthys_yunnanensis

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Luganoia_fortuna

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Fuyuanperleidus_dengi

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Peltopleurus_nitidus

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Peltopleurus_tyrannos

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Peltopleurus_rugosus

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Peripeltopleurus

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Potanichthys

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Gigantopterus

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Thoracopterus_magnificus

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Thoracopterus_martinisi

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Habroichthys

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Caturus

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Amia

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Lepisosteus

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Semionotus

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Leptolepis

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Elops

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