Online Supplementary Material

A new ionoscopiform fish (Holostei: Halecomorphi) from the Middle Triassic (Anisian) of Yunnan, China

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Part A. Supplementary Figures

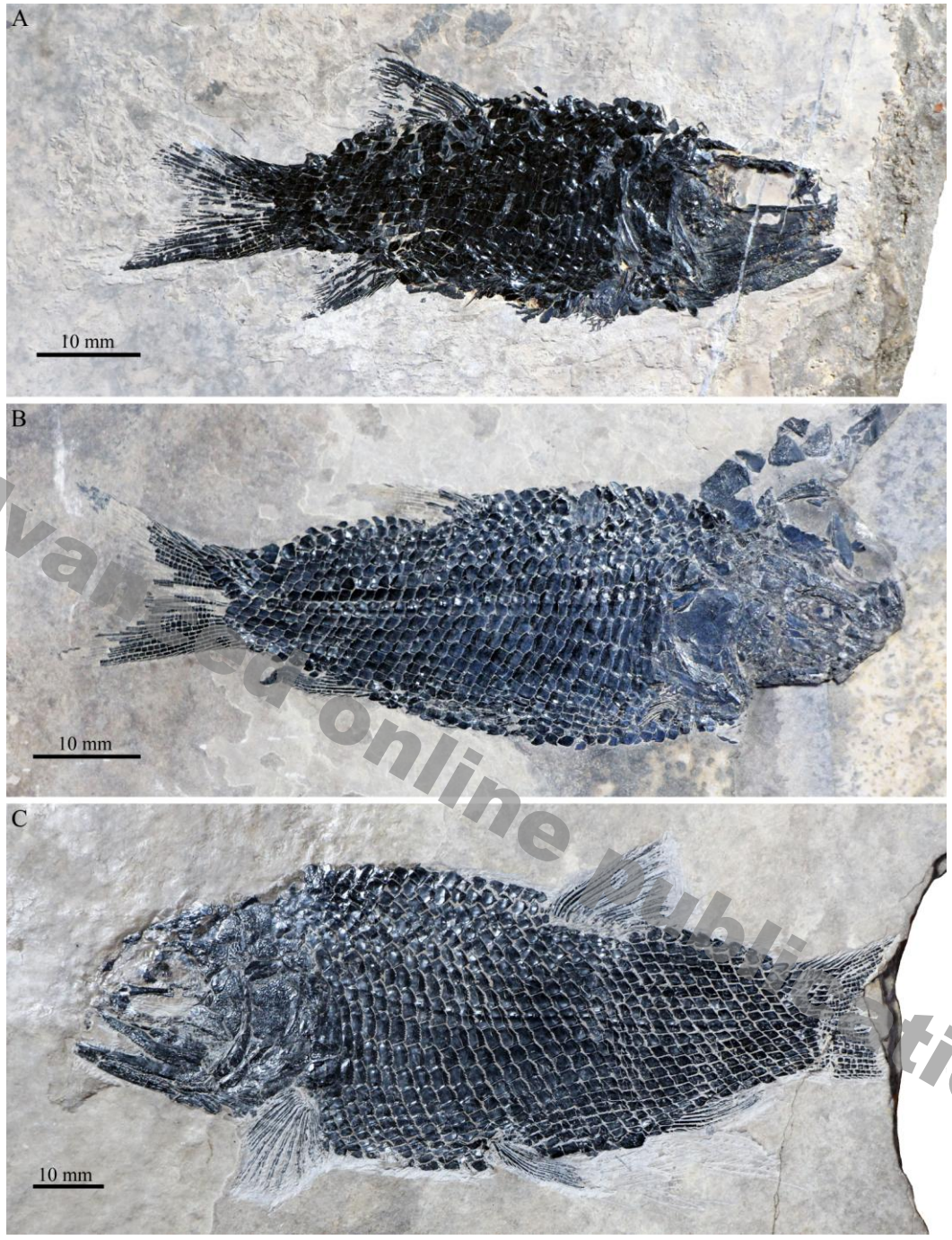

Fig. 1S *Subortichthys triassicus* gen. et sp. nov.

