

Stocks of *Oryzias* species in Japan

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General account of the *Oryzias* stocks in Japan

Fishes of the genus *Oryzias* (the so-called medaka) inhabit fresh and brackish waters from India throughout South-east Asia across Wallace's line to Timor, Sulawesi, Luzon, and Japan. So far, fourteen species (*O. celebensis*, *O. curvinotus*, *O. javanicus*, *O. latipes*, *O. luzonensis*, *O. marmoratus*, *O. matanensis*, *O. mekongensis*, *O. melastigma*, *O. minutillus*, *O. nigrimas*, *O. profundicola*, *O. orthognathus*, *O. timorensis*) have been described in the literature (Iwamatsu, 1993). It is generally believed that the tiny freshwater fishes (less than 50 mm in total length) are actually not diadromous. These fishes are laterally compressed with a short dorsal and larger anal fin, both posteriorly placed. Their eyes are large and in most species blue, hence their name is Japanese "medaka" or English "blue eye". The genus *Oryzias* belonging to the family Oryziatidae (Oryziidae) is oviporous and possesses non-protrusible jaws and a terminal or superior mouth which facilitates surface feeding. Many distinctive osteological features are considered taxonomical criteria for identifying the superfamily Adrianichthyoidea, which includes Oryziatidae, as follows (Rosen, 1964): Preopercle absent; supracleithrum wanting; auto-palatine usually capped by sesamoid bone; pterygoquadrate cartilage forming dorsal process; lower end of premaxilla not hooked or trapezoidal rib on third vertebra; pelvic bones with upright lateral spurs, not joined at midline; hypochordal musculature present on caudal skeleton; hypural plates in no case joined together; caudal fin forming incipient lobes.

In the period from 1979 to 1992, we have collected twelve species *Oryzias* from Indonesia, India, Thailand, Philippines, China, Korea, and Japan. At present, these are kept at several laboratories in Japan. Because most of them are tropical fishes, they are kept under indoor, temperature-controlled conditions. As more information has become available to biologists, a new approach for clarifying evolution and species differentiation has

been developed. However, the present state of our knowledge on the species of *Oryzias* is not satisfactory.

This description provides the illustration and the data necessary for understanding each species of the genus *Oryzias*. It also offers information investigators can use to gain access to the literature where they may obtain more detailed data pertaining to these fishes.

Acknowledgements

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References

- Iwamatsu, T. (1993) *The Biology of the Medaka*. Scientist Co. (Tokyo). (in Japanese)
Rosen, D.E. (1964) *Bull. Amer. Mus. Nat. Hist.*, **127** (Art. 5): 217–268.

Explanations for 12 species of *Oryzias*

(1) *Oryzias curvinotus* (Fig. 1)

Collector: D. Dudgeon and H. Uwa. (Nov. of 1986 at Sam A Tsuen, Plover Cove Country Park, Hong Kong).

Original description: Nichols, J.T. and C.H. Pope (1927) *Bull. Amer. Mus. Nat. Hist.*, **54**: 321–394.

