**APPENDIX 1**

**Data used in the phylogenetic analysis of *Amakusaichthys benammii* sp. nov.**

This supplementary file presents the data considered in the phylogenetic analysis indicated in the main text, including the list of characters (Table S1) and its generated data matrix (Table S2). In addition, this document shows the results obtained from this analysis. As is indicated in the main text, two consensus trees were obtained, one by majority rule of 50% and the other by strict consensus (Figure 16 of main text). Table S3 shows the support supporting characters of the nodes of these hypotheses generated by PAUP.

Data to perform the present phylogenetic analysis are based on those of the phylogenetic analysis B performed by Hacker and Shimada (2021), which at the same time is constructed with data from previous studies (Cavin et al., 2013; Yabumoto et al., 2018; Cavin and Berrell, 2019; Baños-Rodríguez et al., 2020).

It adds data of the species described here and five new characters [size of the preopercular horizontal limb (ch. 73), relative position of the pelvic fin (ch. 74), shape of the hypural 2 (ch. 75), presence of the folded corner ridge in the hypural 2 (ch. 76), and presence of saddle-shaped processes in the most posterior preural centra (ch. 77)] (Appendices 1–2). The following characters of *A. goshouraensis* change in this study based on the main text and figures of Yabumoto et al. (2018): ch. 27 is 0, ch. 28 is 1, Ch. 53 is 4, ch. 61 is ?, Ch. 65 is 0, ch. 66 is 2, ch. 69 is 1, and ch. 70 is 0.

Table S1. List of characters used in the present phylogenetic analysis.

**1. Epioccipital crest.**

0) Absent.

1) Present.

**2. Supraoccipital crest.**

0) Absent or small.

1) Large, extending over the occipital region only.

2) Very large and extending over ﬁrst few vertebrae.

**3. Parietals.**

0) Paired.

1) Fused in midline.

**4. Notch in frontal to receive nasal.**

0) Absent.

1) Present.

**5. Anterior extent of the pterotic.**

0) Not reaching the level of the autosphenotic bone.

1) Extending anteriorly beyond the level of the autosphenotic bone.

**6. Intercalar.**

0) Normal in size.

1) Enlarged, forming part of the hyomandibular facet and enclosing a canal for the jugular vein.

**7. Occipital condyle.**

0) Simple condyle formed entirely by basioccipital.

1) Compound condyle formed by both basioccipital and exoccipitals.

**8. Basipterygoid process.**

0) Small or absent.

1) Prominent, angled downward.

2) Prominent, angled upward.

**9. Parasphenoid dentition:**

0) Present.

1) Absent.

**10. Parasphenoid proﬁle.**

0) Almost straight in lateral view or forming only a slight angle beneath the posterior margin of the orbit.

1) Forming a pronounced angle beneath the posterior margin of the orbit.

**11. Parasphenoid extent.**

0) Extends posteriorly to the occipital condyle.

1) Fails to reach the occipital condyle.

**12. Vomer.**

0) With teeth.

1) Teethless.

**13. Ethmopalatine.**

0) Absent.

1) Small, no membranous outgrowth, articular facet simple, and ventrally orientated.

2) Large, no membranous outgrowth.

3) Large, with membranous outgrowths separating and suturing with the rostrodermethmoid and lateroethmoid, its articular facet is complex.

**14. Rostrodermethmoid.**

0) With a considerable constriction behind the initial extension in the dorsal view.

1) Only slight constriction behind the initial extension.

2) Absent.

**15. Suborbital.**

0) Absent.

1) Present.

**16. Perichondral basal sclerotic bone with a serrated margin.**

0) Absent.

1) Present.

**17. Supramaxillae.**

0) Two, the posterior one with a long and thin anterodorsal process extending over the anterior supramaxilla.

1) Two, the posterior one without a long process.

2) Two, the posterior one with a long and thin anteroventral process extending under the anterior supramaxilla.

3) Absent.

4) One supramaxilla.

**18. Premaxilla articulations.**

0) With a well-developed dorsal process, articulating with the maxilla.

1) With a poorly developed or no dorsal process, articulating with the maxilla.

2) Firmly attached posteriorly to maxilla.

3) Firmly attached to the skull roof.

**19. Oral margin of the maxilla.**

0) Regularly convex.

1) Straight or slightly convex.

2) Sinusoidal.

**20. Shape of the maxilla.**

0) The bone is machete-shaped because its alveolar-posterior part is relatively high and expanded, while its small and shallow articular-anterior limb projects anterodorsally.

1) The articular-anterior and alveolar-posterior parts of the bone are high, and their ventral and dorsal margins are parallel.

2) The alveolar-posterior part of the maxilla is triangular; its anterior end is as high as the articular-anterior part of the bone, and its ventral and dorsal margins converge posteriorly.

**21. Teeth in jaws.**

0) In several series.

1) In a single series.

2) Absent.

**22. Maxillary teeth.**

0) Uniform in size.