A. IVPP V 22950; B. V 19003; C. V 20680

Fig. 2S Sensory pores on the maxilla of *Subortichthys triassicus* gen. et sp. nov.

A, C. IVPP V 20680; B, D. IVPP V 22950

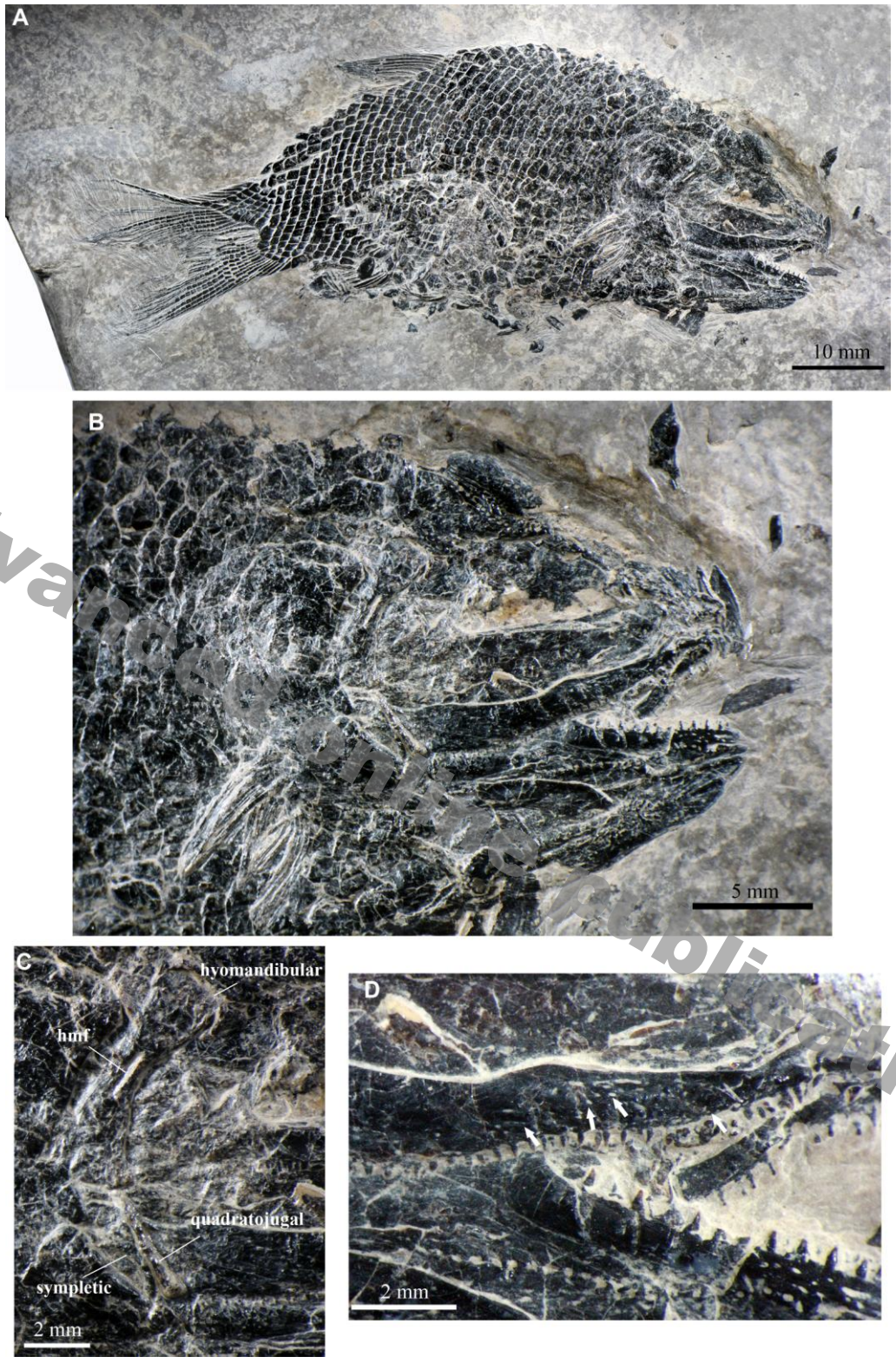

Fig. 3S *Subortichthys triassicus* gen. et sp. nov., IVPP V 22951

A. photo; B. skull and pectoral girdle; C. close up of hyomandibular, quadratojugal and sympletic; D. sensory pores on the maxilla. hmf, foramen for the hyomandibular trunk of facial nerve (VII)

