

Diversity of Freshwater Fishes in Southeast Asia

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The history of biodiversity research in the freshwaters of Southeast Asia starts with the publication by Bontius in 1642 of a plate representing a fish labelled 'tinca marina' (the 'marine tench', now known as *Notopterus notopterus*). Between the beginning of Linnaean nomenclature in 1758 and April 2009, 6614 nominal species have been described from inland waters (fresh waters, estuaries, inland mangroves) of Southeast Asia (pers. obs.). (Southeast Asia refers here to the area on the mainland between and including the Irrawaddy and Red River drainage, Indonesia eastwards to Bali and Sulawesi, the Philippines and Hainan Island). The discovery and description of new species shows three peaks (Fig. 1), one in the years 1840~1870 (870 nominal species, due mainly to the activity of Pieter Bleeker during his stay in Java),

in 1920~1940 (about 650 nominal species, mainly obtained by expeditions organised by large American and European institutions, and work by colonial administrations) and in 1990~2005 (about 700 nominal species).

In a not yet published checklist, I consider that 2878 of these 6614 nominal species are valid. About 2200 are strictly freshwater species and about 680 are brackish water species and marine species more or less frequently entering inland waters.

There are about 300 additional species present on museum shelves but which are still unnamed and around 200 nominal species presently treated as synonyms that are likely to in fact represent valid species. A reasonable guess is that up to 600 species may still await discovery in the inland waters of the area, especially in Myanmar,

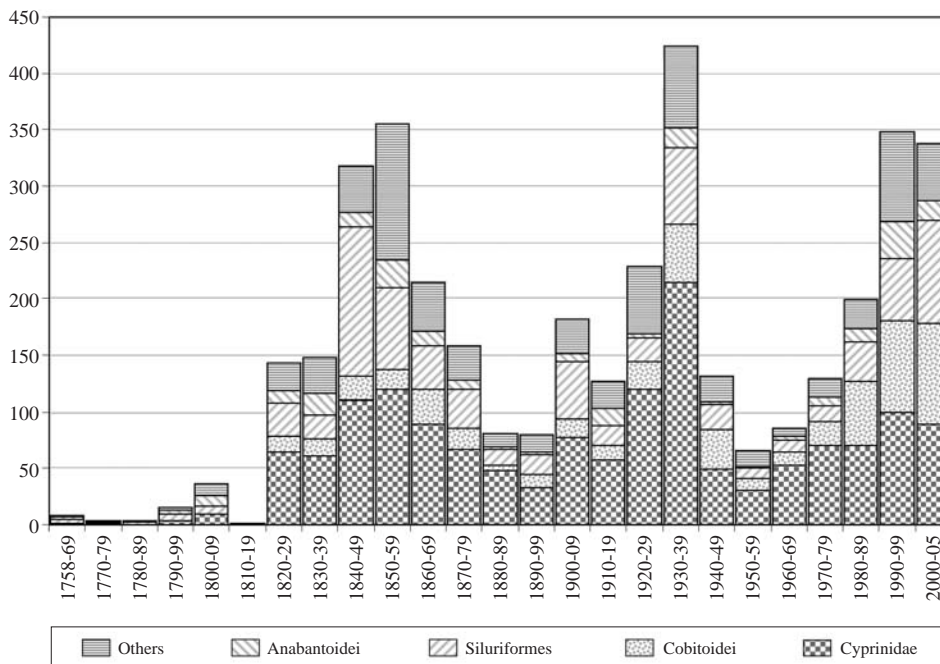


Fig. 1. Species descriptions of Southeast Asian freshwater fishes, distributed in periods of 10 years, between 1758 and 2005.

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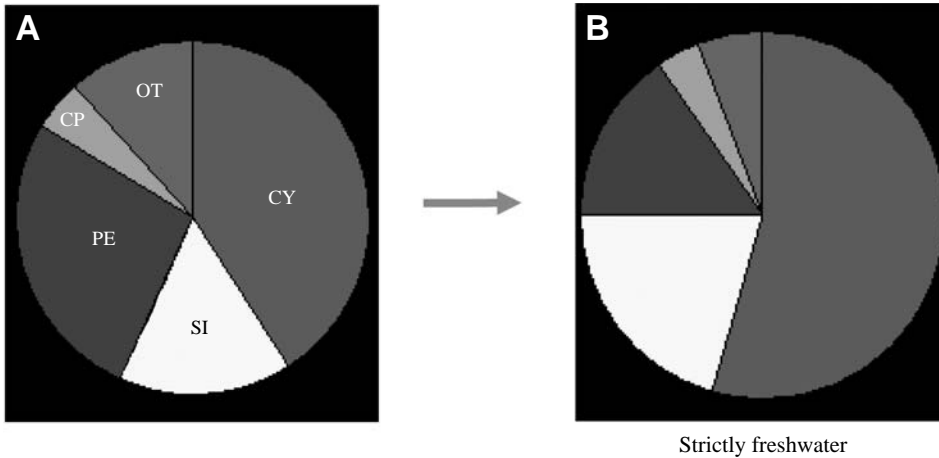