1) Irregular in size.

2) Absent.

**23. Maxillary and dentary teeth.**

0) Conical with no carinae.

1) Laterally compressed with no carinae.

2) Conical, with anterior and posterior carinae.

**24. Premaxillary teeth.**

0) Regular size.

1) Irregular size.

**25. Symphyseal teeth on premaxilla.**

0) Absent.

1) Present.

**26. Dentary teeth.**

0) Regular size.

1) Irregular size.

**27. Dentary teeth, orientation.**

0) Perpendicular to the oral margin.

1) Anteriorly inclined.

**28. Replacement tooth alveoli.**

0) Absent.

1) Present.

**29. The coronoid process is reduced, the oral and ventral margins of the mandible are almost parallel, and the mandibular symphysis is deep.**

0) Absent.

1) Present.

**30. Predentary.**

0) Absent.

1) Present as an isosceles triangle.

2) Present as a right triangle, with a right angle at the posteroventral corner.

**31. Fossa well deﬁned on the medial side of the mandible near its anterior extremity.**

0) Absent.

1) Present.

**32. Retroarticular contributes to the articular facet.**

0) Unknown because retroarticular fused.

1) Present.

2) Absent.

**33. Angular contributing to articular facet for quadrate.**

0) Unknown because it fused with another bone.

1) Absent.

2) Present.

**34. Head proportion index (hpi) (position of the lower jaw-quadrate articulation).**

0) The hpi index > 0.8, the lower jaw-quadrate articulation is below the posterior half of the orbit or posterior to the orbit.

1) 0.4<hpi<0.7, the lower jaw-quadrate articulation is below the anterior margin of the orbit.

2) hpi < 0.2, the lower jaw-quadrate articulation is below the lateroethmoid.

**35. Mouth cleft orientation.**

0) Directed anteriorly.

1) Directed upward.

**36. Hyomandibular.**

0) With no fossae.

1) With fossae both sides of hyomandibular ridge.

2) With single fossa.

**37. Opercular process on the hyomandibular.**

0) Well-deﬁned and rounded.

1) Prominent vertical ridge.

**38. Preopercular process on the hyomandibula.**

0) Absent.

1) Present.

**39. Contact metapterygoid-palatine.**

0) Absent.

1) Present.

**40. Anterior ceratohyal with a foramen.**

0) Absent.

1) Present.

**41. Parietal branch of the supraorbital sensory canal.**

0) Present.

1) Present as an anterior pit line only.

**42. Otic sensory canal.**

0) Bone enclosed throughout its path.

1) In a groove (at least in the anterior part).

**43. Canaliculi in infraorbital canal.**

0) Few.

1) Many.

**44. Infraorbital canal.**

0) Ends blindly in the infraorbital 1.

1) Extends into antorbital bone.

**45. The mandibular sensory canal runs above a ventrally oriented groove.**

0) Absent.

1) Present.

**46. Extrascapular.**

0) Normal size.

1) Large, covering the lateral face of the supraoccipital crest.

**47. Coracoid.**

0) Normal.

1) Enlarged, broadly meeting antimere in the ventral midline.

**48. Shape of the first pectoral ray.**

0) 1.5 times the breadth of the second pectoral ray.

1) 2 or more times the breadth of the second ray.

**49. Interdigitating suture uniting paired pelvic bones.**

0) Absent.

1) Present.

**50. Anterior process of the pelvic bone.**

0) Broad.

1) Rod-like.

**51. Co-ossification of the parapophyses.**

0) Absent, these bones are autogenous,

1) Present, the parapophyses are co-ossiﬁed with the respective centra.

**52. Rib shape**

0) Tapers regularly from the proximal to the distal extremities.

1) With an anterior wing along the proximal quarter.

**53. Relative position of anal and dorsal fins.**

1) Both anal and dorsal fins are triangular; the dorsal fin is short and extends in the middle of the trunk, and the anal fin is long and extends far in the back of the trunk and well behind the dorsal ﬁn.

2) The dorsal fin is triangular and shorter than the long falcate anal fin, their anterior ends oppose each other, and both fins arise in the middle of the trunk.

3) The dorsal fin is shorter than the anal fin, its anterior end arises well behind the high part of the long falcate anal fin, and both fins occur far in the back of the trunk.

4) The dorsal fin is triangular and shorter than the long falcate anal fin, its anterior end opposes the anterior lobe of the anal fin, and both fins arise far in the back of the trunk.

**54. Length of the first anal and dorsal proximal pterygiophores.**

0) Short, these do not reach the hemal spine or tip-to-tip contact with the hemal spine

1) Long, these extend within the interhemal spine spaces.

**55. Shape of the ﬁrst dorsal proximal pterygiophore.**

0) Simple or rod-like.

1) Basally forked.

**56. Epineural bones.**

0) Absent.

1) Present, elongated.

**57. Anterior supraneurals.**

0) Simple rod-like structure

1) With an anterior membranous blade.