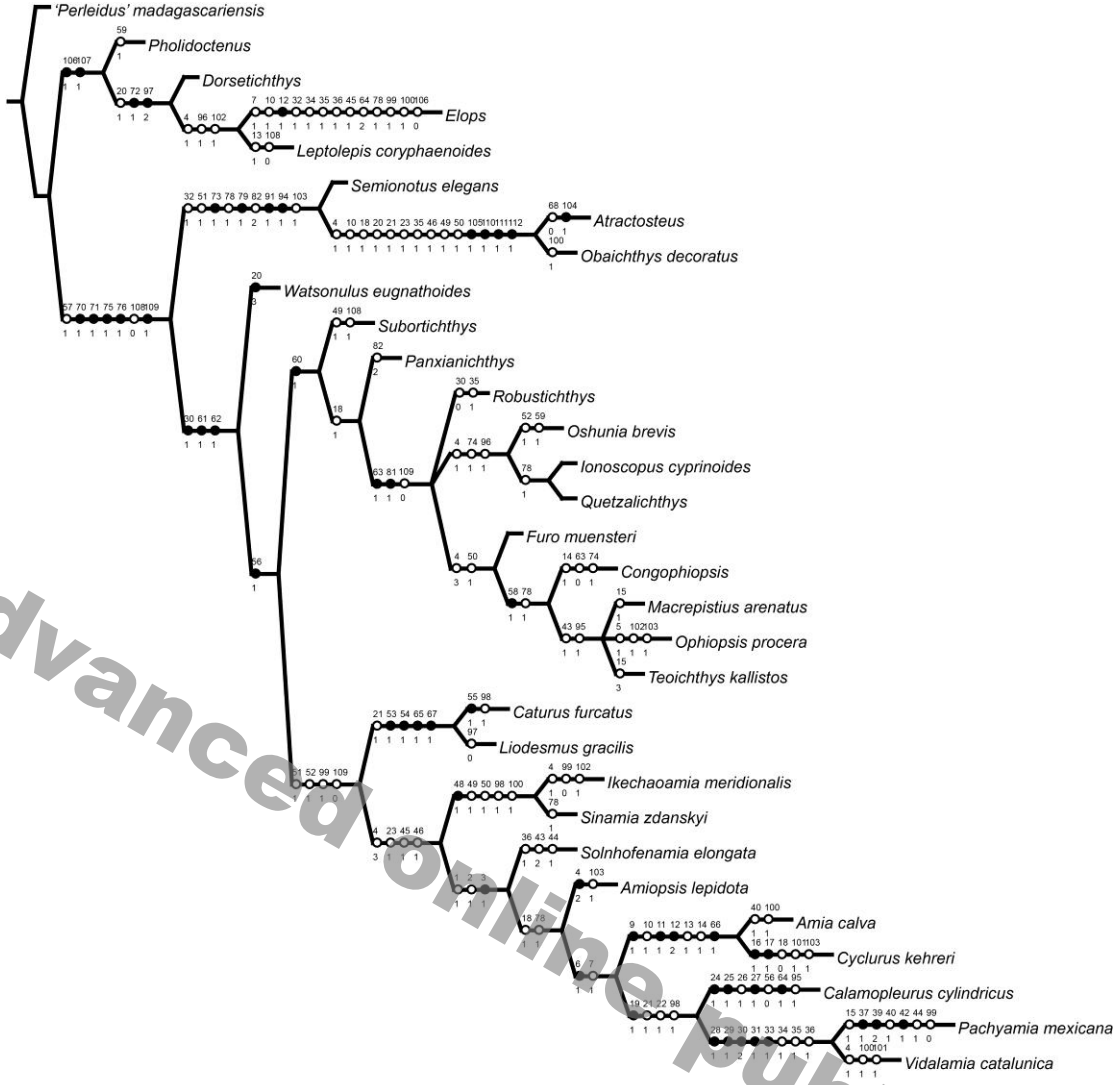

Fig. 4S Strict consensus of nine most parsimonious trees, illustrating the phylogenetic position of *Subortichthys triassicus* gen. et sp. nov.