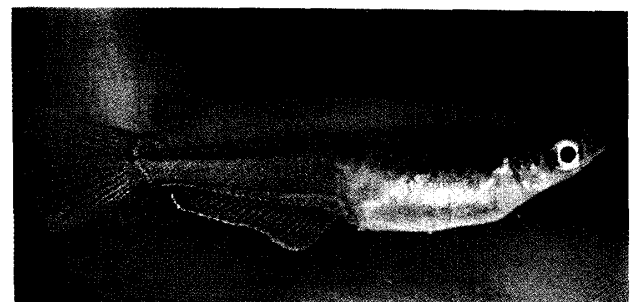
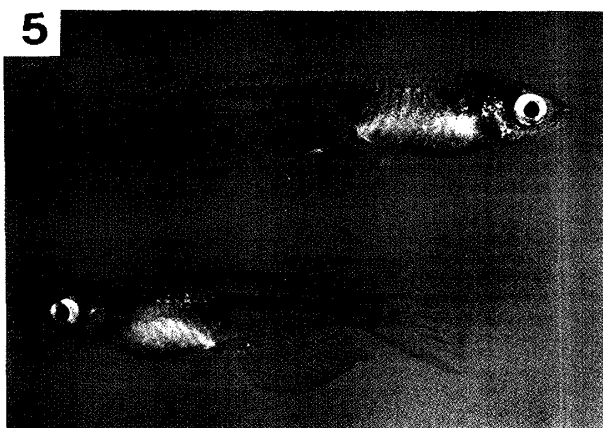
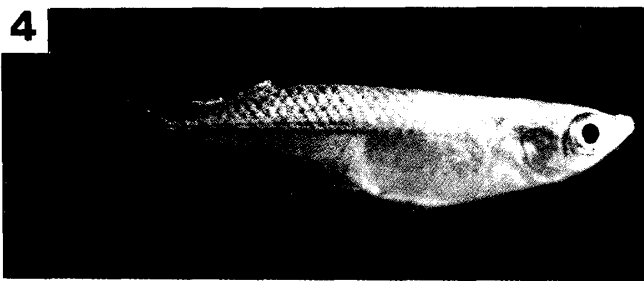
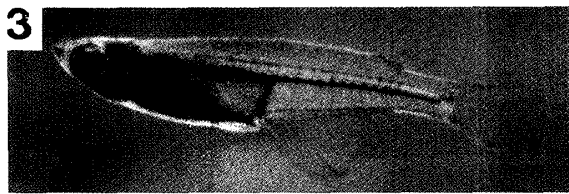
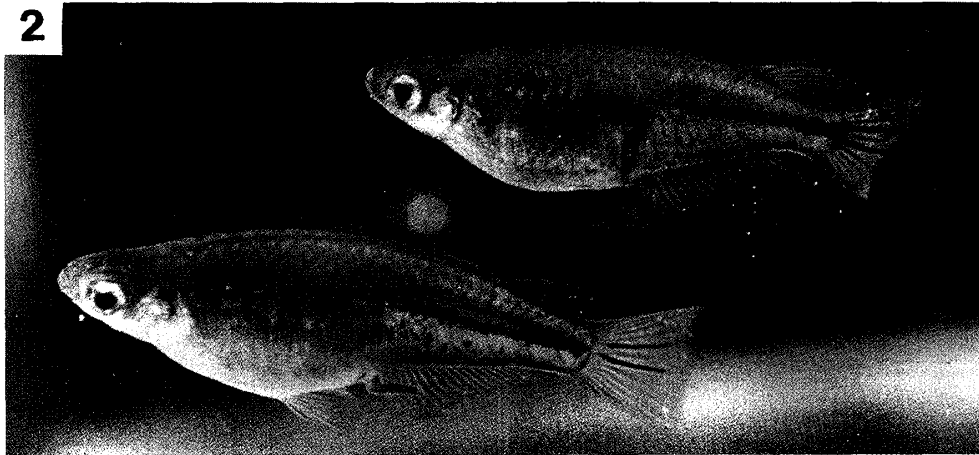
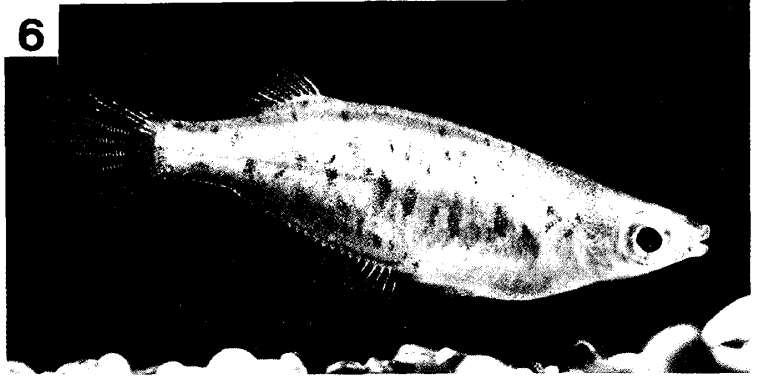
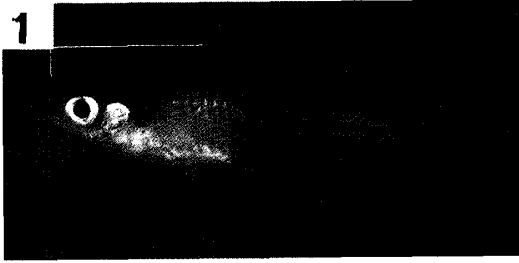
Characterization: SL (standard length), up to 26 mm; D (dorsal fin rays), 5–6; A (anal fin rays), 17–20. Dorsal fin far back. Karyotype; 2n = 48, NF = 82.