**58. Ventral lobe of the caudal ﬁn in adult-sized individuals.**

0) As long as the dorsal lobe.

1) At least 1.4 times longer than the dorsal lobe.

**59. Ornamentation in the lateral sides of the vertebrae**.

0) With several (at least 3) shallow longitudinal grooves or elongated pits.

1) With a longitudinal, lateral ridge separating two deep, elongated pits.

2) With a single pit.

3) Smooth.

**60. Fusion of the hemal arches.**

0) Absent, the hemal arches are autogenous.

1) Present, the hemal arches fuse to the respective caudal centra.

**61. Articulation ural1-hypurals 1 and 2.**

0) These bones show simple surfaces with no differentiated facets and articular heads.

1) The hypural 1 or hypurals 1 and 2 have a protruding articular head that matches a deep articular facet of the ural 1, forming a ball-and-socket joint.

**62. Number of epurals.**

0) 3.

1) 2.

2) 1.

**63. Number of hypurals.**

0) 7.

1) 8.

2) Nine or more.

**64. Position of the uroneurals**

0) All lie on the dorsal lateral side of the urals and posterior preural centra.

1) The ﬁrst three or four extend anteroventrally, covering the lateral surface of the urals and posterior preural centra.

**65. Anterior extension of the uroneural 1**.

0) The uroneural extends forwards up to the preural 2.

1) The uroneural extends forwards up to the preural 1.

2) The uroneural extends forwards up to the preural 4.

3) The uroneural extends forwards up to the preural 3.

**66. Number of urodermals.**

0) 1.

1) 2.

2) None.

**67. Sutures between segments of the caudal ﬁn**

0) straight or sigmoidal.

1) zigzagging or step-like.

**68. Scales with pits on the posterior exposed part.**

0) Pits absent.

1) Pits present.

**69. Number of total vertebrae.**

0) Less than 75.

1) 76-85.

2) 86-95.

3) More than 96.

**70. Cleithrum shape in lateral view.**

0) Its vertical and horizontal arms are aligned at an obtuse angle.

1) Its vertical and horizontal arms are aligned approximately perpendicular.

**71. Posteriorventral end of the preopercle.**

0) Short.

1) Elongated until the posterior border of the opercle.

**72. Size of the dorsal limb of preopercle.**

0) High exceeds half of the opercular height.

1) Sallow, reaching only the level of mid-height of the opercle.

**73. Size of the preopercular horizontal limb.**

0) The length of the preopercular horizontal limb is smaller than the height of the preopercular vertical limb.

1) The length of the preopercular horizontal limb is larger than the height of the preopercular vertical limb.

**74. Position of the pelvic fin.**

0) In the middle of the abdomen, the pelvic-pectoral distance is nearly two times the pelvic-anal distance.

1) Positioned further back in the abdomen, near the anal fin and the pectoral-pelvic distance is about four times the pelvic-anal distance.

**75. Shape of the hypural 2.**

0) Rectangular, smaller than hypural 1.

1) Triangular or fan-shaped, larger than the hypural 1.

**76. Folded corner ridge in the hypural 2.**

0) Absent.

1) Present.

**77. Saddle-shaped processes in the anterodorsally edge in the neural spines of posterior preural centra.**

0) Absent.

1) Present.

Table S2. Data matrix considered in the present phylogenetic analysis. Abbreviation of polymorphic characters P = 0 and 1; Q= 1 and 2.