Character changes indicated with solid points are unique

Part B. Phylogenetic Analyses

(1) Characters list

1 Solid, perichordally ossified, diplospondylous centra in adult-sized individuals: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015)

2 Posterior extent of exoccipitals in adult-sized individuals: reaches posterior margin of occiput (0); does not reach posterior margin of occiput (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

3 Anteriorly projecting spine-like processes on neural and/or haemal arches: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

4 Solid vertebral centra of adult-sized individuals: absent (0); present, with two lateral fossae on each side of most centra (1); present, with three or more lateral fossae on each side of most of the centra (2); present, centra smooth-sided (3). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

5 Number of supraneurals: 15 or more (0); 13 to 14 (1); 5 to 11 (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

6 Articular ossification of lower jaw: a single element, or two elements tightly sutured to each other (0); two separate elements not in contact with each other (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

7 Suborbital bones: present (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

8 Rostral/frontal contact: present (0), absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

9 Hypural-ural centra fusion in adult-sized individuals: all hypurals autogenous (separate) from the ural centra (0); all but first hypural fused to corresponding centra (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

10 Large parapophyses fused to most of the abdominal centra: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

11 Substantial scapulocoracoid ossification in adult-sized individuals: one or more elements present in the shoulder girdle (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

12 Supraorbital bones: two or more (0); single (1) absent (2). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

13 Urodermals in the caudal skeleton: present (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

14 Sclerotic ring ossification: present (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

15 Size and shape of dorsal fin: short, with straight to falcate margin, no more than 29 segmented rays and no more than 29 proximal radials (0); medium long, with bow-shaped or straight margin, 30-35 segmented rays, and an estimated 30-35 proximal radials (1); very long, with bow-shaped margin, 36-47 segmented rays, and 37-48 dorsal proximal radials (2); extremely long, with bow-shaped margin, 48-53 segmented rays, and 49-54 proximal radials (3). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

16 Morphology of teeth on anterior coronoids: conical, with pointed tips (0); styliform, with broadly rounded or flattened tips (1); inapplicable because of absence of anterior coronoids (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

17 Anterior extent of parasphenoid tooth patch: extends well anterior to the lateral ascending arms of parasphenoid (0); short, does not extend anterior to the lateral ascending arms (1); parasphenoid tooth patch absent (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

18 Parietal length: relatively short, with a width-to-length ratio range well exceeding 0.90 (0); relatively long, with a width-to-length ratio range not exceeding 0.90 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

19 Number of ural centra: 10 or fewer (0); 11 to 22 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

20 Shape of preopercle: expanded dorsally (0); L-shaped (1); crescent-shaped (2); ovoid (3). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

21 Morphology of caps of the jaw teeth in adult-sized individuals: round in cross-section, not sharply carinate (0); labiolingually compressed, sharply carinate (keeled) (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

22 Lateral edge of posttemporal in adult-sized individuals: shorter than length of anterior edge (0);

elongate, about equal to or greater than width of anterior edge (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

23 Shape of posterior margin of caudal fin (multi-state character): forked (0); convexly rounded or nearly vertical (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

24 Elongation of opercular process of hyomandibula: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

25 Number of tooth rows on coronoids: two or more rows for at least part of one or more coronoids (0); one row (1); inapplicable because of absence of coronoids (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

26 Arrangement of vomerine teeth: tooth patch with two to several rows of teeth (0); tooth patch with only a single anterior marginal row, plus one or more teeth in a longitudinal series perpendicular to the anterior marginal row (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