Habitation area (Distribution): Southern China.

Breeder: M. Sakaizumi (Breeding place; Dept. Biol., Coll. Gen. Educ., Niigata Univ.)

References:

- Sakaizumi, M., Y. Shimizu, T. Matsuzaki and S. Hamaguchi (1993) *J. Exp. Zool.*, **266**: 312–318.
Uwa, H. (1991) *Ichthyol. Explor. Freshwaters*, **1**: 361–367.



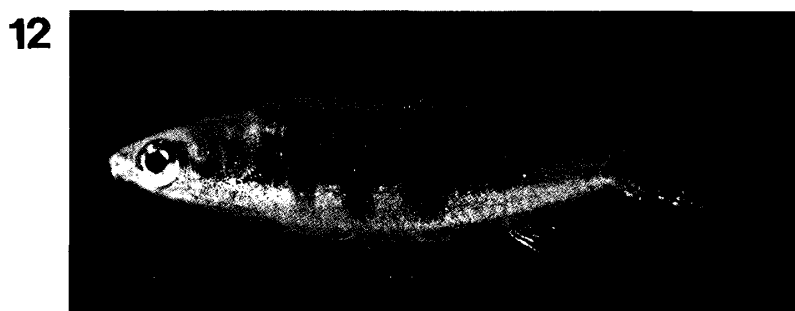
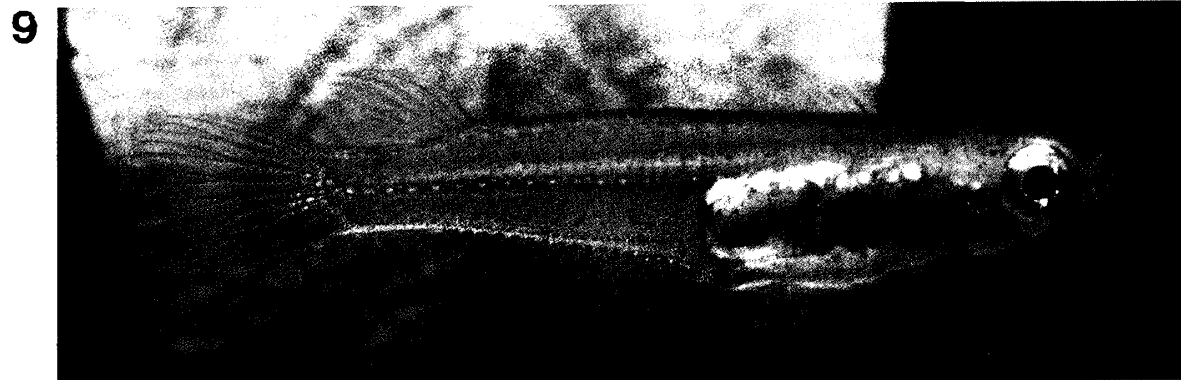


Fig. 1. *Oryzias curvinotus* (male, $\times 2$). Fig. 2. *O. celebensis* (male [upper] and female [lower], $\times 1.4$). Fig. 3. *O. javanicus* (male, $\times 2.5$). Fig. 4. *O. latipes* (male, $\times 2.3$). Fig. 5. *O. luzonensis* (male [lower] and female [upper], $\times 2$). Fig. 6. *O. marmoratus* (male, $\times 3.1$). Fig. 7. *O. mekongensis* (male, $\times 3$). Fig. 8. *O. melastigma* (male [upper] and female [lower], $\times 1.8$). Fig. 9. *O. minutillus* (male, $\times 5$). Fig. 10. *O. nigrimas* (male, $\times 3$). Fig. 11. *O. profundicola* (male, $\times 3$). Fig. 12. *O. matanensis* (male, $\times 1.9$). Photographs were taken by T. Iwamatsu (Figs. 2, 3 and 8), S. Hamaguchi (Figs. 1, 5 and 7), K. Naruse (Figs. 4, 6 and 12), and K. Takata (Figs. 9, 10 and 11).