|  |  |
| --- | --- |
| *Taxon* | 1 2 3 4 5 6 7 7  12345678901234567890123456789012345678901234567890123456789012345678901234567 |
| *Elops hawaiensis*  *Allothrissops mesogaster*  *Amakusaichthys benammii* sp.nov.  *Amakusaichthys goshouraensis*  *Bardackichthys carteri*  *Chirocentrites coroninii*  *Chiromystus mawsoni*  *Cladocyclus gardneri*  *Cladocyclus geddesi*  *Cooyoo australis*  *Dugaldia emmilta*  *Eubiodectes libanicus*  *Ghrisichthys bardacki*  *Gillicus arcuatus*  *Gillicus serridens*  *Heckelichthys preopercularis*  *Heckelichthys*“Vallecillo”  *Heckelichthys vexillifer*  *Ichthyodectes ctenodon*  *Jinjuichthys cheongi*  *Mesoclupea showchangensis*  *Occithrissops willsoni*  *Ogunichthys triangularis*  *Saurocephalus lanciformis*  *Saurodon elongatus*  *Saurodon intermedius*  *Saurodon leanus*  *Thrissops formosus*  *Thrissops "*Kimmeridgean"  *Unamichthys espinosai*  *Vallecillichthys multivertebratum*  *Verraesichthys bloti*  *Xiphactinus audax* | 00000000000000000000000000000000000000000000000000000000000000000000000000000  000010010010101000021000000000?120000?01000?1010?1001110000?00113110000001000  111011011111310112011000?00110?222110000111?1111010041110210?1010211100011111  ????1???????31??1?01100??1011??2221???????101??1??1041110211?1?10211100011111  101?0??????????10?0122-??--0?0???1111?0?????1?11?1101??10201?1?0121?000000000  11???1???1??????1220110101-0100??01???????101110110011111210???10?1?0?0001000  1?1??11?11??2????1201001?10010???0120?0???111?10???101?11010???1??110???0?000  1210111211?0301111101P0PP100100120120101111?P1?001011101?01012110211010001000  121011??????30?111?01000?10010012?120???????1????????????????????????10001???  11110112111?300112101000?10?10?2?012??0?????0?10??0????1??1?????????0?0001???  ???001101110310?0?00120??10?00??21100001??1?1?10??01???11000??????1?0?000?000  12100??2111?2??112201001110010???11?0?0?00?11110?1001101121011?10?10000001000  111111?1101?3?011210100??000100??112000??0101?11??00???1??10???12???00000????  1111111211?131?11220100000?010122111101111??1?10?1001111?0101?013?110?0001000  121?11???1??31??2220100101??10??211?????11??1110??0?????1?1???????????000????  10??0???10??20002201??0?0???10??2210???0001?0?10?0104101021111?10?10001111000  121?0??111??20?11201---?0--010???2101?1??00?01?011004101?21?11?11???0?0011000  12100??11???20?11201---?0-0010???210110???0?01?0????4111?21????????00?0111000  11111111101?30?1121010?0000010?2201?10?1??????10????2??????01?013?11000001000  1?0001?211??????0?02122?000?00???110??0?????10???1?111??00000000000??00000000  ?0010????1?????001021000000?00???11???1???????10???011110000?200320?0?0000000  0000?1??11??2??00102??00000?00???0100?0110??1?100101111??2101010300?000000000  ?100?1?111??30?102Q01001110?00?22110??0???1?1110?10011?10?1??0?132?1000100000  1111111??????1???21110100011111?????????0???????????????????????????????0?000  ?????1???1???????22110???01?1P?2??1??00???????1??110110100101?013?113???01000  11101????????1??1211101110101????11???0?00??0?????????????????????????000????  11111111111131?02211101000111112211?1?01????0?1???????????101?011??1300001000  120011?110?12?01011210000000000??0100?0010??111001011111100110102010000000000  1201?1??001?201?0102100010000001?010010???0?0?1????0111???0???????10??000????  110011?111??311112001000010?10?2201???????1?0110??0011?1?210?0?132?1100000000  121111?111?131?12201102101001212?112101?????00101100110100101?013?11310001000  121011??1???30??02121000100?00???110000???????11??0?11?1??10??00????000000000  1111111110003001121011010100100220121011?01?0111110021?110101?013?11200001000 |

Table S3. Supporting characters of both strict consensus phylogenetic hypotheses of Ichthyodectiformes obtained in this work (Figure 16 in the main text), including unambiguous characters (shown by both the Acctran and Deltran optimization criteria) and unambiguous characters (indicated by one or the other of these optimization criteria). The characters are shown as follows: "N (x.xxx) A→B", in which: N = character number (as listed in Table 1.1); x.xxx = individual consistency index of the respective character; A→B, step or change of the state characters, from the previous (A) to final (B) state. Synapomorphies appear in black.