27 Dermopterotic ribs: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

28 Number of epurals: 2-8 (0); 10-15(1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

29 Shape of basipterygium: proximal end flat and widened anteriorly (0); proximal end long and rod-like, without significant widening anteriorly (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

30 Postmaxillary process under postmaxillary notch: absent (0); short (1); thick and elongate (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015)

31 Morphology of pleural ribs: distal ends pointed or with rounded points (0); distal ends flatly truncated, even in large adults (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

32 Median gular: present (0); absent (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

33 Peculiar ornamentation pattern of strongly defined, converging lines on opercles in adult-sized individuals: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015;

Sun et al., 2017)

34 Frontal width in adult-sized individuals: relatively wide, with a width-to-length ratio of 0.26 to -0.65 (0); relatively narrow, with a width-to-length ratio of 0.13 to 0.21 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

35 Shape of dermopterotic: greatly widened posteriorly and tapered anteriorly (0); subrectangular, not substantially tapered anteriorly or widened posteriorly (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

36 Width of opercle: narrow, with width-to-height ratio of 0.56 to 1.06 (0); wide, with width-to-height ratio in range of 1.07 to 1.39 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

37 Interfrontal fontanelle in adult-sized individuals: absent, frontals sutured to each other medially for their entire length (0); frontals separated for about one-half their length or more by a fontanelle (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

38 Position of dermosphenotic relative to orbit in adult-sized individuals: anterior or anteroventral margin of dermosphenotic included in circumorbital margin, even in large individuals of 200 mm SL or more (0); dermosphenotic excluded from orbital margin in large individuals of 200 mm SL or more (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

39 Supramaxilla: absent (0); present, elongate (1); present, extremely deep, shaped like a rounded triangle (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

40 Number of preural vertebral centra: 40 to 73 (0); 75 to 82 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

41 Shape of posterior end of posttemporal in adult-sized individuals: elongate, with rounded apex or apices (0); elongate but abruptly truncated (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

42 Ventral transverse ridge of gular: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

43 Shape of anterior subinfraorbital bone in adult-sized individuals (multistate character): short, subrectangular, longer than deep (0); short, subrectangular, deeper than long (1); long and low (2); long, posteriorly expansive, tapering anteriorly (3). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

44 Number of epaxial procurrent caudal fin rays: 0 to 11 (0); 12 to 15 (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

45 Fringing fulcra on median fins: present (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

46 One-to-one arrangement of hypurals and caudal fin rays: last few hypurals each articulate with the bases of several caudal fin rays (0); each hypural normally bears a single caudal ray (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

47 Number of ossified ural neural arches in adult-sized individuals: normally four or more (0); normally 2 or fewer (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

48 Number of parietal bones: paired parietals normally present (0); only a single median parietal present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

49 Number of pairs of extrascapular bones: only one pair present (0); three pairs normally present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

50 Dermopterotic length to parietal length: dermopterotic significantly longer (0); lengths about equivalent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)
Remarks: The state of *Panxianichthys* was changed as "0" according to specimens described by Sun et al. (2016).

51 Opisthotic: present (0); absent (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

52 Pterotic: present (0); absent (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

53 Maxilla extremely slender and rod-like: absent (0), present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

54 Number of branchiostegal rays: 21 or fewer (0); 22 or more (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

55 Numerous paired, block-like ural neural arch ossifications: absent (0); present (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

56 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). (Grande

and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

57 Shape of rostral bone: relatively large, plate-like (0); much reduced, short tube-like or roughly V-shaped with lateral horns (1); lost (2). (Modified from Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

58 Lachrymal shape: longer than deep, and smaller than orbit (0); deeper than long, and massive, about size of orbit (1); deeper than long, and smaller than orbit (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

59 Quadrate-mandibular articulation: below or posterior to orbit (0); anterior to orbit (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

60 Lateral line canal in maxilla: absent (0); present (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

61 Symplectic involvement in jaw joint: does not articulate with lower jaw (0); distal end articulates with articular bone of lower jaw (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