Fig. 2. Composition of the inland fish fauna of Southeast Asia. A, total inland fauna (including estuarine, brackish and occasional species); B, strictly freshwater species. CY, Cypriiniformes; SI, Siluriformes; CP, Cypriinodontiformes, Atheriniformes, Mugiliformes, Beloniformes; PE, Perciformes; OT, others.

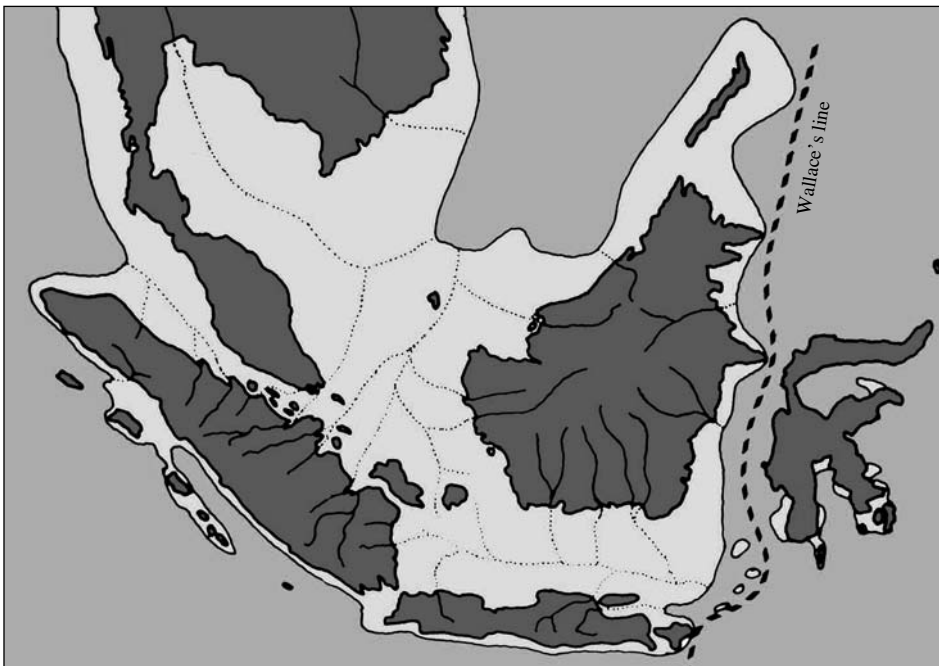


Fig. 3. Sundaland, about 12,000 years BP. Dark gray: present emerged; white: present submerged, but emerged during glaciations; soft gray: sea level during glaciations. Dotted lines represent river course during glaciations.

Vietnam, Laos, Borneo and the Philippines. This brings to an estimated total of 4000 species.

This diversity is made mainly by Ostariophysi, of which about 1000 are Cypriniformes (of which 350 Cobitoidei) and 370 Siluriformes. About 700 are Perciformes (especially Gobioidae and Anabantoidei) (Fig. 2). About 95 families are recorded in inland waters of southeast Asia, much more than in any other area of the world. A great number of them are mostly marine with a few or a single freshwater species, or are represented only by species more or less frequently observed inland. This great number of families (and marine visitors) is explained by several factors, including:

1) the area is surrounded by the richest and most diverse marine fauna of the world;

2) the huge and shallow Sunda shelf, with a low salinity, surrounded by land masses with numerous rivers with high discharge (Fig. 3) apparently allowed an easier access by marine families into inland waters;

3) the river drainages of most areas outside the Sunda Shelf are flowing to deep marine areas (e.g. Sulawesi, Eastern Borneo, the southern coast of Sumatra and Java, the Philippines) and have had only very limited connections with other river drainages; as a result their fauna is made of only few species of the primary freshwater families, allowing marine species to occupy freshwater niches and habitats that remained empty.