|  |  |  |
| --- | --- | --- |
|  | Analysis 1  (including all taxa) | Analysis 2  (excluding *Bardackichthys*, *Jinjuichthys,* and *Mesoclupea*) |
| Node A | Unambiguous  **21 (1.000) 1→0**  **33 (1.000) 2→0**  **47 (1.000) 1→0**  **54 (1.000) 1→0** | Unambiguous  **21 (1.000) 1→0**  **33 (1.000) 2→0**  **47 (1.000) 1→0**  **54 (1.000) 1→0** |
| Node B | Unambiguous  **6 (1.000) 0→1**  9 (0.500) 0→1  10 (0.200) 0→1  13 (0.500) 1→2  18 (0.667) 0→1  **35 (1.000) 0→1**  41 (0.250) 0→1  Acctran  7 (0.500) 0→1  52 (0.200) 0→1  **56 (1.000) 0→1**  61 (0.500) 0→1 | Unambiguous  **6 (1.000) 0→1**  9 (0.500) 0→1  13 (0.500) 1→2  18 (0.667) 0→1  **35 (1.000) 0→1**  41 (0.250) 0→1  **61 (1.000) 0→1**  Acctran  7 (0.500) 0→1  46 (0.500) 0→1  52 (0.250) 0→1  **56 (1.000) 0→1**  57 (0.250) 0→1 |
| Node C |  | Unambiguous  **1 (1.000) 0→1**  2 (0.333) 0→2  16 (0.333) 0→1  Deltran  46 (0.500) 0→1  **56 (1.000) 0→1**  67 (0.500) 0→1 |
| Node D |  | Unambiguous  25 (0.400) 0→1  Acctran  52 (0.250) 1→0  63 (0.333) 1→0  **66 (1.000) 0→2** |
| Node E | Unambiguous  13 (0.500) 2→3  18 (0.667) 1→2  59 (0.250) 0→1  Acctran  32 (0.667) 1→2  43 (0.333) 0→1  49 (0.333) 0→1  68 (0.333) 0→1 | Unambiguous  13 (0.500) 2→3  18 (0.667) 1→2  59 (0.333) 0→1  34 (0.333) 0→1  Acctran  10 (0.200) 0→1  32 (0.667) 1→2  43 (0.333) 0→1  68 (0.333) 0→1 |
| Node F |  | Unambiguous  2 (0.333) 2→1  20 (0.500) 2→0  26 (0.200) 0→1  64 (0.500) 0→1  Deltran  10 (0.200) 0→1  32 (0.667) 1→2  43 (0.500) 0→1  **66 (1.000) 0→2**  68 (0.333) 0→1 |
| Node G |  | Unambiguous  14 (0.250) 0→1  Acctran  25 (0.400) 1→0  Deltran  7 (0.500) 0→1  57 (0.333) 0→1 |
| Node H | Unambiguous  58 (0.500) 0→1  60 (0.333) 0→1  Acctran  4 (0.200) 1→0  5 (0.143) 1→0  7 (0.500) 1→0  19 (0.333) 2→0  40 (0.333) 1→0  48 (0.200) 0→1  51 (0.250) 0→1  65 (0.333) 3→0  Deltran  36 (0.500) 2→1 |  |
| Node I | Unambiguous  34 (0.286) 1→2  53 (0.750) 1→4  **73 (1.000) 0→1**  Deltran  4 (0.200) 1→0  40 (0.333) 1→0  65 (0.333) 3→0 | Unambiguous  20 (0.500) 0→1  34 (0.333) 1→2  40 (0.333) 1→0  53 (0.750) 1→4  Acctran  7 (0.500) 1→0  12 (0.333) 0→1  57 (0.250) 1→0  58 (0.500) 0→1  60 (0.333) 0→1  **73 (1.000) 0→1**  Deltran  4 (0.250) 1→0  58 (0.500) 0→1  65 (0.429) 3→0  **73 (0.750) 0→1** |
| Node J | Unambiguous  28 (0.500) 0→1  69 (0.750) 0→1  **75 (1.000) 0→1**  **76 (1.000) 0→1**  **77 (1.000) 0→1**  Acctran  5 (0.143) 0→1  37 (0.333) 1→0  49 (0.333) 1→0  Deltran  48 (0.200) 0→1 | Unambiguous  28 (0.500) 0→1  48 (0.250) 0→1  69 (0.750) 0→1  Acctran  36 (0.667) 0→1  42 (0.333) 0→1  **75 (1.000) 0→1**  **76 (1.000) 0→1**  **77 (1.000) 0→1**  Deltran  75 (0.750) 0→1  76 (0.750) 0→1  77 (0.750) 0→1 |
| Node K | Unambiguous  13 (0.500) 3→2  14 (0.250) 1→0  36 (0.667) 1→0  45 (0.286) 1→0  68 (0.333) 1→0  Acctran  2 (0.286) 1→2  38 (0.333) 0→1  41 (0.250) 1→0  42 (0.333) 1→0  43 (0.333) 1→0  48 (0.200) 1→0  55 (0.200) 1→0  Deltran  5 (0.143) 1→0 | Unambiguous  5 (0.200) 1→0  13 (0.500) 3→2  14 (0.250) 1→0  45 (0.286) 1→0  68 (0.333) 1→0  Acctran  2 (0.333) 1→2  37 (0.333) 0→1  38 (0.333) 0→1  41 (0.250) 1→0  43 (0.333) 1→0  49 (0.500) 0→1  55 (0.200) 1→0  Deltran  36 (0.667) 1→0  45 (0.286) 1→0  68 (0.333) 1→0 |