62 Shape of posterior margin of maxilla: convexly rounded or straight (0); excavated (concave or with a posterior maxillary notch present) (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013)

63 Inner orbital flange of dermosphenotic: smooth, without sensory canal (0); bearing sensory canal tube (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

64 Posterior margin of gular: smooth (0); deeply scalloped with a series of sharp points and concavities (1); gular absent (2). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

65 Shape of haemal spines: spine-like or rod-like (0); broadly spatulate in the transverse plane (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

66 Relative size of uppermost postinfraorbital in adult-sized individuals: short, much shorter than lowermost postinfraorbital (0); long, about equal in length to lowermost postinfraorbital (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

67 Orientation of preural haemal and neural spines near caudal peduncle: positioned at about 25 ºto 45 º

from the horizontal (0); strongly inclined to nearly horizontal (1). (Grande and Bemis, 1998; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

68 Interopercle: absent (0); present (1). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

69 Number of supramaxillae: none (0); one (1); two (2). (Grande and Bemis, 1998; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

70 Premaxilla immovably attached to braincase by means of a long nasal process tightly sutured to frontals: absent (0); present (1). (Grande, 2010; Xu and Wu, 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

71 Foramen for olfactory nerves on premaxilla: absent (0); present (1). (Grande, 2010; Xu and Wu, 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

72 Supraoccipital bone: absent (0); present (1). (Grande, 2010; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

73 Number of lachrymal bone(s): single (0); two or more (1). (Grande, 2010; Xu and Wu, 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

74 Posterior notch of second infraorbital for supramaxilla: absent (0); present (1). (Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

75 Sphenotic with small dermal component: absent (0); present (1). (Grande, 2010; Xu and Wu, 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

76 Tube-like canal bearing anterior arm of antorbital: absent (0); present (1). (Grande, 2010; Xu and Wu, 2012; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

77 Intercalar/parasphenoid contact: absent (0); present (1). (Gardiner et al., 1996; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

78 Antorbital contributing to orbital margin: present (0); absent (1). (Xu et al., 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

79 Ethmoid ossification: present (0); absent (1). (Grande, 2010; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

80 Mobile maxilla in cheek: absent (0); present (1). (Coates, 1999; Brito and Alvardo-Ortega, 2013; Xu et al., 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

81 Posterior border of last infraorbital inclined backwards: absent (0); present (1). (Gardiner et al., 1996;

Alvarado-Ortega and Espinosa-Arrubarrena, 2008; Xu et al., 2014; Xu and Shen, 2015)

82 Number of infraorbitals between antorbital and dermosphenotic: two or three (0); four or five (1); six or more (2). (Gardiner and Schaeffer, 1989; Xu et al., 2012; Xu et al., 2014; Xu and Shen, 2015)

83 Elongated posteroventral process of quadrate: absent (0); present (1). (Arratia and Schultze, 1990; Arratia, 1999; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

84 Uroneurals: absent (0); present, both preural and ural neural arches modified as uroneurals (1); present, only ural neural arches modified as uroneurals (2). (Arratia, 1999; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

85 Vomer in adults: paired (0); median (1). (Patterson, 1975; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

86 Parasphenoid/basioccipital contact: absent (0); present (1). (Xu et al., 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

87 Internal carotid foramen on parasphenoid: absent (0); present (1). (Gardiner et al., 1996; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

88 Efferent pseudobranchial foramen on parasphenoid: absent (0); present (1). (Gardiner et al., 1996; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

89 Dermohyal: present (0); absent (1). (Xu and Gao, 2011; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

90 Coronoid process: absent (0); present (1). (Gardiner and Schaeffer, 1989; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

91 Intercalar: present (0); absent (1). (Gardiner et al., 1996; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

92 Number of hypobranchials: three (0); four (1). (Grande, 2010; Xu and Wu, 2012; Brito and Alvardo-Ortega, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

93 A gap between hypurals 2 and 3: absent (0); present (1). (Arratia, 2013; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

94 Symplectic/quadrate contact: present (0); absent (1). (Grande, 2010; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

95 Lateral line ossicles extending onto caudal fin: absent (0); present (1). (Gardiner et al., 1996; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

