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Supporting Information

Appendix 1 Characters used in analysis

Appendix 2 Data matrix of taxa and characters

The supporting information is available online at csb.scichina.com and www.springerlink.com. The supporting materials are published as submitted, without typesetting or editing. The responsibility for scientific accuracy and content remains entirely with the authors.

Appendix 1 Characters used in analysis

Characters are adopted from previous publications on the phylogenetic relationships of lower actinopterygians (GS, Gardiner and Schaeffer [31]; GML, Gardiner et al. [32]; P, Pinna [34]; BFG, Bemis et al. [35]; GB, Grande and Bemis [5]; C, Coates [36]; PL, Poplin and Lund [37]; GSM, Gardiner et al. [33]; H, Hurley et al. [19]; G, Grande [3]; XG, Xu and Gao [6]).

1. Post-temporal fossa: present (0); absent (1). (GS-28; C-33; GSM-1)
2. Sub-temporal fossa: absent (0); present (1). (GS-29; GSM-2)
3. Dilator fossa: absent (0); present (1). (GS-31; C-34; GSM-3)
4. Lateral cranial canal: absent (0); present (1). (C-32; GSM-5)
5. Posterior myodome: absent (0); paired (1); median (2). (GS-10; GSM-6)
6. Anterior myodome: present (0); absent (1). (Modified from C-42)
7. Parasphenoid: terminates at otic fissure (0); extends across otic fissure (1); extends to basioccipital (2). (Modified from GSM-8)
8. Parabasal canal: present (0); absent (1). (XG-10)
9. Ascending process of parasphenoid: relatively low, approaching the open of spiracular canal (0); deep, overlapping part of orbitotemporal and otic regions (1). (Modified from GSM-10)
10. Basipterygoid process: present (0); absent (1). (GSM-12)
11. Internal carotid foramen on parasphenoid: absent (0); present (1). (GML-14)
12. Efferent pseudobranchial foramen on parasphenoid: absent (0); present (1). (GML-15)
13. Pterotic: present (0); absent (1). (GML-2)
14. Intercalar: present (0); absent (1). (GML-4)
15. Extrascapular: uneven (0); paired (1). (Modified from PL-12)
16. Sphenotic with small dermal component: absent (0); present (1). (G-23)
17. Rostral(s): one or several bones as a cap on snout apex partially or wholly separating the nasals (0); tube-like, much reduced or fused with other snout bones (1). (GML-19)
18. Position of anteriormost lacrimal: part of orbital ring (0); anterior to orbital ring (1). (G-20)
19. Tube-like canal bearing anterior arm on antorbital: absent (0); present (1). (G-12)
20. Large foramen for olfactory nerves on premaxilla: absent (0); present (1). (Modified from G-8)
21. A peg-like anterior articular process of maxilla: absent (0); present (1). (G-45)

22. Anterior margin of orbit: nasal consisting part of anterior margin of orbit (0); nasal not consisting part of anterior margin of orbit (1).

23. Developed nasal process of premaxilla: absent (0); present (1). (GS-24)

24. Number of lacrimal bones: only a single (0); two (1); three or more (2). (Modified from G-21)

25. Vomer in adults: absent (0); paired (1); median (2). (Modified from G-37)

26. Infraorbitals: two elements (0); three elements (1); four or more elements (2). (Modified from GS-21)

27. Supraorbital bones: absent (0); present (1). (GS-14; GSM-22)

28. Suborbitals (or spiraculars): absent (0); present (1). (Modified from GS-9)

29. Dermohyal: absent (0); present (1). (GSM-24)

30. Mobile premaxilla: absent (0); present (1). (P-14)

31. Maxilla free from preopercular: absent (0); present (1). (C-15)

32. Supramaxilla: absent (0); present, one (1); present, two (2). (Modified from GS-22)

33. Mobile maxilla in cheek: absent (0); present (1). (C-16)

34. Supra-angular: present (0); absent (1). (GSM-27)

35. Coronoid process: absent (0); present (1). (GS-17)

36. Hyoid facet horizontal: absent (0); present (1). (Modified from GSM-29)

37. Double articulation between lower jaw and suspensorium: absent (0); present (1). (G-49)

38. Hyomandibula with canal for the hyoid branch of nerve VII and opercular process: absent (0); present (1). (C-22)

39. Quadratojugal: plate-like, overlying quadrate (0); splint-like bone, bracing quadrate and articulating with preopercular (1); absent (2). (Modified from GSM-26; C-20)

40. Symplectic: absent (0); present, contacting quadrate (1); present, separated from quadrate by quadratojugal (2). (Modified GSM-13; G-69)

41. Uncinate processes on epibranchials: absent (0); present (1). (C-25; G-79)

42. Number of hypobranchials: three (0); four (1). (G-99)

43. Opercular: deeper than subopercular (0); roughly equal or slightly lower than subopercular (1); reduced (2). (Modified from BFG-14)

44. Interopercular: absent (0); present (1). (GS-18)

45. Gular bones: both median and lateral gular bones present (0); median gular present (lateral gulars absent) (1); all absent (2). (Modified from C-11)

46. A notch or concavity in the posterior margin of the maxilla: absent (0); present (1). (GB-62)

47. Clavicle: large, caps anterior end of cleithrum (0); toothed plates on postbranchial lamina of cleithrum (1);

54. Dorsal and anal fin rays: segmented proximally (0);

60. Scales: normal (0); flank scales much deep and narrow (1); reduced, only a few scales in caudal region (2). (Modified from GSM-35)

Taxa	0000000001	1111111112	2222222223	3333333334	4444444445	5555555556
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890
<i>Acipenser</i>	0000012000	0011000???	00?0111000	?0?1000000	0020200110	0000000002
<i>Birgeria</i>	000?1?200?	00??100000	0000021100	0000000000	0000000100	0000000002
<i>Australosomus</i>	0110200111	000010?0??	0?00010110	0000000000	0000000010	000010?011
<i>Dapedium</i>	01?1202???	11001?0000	?110121100	111?110111	??01104110	?01110?211
<i>Felberia</i>	??????????	????10000?	0000?01010	000?010???	??00?0?111	???11??111
<i>Kyphosichthys</i>	??????????	????1?111?	1111?21100	111011?11?	??0120?111	???11??111
<i>Leptolepis</i>	0111202110	1100101000	1110221101	1211110111	1001104010	1111111000
<i>Luganoia</i>	??????????	0???100000	01?0?01110	0010110???	??00100010	001110?011
<i>Macrosemius</i>	?????12???	000?101110	1112120000	1010110111	1101202110	0011101010
<i>Perleidus</i>	0111201110	0000100000	0000?01110	00000001?0	??10100110	0011101010
<i>Pholidophorus</i>	0111202110	1100100000	1110221101	1210110111	1001104110	0111111010
<i>Semionotus</i>	?????12???	0011111111	1112121100	1110110112	1101202110	0011101110
<i>Watsonulus</i>	0?11201110	00?01?1011	1110121100	11101111?1	1101110110	0011101010
<i>Amia</i>	0010202111	0010111011	1110120000	1110111121	1101113010	0011101000
<i>Lepisosteus</i>	1011012110	0011111111	1112121110	1000110112	1100201110	0011101110