| Node L | Acctran  42 (0.333) 0→1  52 (0.250) 0→1  62 (0.667) 1→2  70 (0.500) 0→1  Deltran  20 (0.500) 0→1  45 (0.286) 1→0  55 (0.200) 1→0  57 (0.333) 1→0  69 (0.750) 0→3 |  |
| Node M | Acctran  14 (0.250) 1→0  18 (0.667) 2→1  25 (0.400) 0→P  34 (0.250) 1→0  Deltran  **27 (1.000) 0→1** |  |
| Node N | Acctran  28 (0.500) 0→1  **30 (1.000) 0→1** |  |
| Node O | Unambiguous  10 (0.200) 1→0  19 (0.333) 2→1  Acctran  14 (0.250) 1→0  53 (0.750) 1→2 | Unambiguous  10 (0.200) 1→0  Acctran  14 (0.250) 1→0  19 (0.750) 2→1  53 (0.750) 1→2  Deltran  19 (0.333) 0→1 |
| Node P | Unambiguous  34 (0.286) 1→0  Acctran  45 (0.286) 1→0  Deltran  14 (0.250) 1→0  37 (0.333) 0→1  53 (0.750) 1→2 | Unambiguous  34 (0.333) 1→0  Acctran  45 (0.286) 1→0  Deltran  14 (0.250) 1→0  37 (0.333) 0→1  53 (0.750) 1→2 |
| Node Q | Unambiguous  26 (0.200) 0→1  Deltran  45 (0.286) 1→0 |  |
| Node R | Unambiguous  24 (0.286) 0→1  65 (0.333) 3→0  Acctran  8 (0.333) 1→2  32 (0.667) 2→1  38 (0.333) 0→1  63 (0.250) 0→1  Deltran  19 (0.333) 0→2 |  |
| Node S | Unambiguous  2 (0.286) 1→2  **44 (1.000) 0→1**  55 (0.200) 1→0  Acctran  49 (0.333) 1→0  Deltran  8 (0.333) 1→2 | Unambiguous  2 (0.333) 1→2  8 (0.400) 1→2  44 (0.750) 0→1  55 (0.200) 1→0  Acctran  15 (0.250) 0→1  32 (0.667) 2→1  38 (0.333) 0→1  63 (0.333) 0→1 |
| Node T | Unambiguous  42 (0.333) 0→1  Acctran  52 (0.200) 0→1  62 (0.667) 1→2  70 (0.500) 0→1 | Unambiguous  42 (0.333) 0→1  Acctran  52 (0.250) 0→1  62 (0.750) 1→2  70 (0.500) 0→1 |
| Node U | Unambiguous  14 (0.250) 1→0  18 (0.667) 2→1  Acctran  25 (0.333) 0→P  34 (0.286) 1→0  Deltran  32 (0.667) 2→1  70 (0.500) 0→1 | Unambiguous  14 (0.250) 1→0  18 (0.667) 2→1  Acctran  25 (0.400) 0→P  34 (0.333) 1→0  Deltran  32 (0.667) 2→1  70 (0.500) 0→1 |
| *Allothrissops mesogaster* | Unambiguous  5 (0.143) 0→1  64 (0.333) 0→1  66 (0.667) 0→1  67 (0.500) 0→1  74 (0.333) 0→1  Deltran  13 (0.500) 0→1  15 (0.250) 0→1  63 (0.250) 0→1 | Unambiguous  15 (0.250) 0→1  64 (0.500) 0→1  **66 (1.000) 0→1**  74 (0.500) 0→1  Deltran  13 (0.500) 0→1  67 (0.500) 0→1 |
| *Amakusaichthys benammii* | Unambiguous  60 (0.333) 1→0  Acctran  51 (0.250) 1→0  Deltran  7 (0.500) 1→0  37 (0.333) 1→0  42 (0.333) 0→1  49 (0.333) 1→0 | Acctran  26 (0.200) 1→0  60 (0.333) 1→0  Deltran  7 (0.500) 1→0  37 (0.333) 1→0  42 (0.333) 0→1  49 (0.333) 1→0 |
| *Amakusaichthys goshouraensis* | Unambiguous  26 (0.200) 0→1  Deltran  51 (0.250) 0→1 | Unambiguous  51 (0.333) 0→1  Deltran  26 (0.200) 0→1  60 (0.333) 0→1 |
| *Bardackichthys carteri* | Unambiguous  2 (0.286) 1→0  17 (0.333) 1→0  **21 (1.000) 1→2**  22 (0.500) 0→2  59 (0.250) 1→0  64 (0.333) 1→0  65 (0.333) 0→1  74 (0.333) 1→0  Deltran  5 (0.143) 1→0  48 (0.200) 0→1  51 (0.250) 0→1 |  |
| *Chirocentrites coroninii* | Unambiguous  22 (0.500) 0→1  34 (0.286) 1→0  49 (0.333) 0→1 | Unambiguous  22 (0.750) 0→1  34 (0.333) 1→0  Deltran  49 (0.333) 0→1 |