As an example of the magnitude of the discoveries done in recent years, I can refer to my work done in Laos. 216 species had been recorded (Taki, 1974) from

this country before I started my work in 1996; actually most were recorded from the Mekong main river were it makes the international border between Laos and Thailand; any species recorded from the Thai shore could logically be expected on the Lao shore too. By the end of 1997 they were 370, by the end of 2000 they were 481 (Kottelat, 2001). Their number now is about 510 named species (unpubl. data). 131 new species were described between 1996 and 2001 (Kottelat, 1998, 2000), collected during only 13 weeks of fieldwork. These figures, however, should not be misinterpreted. They do not represent an excessively high diversity; they more simply indicate that almost nobody had researched this fauna before. In the colonial period there had been only three papers reporting two small collections from outside the Mekong River itself; then the political situation made any research impossible until the early 1990s; and I was lucky to be among the first able to conduct large scale ichthyological exploration in the country and this material was not simply piled on the shelves of a museum. It is nevertheless an extremely rare situation to discover, observe alive in the field and report more than half of the fauna known from such a large area.

REFERENCES

- Kottelat, M. 1998. Fishes of the Nam Theun and Xe Bangfai basins, Laos, with diagnoses of twenty-two new species (Teleostei: Cyprinidae, Balitoridae, Cobitidae, Coiidae and Odontobutidae). *Ichthyological Exploration of Freshwaters*, 9: 1-128.
- Kottelat, M. 2000. Diagnoses of a new genus and 64 new species of fishes from Laos (Teleostei: Cyprinidae, Balitoridae, Bagridae, Syngnathidae, Chaudhuriidae and Tetraodontidae). *Journal of South Asian Natural History*, 5: 37-82.
- Kottelat, M. 2001. *Fishes of Laos*. Wildlife Heritage Trust, Colombo, 198pp.
- Kottelat, M. 2006. *Fishes of Mogolia-A check-list of the fishes known to occur in Mogolia with comments on systematics and nomenclature*. Environment and Socio Development Sector, East Asia and Pacific Region, The World Bank, Washington xii+103.PP.
- Taki, Y. 1974. *Fishes of the Lao Mekong basin*. U.S.A.I.D. Mission to Laos, Vientiane, 232pp.

Appendix.

List of Monolian Fishes

The lecture of Dr Kottelat also included presentation of some results of his work on the fishes of Mongolia. We give here a list of the species, extracted from Kottelat (2006). The check-list below summarizes nomenclaturally valid names of Mongolian fish species, with taxonomic authority. The apparent inconsistency with the use of parentheses in fact is precisely dictated by the International Code of Zoological Nomenclature.