- Uwa, H. and D. Dudgeon (1988) *Zool. Sci.*, **5**: 1244.
 Uwa, H., K. Tanaka and M.J. Formacion (1982) *Chromosome Inform. Serv.*, **33**: 15–17.

(2) *Oryzias celebensis* (Fig. 2)

Collector: K. Hirata and T. Iwamatsu (Mar. of 1979 in Ujung Pandang, Sulawesi, Indonesia)
 Original description: Weber, M. (1894) *Zool. Ergebn. einer Reise in Niederl.*, **III**: 426.
 Weber, M. and L.F. de Beauform (1922) *The fishes of the Indo-Australian archipelago*. **4**: 370–374.
 Characterization: D, 7–10; P (pectoral fin rays), 10–11; V (ventral fin rays), 6; A, 17–22; L.l. (lateral longitudinal scales), 29–32; L.tr. (lateral transverse scales), 12–14. Long dorsal fin in males. Karyotype; $2n = 36$, NF = 48.
 Habitation area (Distribution): Freshwater in Ujung Pandang, Makassar, Maros, Sidenreng sea, Teleadji, Sulawesi.
 Breeder: T. Iwamatsu (Breeding place; Dept. Biol., Aichi Univ. Educ.).
 References:
 Iwamatsu, T. and K. Hirata (1980) *Bull. Aichi Univ. Educ.*, **29** (Nat. Sci.): 103–120.
 Iwamatsu, T., H. Uwa, A. Inden and K. Hirata (1984) *Zool. Sci.*, **1**: 653–663.
 Uwa, H., T. Iwamatsu and Y. Ojima (1981) *Proc. Japan Acad.*, **57B**: 95–99.

(3) *Oryzias javanicus* (Fig. 3)

Collector: K. Hirata and T. Iwamatsu (May of 1983 at Pluit in Jakarta, Indonesia).
 Original description: Bleeker, P. (1854) *Nat. Tijdschr. Ned. Ind.*, **7**: 309–326.
 Characterization: D, 7; P, 10–11; V, 6; A, 21–24; L.l., 29–30; L.tr., 10. Karyotype; $2n = 48$, NF = 48.
 Habitation area (Distribution): Brackish water or freshwater in Singapore, Jakarta, Lombok, Malacca, Karoli Janos, West Kalimantan.
 Breeder: T. Iwamatsu (Breeding place; Dept. Biol., Aichi Univ. Educ.).
 References:
 Iwamatsu, T., A. Imai, A. Kawamoto and A. Inden (1982) *Annot. Zool. Japan*, **55**: 190–198.
 Iwamatsu, T. and K. Hirata (1984) *Bull. Aichi Univ. Educ.*, **33** (Nat. Sci.): 87–109.

- Iwamatsu, T., T. Watanabe, R. Hori, T.J. Lam and O.P. Saxena (1986) *Zool. Sci.*, **3**: 287–293.

Uwa, H. and A. Iwata (1981) *Chromosome Inform. Serv.*, **31**: 24–26.

(4) *Oryzias latipes* (Fig. 4)

Collector: K. Naruse and O. Terao (1983 at Sakura, Chiba) and M. Sakaizumi (1979 at Sakura, Chiba).
 Original description: Temminck, C.J. and H. Schlegel (1846) *Siebold's Fauna Japonica*, p. 224, Pl. 102, Fig. 5. Jordan, S. and J. Snyder (1906) *Proc. U.S. Nat. Mus.*, **31**: 287–290. (Establishment of the genus *Oryzias*)
 Characterization: A, 17–18; D, 5; V, 5; P, 10. Karyotype; $2n = 48$, NF = 68, 70. Only one species of the genus *Oryzias* distributed in the Temperate Zone. Well studied species in the genus *Oryzias*. Many wild populations, mutation strains and inbred strains are maintained in several laboratories in Japan. An orange-red variety is commercially available.
 Habitation area (Distribution): China, Korea, Formosa and Japan.
 Breeder: A. Shima and A. Shimada (Breeding place; Zool. Inst., Fac. Sci., Univ. Tokyo).
 References:
 Yamamoto, T. (1975) *Medaka (Killifish): Biology and Strains*. Keigaku Publishing Company, Tokyo.
 Egami, N., K. Yamagami and A. Shima (eds.) (1990). *Biology of the Medaka*. Pressed by University of Tokyo, Tokyo. (in Japanese)