| *Chiromystus mawsoni* | Unambiguous  13 (0.500) 3→2  53 (0.750) 1→0 | Unambiguous  13 (0.500) 3→2  53 (0.750) 1→0 |
| *Cladocyclus gardneri* | Unambiguous  19 (0.333) 2→1  22 (0.500) 0→P  24 (0.286) 1→P  45 (0.286) 1→P  Deltran  15 (0.250) 0→1  25 (0.333) 0→P  38 (0.333) 0→1  62 (0.667) 1→2  63 (0.250) 0→1 | Unambiguous  22 (0.750) 0→P  45 (0.286) 1→P  Acctran  24 (0.250) 0→P  Deltran  24 (0.286) 1→P  15 (0.250) 0→1  19 (0.333) 2→1  25 (0.400) 0→P  38 (0.333) 0→1  62 (1.000) 1→2 |
| *Cladocyclus geddesi* | Unambiguous  24 (0.286) 1→0 | Deltran  24 (0.286) 1→0 |
| *Cooyoo australis* | Unambiguous  5 (0.143) 1→0  8 (0.333) 1→2  10 (0.200) 0→1 | Unambiguous  5 (0.200) 1→0  8 (0.400) 1→2  10 (0.200) 0→1 |
| *Dugaldia emmilta* | Unambiguous  5 (0.143) 1→0  8 (0.333) 1→0  22 (0.500) 0→2  52 (0.200) 0→1  59 (0.250) 1→0  Acctran  15 (0.250) 1→0 | Unambiguous  5 (0.200) 1→0  8 (0.400) 1→0  22 (0.750) 0→2  52 (0.250) 0→1  59 (0.333) 1→0 |
| *Eubiodectes libanicus* | Unambiguous  5 (0.143) 1→0  13 (0.500) 3→2  25 (0.333) 0→1  41 (0.250) 1→0  58 (0.500) 0→1  68 (0.333) 1→0 | Unambiguous  5 (0.200) 1→0  13 (0.500) 3→2  25 (0.400) 0→1  41 (0.250) 1→0  58 (0.500) 0→1  68 (0.333) 1→0 |
| *Ghrisichthys bardacki* | Unambiguous  48 (0.200) 0→1  65 (0.333) 3→2  Acctran  37 (0.333) 1→0 | Unambiguous  48 (0.250) 0→1  65 (0.429) 3→2  Acctran  37 (0.333) 1→0 |
| *Gillicus arcuatus* | Unambiguous  8 (0.333) 1→2  39 (0.200) 0→1  Acctran  20 (0.500) 1→0  19 (0.333) 0→2  36 (0.500) 2→1  42 (0.333) 0→1 | Unambiguous  8 (0.400) 1→2  39 (0.250) 0→1  42 (0.333) 0→1  Acctran  36 (0.667) 2→1  Deltran  19 (0.333) 0→2 |
| *Gillicus serridens* | Unambiguous  17 (0.333) 1→2 | Acctran  17 (0.500) 1→2  Deltran  17 (0.400) 1→2 |
| *Heckelichthys preopercularis* | Unambiguous  2 (0.286) 2→0  16 (0.333) 1→0  17 (0.333) 1→2  **71 (1.000) 0→1**  Acctran  43 (0.333) 0→1  Deltran  10 (0.200) 1→0  41 (0.250) 1→0  50 (0.500) 1→0  51 (0.250) 0→1  55 (0.200) 1→0  72 (0.333) 0→1 | Unambiguous  16 (0.333) 1→0  43 (0.333) 0→1  **71 (1.000) 0→1**  Acctran  17 (0.500) 1→2  2 (0.333) 2→0  Deltran  2 (0.333) 1→0  10 (0.200) 1→0  17 (0.400) 1→2  41 (0.250) 1→0  50 (0.500) 1→0  51 (0.333) 0→1  55 (0.200) 1→0  60 (0.333) 0→1  72 (0.333) 0→1 |
| *Heckelichthys vexillifer* | Acctran  55 (0.200) 0→1  Deltran  38 (0.333) 0→1  72 (0.333) 0→1 | Acctran  55 (0.200) 0→1  Deltran  72 (0.333) 0→1 |
| *Heckelichthys* “vallecillo” | Unambiguous  39 (0.200) 0→1  65 (0.333) 0→1  Acctran  51 (0.250) 1→0  Deltran  55 (0.200) 1→0 | Unambiguous  39 (0.250) 0→1  65 (0.429) 0→1  Deltran  55 (0.200) 1→0 |
| *Jinjuichthys cheongi* | Unambiguous  8 (0.333) 1→2  22 (0.500) 0→2  23 (0.667) 0→2  65 (0.333) 3→0  Acctran  61 (0.500) 1→0  Deltran  52 (0.200) 0→1 |  |
| *Mesoclupea showchangensis* | Unambiguous  4 (0.200) 0→1  39 (0.200) 0→1  62 (0.667) 0→2  Deltran  66 (0.667) 0→2 |  |
| *Occithrissops willsoni* | Unambiguous  59 (0.250) 0→1  Acctran  52 (0.200) 0→1  61 (0.500) 0→1  63 (0.250) 0→1 | Unambiguous  10 (0.200) 0→1  59 (0.333) 0→1  Acctran  67 (0.500) 1→0  Deltran  52 (0.250) 0→1 |