Native	
Petromyzontidae	46. <i>Oreoleuciscus potanini</i> (Kessler, 1879)
1. <i>Lethenteron reissneri</i> (Dybowski, 1869)	47. <i>Phoxinus</i> cf. <i>phoxinus</i> (Linnaeus, 1758)
Acipenseridae	48. <i>Phoxinus ujmonensis</i> Kashchenko, 1899
2. <i>Acipenser baerii</i> Brandt, 1869	49. <i>Pseudaspius leptocephalus</i> (Pallas, 1776)
3. <i>Acipenser schrenckii</i> Brandt, 1869	50. <i>Pseudorasbora parva</i> (Temminck & Schlegel, 1846)
Salmonidae	51. <i>Rhodeus sericeus</i> (Pallas, 1776)
4. <i>Hucho taimen</i> (Pallas, 1773)	52. <i>Rhynchocypris czekanowskii</i> (Dybowski, 1869)
5. <i>Brachymystax lenok</i> (Pallas, 1773)	53. <i>Rhynchocypris lagowskii</i> (Dybowski, 1869)
6. <i>Brachymystax</i> cf. <i>tumensis</i> Mori, 1930	54. <i>Rutilus rutilus</i> (Linnaeus, 1758)
Coregonidae	55. <i>Sarcocheilichthys soldatovi</i> (Berg, 1914)
7. <i>Coregonus chadary</i> Dybowski, 1869	56. <i>Saurogobio dabryi</i> Bleeker, 1871
8. <i>Coregonus migratorius</i> (Georgi, 1775)	57. <i>Squalidus chankaensis</i> (Dybowski, 1872)
9. <i>Coregonus pidschian</i> (Gmelin, 1789)	58. <i>Tinca tinca</i> (Linnaeus, 1758)
Thymallidae	Nemacheilidae
10. <i>Thymallus arcticus</i> (Pallas, 1776)	59. <i>Barbatula compressirostris</i> (Warpachowski, 1897)
11. <i>Thymallus baicalensis</i> Dybowski, 1874	60. <i>Barbatula dgebuadzei</i> (Prokofiev, 2003)
12. <i>Thymallus brevirostris</i> Kessler, 1879	61. <i>Barbatula toni</i> (Dybowski, 1869)
13. <i>Thymallus grubii</i> Dybowski, 1869	62. <i>Barbatula</i> sp. Tuul
14. <i>Thymallus nigrescens</i> Dorogostaisky, 1923	63. <i>Barbatula</i> sp. Egiin 9
15. <i>Thymallus</i> sp. 1	64. <i>Triplophysa gundriseri</i> Prokofiev, 2002
Esocidae	65. <i>Triplophysa</i> sp. Tuul
16. <i>Esox lucius</i> Linnaeus, 1758	Cobitidae
17. <i>Esox reichertii</i> Dybowski, 1869	66. <i>Cobitis melanoleuca</i> Nichols, 1925
Cyprinidae	67. <i>Iksookimia lebedevi</i> (Vasil'eva & Vasil'ev, 1984)
18. <i>Acheilognathus asmussii</i> (Dybowski, 1872)	68. <i>Misgurnus mohoity</i> (Dybowski, 1869)
19. <i>Carassius carassius</i> (Linnaeus, 1758)	Siluridae
20. <i>Carassius gibelio</i> (Bloch, 1782)	69. <i>Silurus asotus</i> Linnaeus, 1758
21. <i>Chanodichthys erythropterus</i> (Basilewsky, 1855)	Lotidae
22. <i>Chanodichthys mongolicus</i> (Basilewsky, 1855)	70. <i>Lota lota</i> (Linnaeus, 1758)
23. <i>Culter alburnus</i> Basilewsky, 1855	Percidae
24. <i>Cyprinus rubrofasciatus</i> La Cepede, 1803	71. <i>Perca fluviatilis</i> Linnaeus, 1758
25. <i>Eupallasella percnurus</i> (Pallas, 1814)	Cottidae
26. <i>Gnathopogon strigatus</i> (Regan, 1908)	72. <i>Cottus szanaga</i> Dybowski, 1869
27. <i>Gobio acutipinnatus</i> Menshikov, 1939	73. <i>Mesocottus haitej</i> (Dybowski, 1869)
28. <i>Gobio cynocephalus</i> Dybowski, 1869	74. <i>Leocottus kesslerii</i> (Dybowski, 1874)
29. <i>Gobio sibiricus</i> Nikolski, 1936	Odontobutidae
30. <i>Gobio soldatovi</i> Berg, 1914	75. <i>Percocottus glenii</i> Dybowski, 1877
31. <i>Gobio tenuicorpus</i> Mori, 1934	Introduced
32. <i>Gobio</i> sp. Onon	a) Species that established self-sustaining populations
33. <i>Hemibarbus labeo</i> (Pallas, 1776)	Coregonidae
34. <i>Hemibarbus maculatus</i> Bleeker, 1871	76. <i>Coregonus peled</i> (Gmelin, 1789)
35. <i>Hemiculter leucisculus</i> (Basilewsky, 1855)	77. <i>Cyprinus carpio</i> Linnaeus, 1758
36. <i>Hemiculter varpachovskii</i> Nikolski, 1904	b) Species usually reported to be present in Mongolia but apparently result from occasional capture of stocked or aquaculture individuals, or introduced species that did not establish
37. <i>Ladislavia taczanowskii</i> Dybowski, 1869	Coregonidae
38. <i>Leuciscus baicalensis</i> (Dybowski, 1874)	78. <i>Coregonus sardinella</i> Valenciennes, 1848
39. <i>Leuciscus dzungaricus</i> Koch & Paepke, 1998	Cyprinidae
40. <i>Leuciscus idus</i> (Linnaeus, 1758)	79. <i>Ctenopharyngodon idella</i> (Valenciennes, 1844)
41. <i>Leuciscus waleckii</i> (Dybowski, 1869)	80. <i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)
42. <i>Microphysogobio anudarinii</i> Holcik & Pivnicka, 1969	Siluridae
43. <i>Oreoleuciscus angusticephalus</i> Bogutskaya, 2001	81. <i>Silurus soldatovi</i> Nikolski & Soin, 1948
44. <i>Oreoleuciscus dsapchynensis</i> Warpachowski, 1899	82. <i>Lefua costata</i> Kessler, 1876
45. <i>Oreoleuciscus humilis</i> Warpachowski, 1889	