(5) *Oryzias luzonensis* (Fig. 5)

Collector: M.J. Formacion and H. Uwa (Dec. of 1982, at Maan-anteng, Solsona, Ilocos Norte Province, Philippines).
 Original description: Herre A.W. and G.L. Ablan (1934). *Philip. J. Sci.*, **54**: 275–277.
 Characterization: SL, up to 28 mm; D, 5–7; A, 16–19; L.l., 30–35; L.tr. 10. Females have an yellowish anal fin. Karyotype; $2n = 48$, NF = 96.
 Habitation area (Distribution): North Luzon in the Philippines.
 Breeder: M. Sakaizumi (breeding place; Dept. Biol., Coll. Gen. Educ., Niigata Univ.)

References:

- Blanco, G.J. (1947) *Philip. J. Sci.*, **77**: 89–92.
 Blanco, G.J. and D.V. Vilalid (1951) *Philip. J. Fish.*, **1**: 79–104.
 Formacion, M.J. and H. Uwa (1985) *J. Fish Biol.*, **27**: 285–291.

(6) *Oryzias marmoratus* (Fig. 6)

- Collector: H. Uwa, K. Naruse and B. Soeroto (1992 at Timmanpu, Sulawesi, Indonesia).
 Original description: Aurich, H. (1935) *Mitteilung XIII. Fische I. Zool. Anz.*, **112**: 97–102.
 Kottelat, M. (1989) *Der Towuti-Sea. Aquar. Terrar. Ztschr.*, **42**: 681–684.
 Characterization: D, 8–11; A, 21–24; P, 9–11; V, 6; L.l., 29–36; L.tr., 11–15. Marmoriert in the lateral lines.
 Habitation area (Distribution): Towuti, Maholona and Wawantao lakes, Sulawesi.
 Breeder: K. Naruse (Breeding place; Zool. Inst., Fac. Sci., Univ. Tokyo) and M. Sakaizumi (Breeding place; Dept. Biol., Coll. Gen. Educ., Niigata Univ.)
 Reference:
 Kottelat, M. (1990) *Ichthyol. Explor. Freshwaters*, **1** (2): 151–166.

(7) *Oryzias mekongensis* (Fig. 7)

- Collector: H. Uwa and W. Magtoon (Apr. of 1984 at Yang Talat, Kalasin Province, Thailand).
 Original description: Uwa, H., and W. Magtoon (1986) *Copeia*, **1986** (2): 473–478.
 Characterization: SL, up to 14 mm; D, 6–7; A, 13–16. Males have bright orange longitudinal sub-distal stripes along upper and lower margins of the caudal fin. Karyotype; 2n = 48, NF = 58.
 Habitation area (Distribution): The Mekong basin of northeast Thailand.
 Breeder: S. Hamaguchi (Breeding place; Dept. Biol., Coll. Den. Educ., Niigata University).
 Reference:
 Uwa, H. and W. Magtoon (1986) *Copeia*, **1986**: 473–478.

(8) *Oryzias melastigma* (Fig. 8)

- Collector: O.P. Saxena and T. Iwamatsu (Oct. of 1981 at Chidambaran, India).
 Original description: McClelland, J. (1836) *As. Res. xix, Ind. Cyp. p. 301, pl. 42, Fig. 3.*

Characterization: D, 6–7; P, 10; A, 20–24; C, 15; L.l., 27–30; L.tr., 9–11. Karyotype; 2n = 48, NF = 48.

Habitation area (Distribution): Freshwater or brackish water in Wynaad, Madolas, South India, Pakistan, Sri Lanka, Lower Bengal, Burma.

Breeder: T. Iwamatsu (Breeding place; Dept. Biol., Aichi Univ. Educ.).

References:

- Iwamatsu, T., T. Watanabe, R. Hori, T.J. Lam and O.P. Saxena (1986) *Zool. Sci.*, **4**: 287–293.
 Sriramulu, V. (1959) *Curr. Sci.*, **28**: 117–118.
 Sriramulu, V. (1963) *La Cellule*, **63** (3): 369–374.
 Uwa, H., T. Iwamatsu and O.P. Saxena (1983) *Proc. Japan Acad.*, **59B**: 43–47.