| *Ogunichthys triangularis* | Unambiguous  19 (0.333) 0→P  24 (0.286) 0→1  72 (0.500) 0→1  Acctran  57 (0.333) 1→0  Deltran  25 (0.333) 0→1 | Acctran  19 (0.750) 0→P  24 (0.250) 0→1  57 (0.250) 1→0  72 (0.500) 0→1  Deltran  19 (0.333) 0→P  24 (0.286) 0→1  72 (0.333) 0→1 |
| *Saurodon leanus* | Deltran  16 (0.333) 1→0  17 (0.333) 1→2  65 (0.333) 3→1 | Deltran  16 (0.333) 1→0  17 (0.400) 1→2  65 (0.429) 3→1 |
| *Saurodon intermedius* | Unambiguous  4 (0.200) 1→0  25 (0.333) 0→1  Acctran  17 (0.333) 2→1  Deltran  24 (0.286) 0→1 | Unambiguous  25 (0.400) 0→1  Acctran  4 (0.333) 1→0  Deltran  24 (0.286) 0→1 |
| *Saurodon elongatus* | Unambiguous  19 (0.333) 1→2  **30 (1.000) 1→P**  51 (0.250) 0→1 | Unambiguous  51 (0.333) 0→1  Acctran  30 (0.750) 1→P  Deltran  19 (0.333) 1→2  **30 (1.000) 0→P** |
| *Thrissops formosus* | Unambiguous  19 (0.333) 0→1  52 (0.200) 0→1  Acctran  15 (0.250) 1→0  25 (0.333) 1→0  Deltran  12 (0.500) 0→1  40 (0.333) 1→0  57 (0.333) 0→1  60 (0.333) 0→1  63 (0.250) 0→1  65 (0.333) 3→2 | Unambiguous  40 (0.333) 1→0  60 (0.333) 0→1  65 (0.429) 3→2  Acctran  12 (0.333) 0→1  19 (0.750) 0→1  Deltran  12 (0.500) 0→1  19 (0.333) 0→1  52 (0.250) 0→1  57 (0.333) 0→1 |
| *Thrissops* "Kimmeridgean" | 4 (0.200) 0→1  9 (0.500) 1→0  45 (0.286) 1→0  Deltran  15 (0.250) 0→1  25 (0.333) 0→1  38 (0.333) 0→1 | Unambiguous  9 (0.500) 1→0  15 (0.250) 0→1  38 (0.333) 0→1  45 (0.286) 1→0  Acctran  4 (0.333) 0→1  Deltran  4 (0.250) 0→1 |
| *Unamichthys espinosai* | 34 (0.286) 1→0  45 (0.286) 1→0  69 (0.750) 0→1  Deltran  15 (0.250) 0→1 | Unambiguous  15 (0.250) 0→1  34 (0.333) 1→0  45 (0.286) 1→0  69 (0.750) 0→1 |
| *Vallecillichthys multivertebratum* | 2 (0.286) 1→2  23 (0.667) 1→2  26 (0.200) 0→1  **30 (1.000) 1→2**  39 (0.200) 0→1  70 (0.500) 0→1  19 (0.333) 2→0  17 (0.333) 1→2  46 (0.500) 1→0 | Unambiguous  2 (0.333) 1→2  26 (0.200) 0→1  39 (0.250) 0→1  70 (0.500) 0→1  Acctran  19 (0.750) 1→0  23 (0.750) 1→2  27 (0.500) 1→0  30 (0.750) 1→2  Deltran  17 (0.400) 1→2  23 (1.000) 0→2  24 (0.286) 0→1  **30 (1.000) 0→2**  46 (0.500) 1→0 |
| *Verraesichthys bloti* | Unambiguous  3 (0.500) 0→1  19 (0.333) 0→1  48 (0.200) 0→  25 (0.333) 0→1 | Unambiguous  3 (0.500) 0→1  48 (0.250) 0→1  Acctran  19 (0.750) 0→1  Deltran  19 (0.333) 0→1  63 (0.333) 1→0 |
| *Xiphactinus audax* | Unambiguous  11 (0.500) 1→0  22 (0.500) 0→1  24 (0.286) 0→1  39 (0.200) 0→1  48 (0.200) 0→1  69 (0.750) 0→2 | Unambiguous  11 (0.500) 1→0  22 (0.750) 0→1  39 (0.250) 0→1  48 (0.250) 0→1  69 (0.750) 0→2  Acctran  24 (0.250) 0→1  Deltran  24 (0.286) 0→1 |
| *Elops hawaiensis* | Unambiguous  8 (0.333) 1→0  11 (0.500) 1→0  20 (0.500) 2→0  32 (0.667) 1→0  40 (0.333) 1→0  45 (0.286) 1→0  50 (0.500) 1→0  53 (0.750) 1→0  55 (0.200) 1→0  65 (0.333) 3→0  Acctran  13 (0.500) 1→0  15 (0.250) 1→0  63 (0.250) 1→0 | Unambiguous  5 (0.200) 1→0  8 (0.400) 1→0  11 (0.500) 1→0  20 (0.500) 2→0  32 (0.667) 1→0  40 (0.333) 1→0  45 (0.286) 1→0  50 (0.500) 1→0  53 (0.750) 1→0  55 (0.200) 1→0  63 (0.333) 1→0  65 (0.429) 3→0  Acctran  13 (0.500) 1→0  67 (0.500) 1→0 |

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