96 Scales: rhomboid (0); amioid-type, subrectangular to elongate oval (1); lost (2). (Alvarado-Ortega and Espinosa-Arrubarrena, 2008; Brito and Alvardo-Ortega, 2013; Xu et al., 2012; Xu et al., 2014; Xu and Shen, 2015; Sun et al., 2017)

97 Contact relationships of nasals: separated by broad rostral (0); contact or almost contact each other medially (1); separated by anterior portion of frontals and/or other bones (2). (Modified from Arratia, 2013)

98 Parietal portion of the supraorbital sensory canal: present (0); absent (1). (Wiley, 1976; Cavin, 2010; López-Arbarello, 2012; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016)

99 Junction of supraorbital canal with infraorbital canal: absent (0); present (1). (Wiley, 1976; Cavin and Suteethorm, 2006; Grande, 2010)

100 Frontal/parietal length ratio: >= 2.5 (0); < 2.5 (1). (Jain, 1983; Cavin, 2010; López-Arbarello, 2012; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016)

101 Quadrate covers partly by infraorbitals: absent (0); present (1). (Modified from Deesri et al., 2016)

102 Supra-angular: present (0); absent (1). (Grande, 2010; Brito and Alvardo-Ortega, 2013; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016)

103 Exposed, anterodorsal projection of subopercle: little or narrow projection extending dorsally (0); forming an elongated process extending one third or two thirds the way up along the anterior edge of the opercle (1). (Grande, 2010; López-Arbarello, 2012; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016)

104 Exposure of dorsal limb of preopercle: mostly exposed forming a significant part of the ornamented lateral surface of the skull (0); entirely covered or nearly covered by other dermal bones in adult (1). (Grande, 2010)

105 Posttemporal penetration by lateral line canal: present (0); absent (1). (Grande, 2010; López-Arbarello, 2012; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016)

106 'Leptolepid' notch in ascending margin of dentary: absent (0); present (1). (Arratia, 2013)

107 Mobile premaxilla: absent (0); present (1). (Arratia, 2013)

108 Infraorbital/preopercle contact: absent (0); present (1).

109 Quadratojugal: absent (0); present (1). (Modified from Grande, 2010; Brito and Alvardo-Ortega, 2013; López-Arbarello, 2012; Cavin et al., 2013; Deesri et al., 2013; Deesri et al., 2016; Sun et al., 2017)

110 Nasal process of premaxilla forms much of the ornamented dermal roof in the snout region: absent (0); present (1). (Grande, 2010)

111 Anterior extent of preopercle: not reaching below anterior part of orbit (0); reaching below anterior part of orbit (1). (Grande, 2010)

112 Supraorbital canal incorporated into premaxilla: absent (0); present (1). (Grande, 2010)

(2) Data matrix

The states of character 41 are constant throughout the selected taxa and are not included when performing the phylogenetic analysis.

‘*Perleidus*’ *madagascariensis*

0??0??00?0?00?0000?000000?0??0?00000000?00200??0000000?000000000?0?000000000000000000000000????0000010?0000010000

Amia calva

11?32111111211300102001000000100000000110000111000110001100011000101111000110101010001001101000110110000000000000

Amiopsis lepidota

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Atractosteus

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Obaichthys decoratus

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Calamopleurus cylindricus

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Caturus furcatus

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Cyclurus kehreri

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Dorsetichthys

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Pholidoctenus

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Ikechaoamia meridionalis

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Ionoscopus cyprinoides

0101000100000000001?2000001000100000000100000000000000011001111100001 11?001111101?100

0100110?00011??00000?0000000

Leptolepis coryphaenoides

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Quetzalichthys

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Robustichthys

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Panxianichthys

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Furo muensteri

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Semionotus elegans

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Sinamia zdanskyi

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Solnhofenamia elongata

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Teoichthys kallistos

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Vidalamia catalunica

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Watsonulus eugnathoides

00000001000000000003000000000?10000000010000000?000000000100011000001111000110001010 00100110?000010000000000001000

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