(9) *Oryzias minutillus* (Fig. 9)

- Collector: H. Uwa and W. Magtoon (Apr. of 1984 at Bangkok, Thailand).
 Original description: Smith, H.M. (1945) *Smithsonian Inst. U.S. Nat. Mus. Bull.*, **188**: 1–622.
 Characterization: D, 6–7; A, 17–21; L.l., 27 or 28; L.tr., 10; Predorsals, 19. This species has the smallest body size (SL, ca. 13 mm) in *Oryzias*. Females spawn less than 4 eggs at a time. Karyotype; 2n = 30, 34, 42, NF = 42, 44.
 Habitation area (Distribution): Shallow pond, ditch and paddy field in Central, North, South, Southeast and Northeast Thailand, Yunnan and Rangoon.
 Breeder: K. Takata (Breeding place; Lab. Embryol., Fac. Sci., Shinshu Univ.).
 References:
 Magtoon, W., N. Nadee, N.T. Higashitani, K. Takata and H. Uwa (1992) *J. Fish. Biol.*, **41**: 489–497.
 Magtoon, W. and H. Uwa (1985) *Proc. Japan Acad.*, **61B**: 157–160.
 Scheel, J.J. (1969) *J. Amer. Killifish Assoc.*, **6**: 5–7.
 Takata, K., M. Hoshino, W. Magtoon, N. Nadee and H. Uwa (1993) *Jap. J. Ichthyol.*, **39**: 319–327.
 Uwa, H. (1993) *Fish Biol. J. Medaka*, **4**: 41–44.

(10) *Oryzias nigrimas* (Fig. 10)

- Collector: M. Kottelat (Jun. of 1989 at Lake Poso, Sulawesi, Indonesia).

Original description: Kittelat, M. (1990) *Ichthyol. Explor. Freshwaters*, **1**: 49–67.

Characterization: D, 8–11; P, 11–12; V, 6; A, 21–25; L.l., 34–37; L.tr., 13–15. This species is distinguished from all other species of *Oryzias* by the unique black nuptial coloration of the adult male. Females spawn up to 25 eggs at a time.

Habitation area (Distribution): Lake Poso, east shore between Tentena and Peura, Sulawesi, Indonesia.

Breeder: K. Takata (Breeding place; Lab. Embryol., Fac. Sci., Shinshu Univ.)

References:

Uwa, H. (1993) *Fish Biol. J. Medaka*, **4**: 41–44.

Uwa, H., K. Takata and M. Kottelat (1991) *Zool. Sci.*, **8**: 1126.

(11) *Oryzias profundicola* (Fig. 11)

Collector: H. Uwa, K. Naruse and B. Soeroto (Oct. of 1992 at Timampu, Lake Towuti, Sulawesi, Indonesia).

Original description: Kottelat, M. (1990) *Ichthyol. Explor. Freshwaters*, **2**: 151–166.

Characterization: D, 10–14; A, 26–29; P, 10–11; V, 6; L.l., 32–34; L.tr., 13–15. Higher body depth, 30–35%.

Habitation area (Distribution): Gently sloping shore below 1.5 m with sand and pebble bottom at Lake Towuti, Sulawesi, Indonesia

Breeder: K. Takata (Breeding place; Lab. Embryol., Fac. Sci., Shinshu Univ.)

Reference:

Uwa, H. (1993) *Fish Biol. J. Medaka*, **4**: 41–44.

(12) *Oryzias matanensis* (Fig. 12)

Collector: H. Uwa, K. Naruse and B. Soeroto (Oct. of 1992 in Soroako, Sulawesi, Indonesia).

Original description: Aurich, H. (1935) *Mitteilung XIII. Fische I. Zool. Anz.*, **112**: 97–107. Kottelat, M. (1989) *Aquar. Terrar. Ztschr.*, **42**: 616–618. (Description of neotype)

Characterization: A, 21–24; D, 7–9; P, 9–11; V, 6; L.l., 40–47; L.tr., 13–19. Endemic species in Lake Matano.

Habitation area (Distribution): Lake Matano, Sulawesi, Indonesia.

Breeder: K. Naruse (Breeding place; Zool. Inst., Fac. Sci., Univ. Tokyo).

Reference:

Kottelat, M. (1990) *Ichthyol. Explor. Freshwaters*, **1**: 151–166.