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CONTENTS

Full Papers

The effects of ayu *Plecoglossus altivelis altivelis* on the abundance and algal-grazing habit of introduced pale chub *Zacco platypus*
Osamu Katano, Yoshihiro Baba, Kouichi Kawamura and Hitoshi Ohara

Habitat use by newly emerged fry of red-spotted masu salmon (*Oncorhynchus masou ishikawae*) in a mountain stream, northeastern Kyushu, southern Japan
Keisuke Kimoto, Masaaki Kagehira, Kazuhisa Azechi and Kazuya Nagasawa

Identification of the reproductive mode for internal gamete association in *Vellitor centropomus* (Cottidae): gonadal histological analysis
Yasunori Koya, Naoya Mitsuhashi, Satoshi Awata, Takeshi Ito and Hiroyuki Munehara

Feeding behavior and interactions of three cyprinid species in experimental streams
Hiromu Ogawa and Osamu Katano

Intergeneric hybridization between Japanese char and red-spotted masu salmon in a tributary of the Ibigawa River, Gifu Prefecture, Japan
Takahiko Mukai, Ryo Futamura, Taiki Niwa, Akihiko Goto, Naoki Miwa, Wataru Ishizuka, Yuichi Yaoi and Masaki Takagi

Short Reports

Different timing of spawning migration of sexes in Honmoroko *Gnathopogon caerulescens* from Lake Biwa to the Ibanaiko Lagoon, Japan
Takeshi Kikko, Haruo Okamoto, Muneji Ujiie, Daisuke Ishizaki, Jin Saegusa, Yoshiaki Kai and Yasuhiro Fujioka

Embryonic and larval development of the rosy seabass *Doederleinia berycoides* (Acropomatidae)
Yuta Yagi, Makoto Nitta, Naoki Iida, Hiroyuki Takeuchi, Tatsuya Yamada, Sou Nagasoe, Takeo Yamamoto, Hideo Takahara, Tomoaki Iseki and Shinji Uehara

Long-term effects of bluegill on the population sizes of two freshwater fishes in artificial ponds
Osamu Katano, Hiromu Ogawa, Tomoyuki Nakamura and Shoichiro Yamamoto

The records of the chiasmdontid fish *Pseudoscopelus obtusifrons* from Japan
Seishi Kimura, Junji Yonezawa and Marcelo R. S. Melo

First records of the cardinalfish *Neamia notula* (Perciformes: Apogonidae) from the northwestern Pacific Ocean
Tomohiro Yoshida and Hiroyuki Motomura

Full Papers

Japanese Journal of Ichthyology

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The effects of ayu *Plecoglossus altivelis altivelis* on the abundance and algal-grazing habit of introduced pale chub *Zacco platypus*

Osamu Katano, Yoshihiro Baba, Kouichi Kawamura and Hitoshi Ohara

Abstract Nonbenthic fishes were investigated in 16 rivers in the Chubu and Tohoku regions, into which pale chub *Zacco platypus* had been introduced. Pale chub coexisted predominantly with Japanese dace *Tribolodon hakonensis*, followed by ayu *Plecoglossus altivelis altivelis*, and were abundant in rivers lacking the latter. Although pale chub, ayu, Japanese dace, dark chub *Nipponocypris temminckii* and Amur minnow *Rhynchocypris lagowskii steindachneri* all fed on both benthic algae and invertebrates, the percentage of algae in the diet of pale chub was less when ayu were present. However, the population abundance and diet of pale chub were not affected by the other nonbenthic species. Although pale chub and other cyprinids rarely fed on cyanobacteria, a main food item of ayu, pale chub was considered to be negatively affected by ayu through interference, exploitative competition and indirect effects via changes in algal composition.

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Habitat use by newly emerged fry of red-spotted masu salmon (*Oncorhynchus masou ishikawae*) in a mountain stream, northeastern Kyushu, southern Japan

Keisuke Kimoto, Masaaki Kagehira, Kazuhisa Azechi and Kazuya Nagasawa

Abstract The habitat use of newly-emerged fry of red-spotted masu salmon

(*Oncorhynchus masou ishikawae*) was studied on a channel-unit scale in the Ogata River, northeastern Kyushu, southern Japan from January to March in 2007–2009. Fry abundance was investigated by snorkeling along both banks and the habitat components (channel-unit type, water depth, velocity, vegetation cover, width-depth ratio and distance from spawning redds) assessed in 56 consecutive sections of the lower distribution area of the species in the river. The number of fry per section was positively associated with channel-unit type near the riffles but negatively related to water depth near the banks and distance from spawning redds. Fry were strongly associated with channel-units near the riffles in their lower distribution area, probably because of the profitable microhabitat (low water-velocity habitats adjacent to a fast current, thereby ensuring high energy efficiency, were common in the upper distribution area but were restricted to the marginal area of riffles in the lower area). It is also suggested that fry moved downstream from profitable channel units which lacked profitable microhabitat. Therefore, for maintaining sustainable reproduction and effective stock enhancement of the species in the lower distribution area, it is important to create profitable microhabitats within channel-units near the riffles, thereby balancing the abundance of fry with the carrying capacity of suitable habitats.

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Identification of the reproductive mode for internal gamete association in *Vellitor centropomus* (Cottidae): gonadal histological analysis

Yasunori Koya, Naoya Mitsuhashi, Satoshi Awata, Takeshi Ito and Hiroyuki Munehara

Abstract Artificial fertilization experiments were performed and male and female gonads observed histologically to confirm the oldest known description (published 1934) of the reproductive mode for internal gamete association (IGA) in *Vellitor centropomus* (Cottidae). Stripped eggs from mature females were unfertilized such commencing after their immersion in seawater, indicating that *V. centropomus* is an IGA species. Many spermatozoa were stored in the immature ovary with non-vitellogenic oocytes, evidence that males of the species mature before females and that copulation occurs when females are still immature. The male reproductive organ consisted of paired testes, a specialized seminal vesicle and a functional urogenital papilla. A sperm duct in the testicular hilus was absent. Spermatogenesis occurred sequentially, posterior most first, suggesting that it occurs over an extended period of time. A ventral luminal ampulla, central expanded main sperm duct and dorsal saccular ampulla were observed in the seminal vesicle, all parts being involved in sperm storage. The saccular ampulla had an exocrine function, secreting a periodic acid–Schiff (PAS)-positive substance. Sperm heads stored in the posterior part of the testis or lumen of the seminal vesicle were also PAS-positive. Sperm heads were slender, a typical morphology in IGA species.

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Feeding behavior and interactions of three cyprinid species in experimental streams

Hiromu Ogawa and Osamu Katano

Abstract Three cyprinid fishes, pale chub *Zacco platypus*, dark chub *Nipponocypris temminckii* and Japanese dace *Tribolodon hakonensis*, are common in the middle reaches of Japanese rivers. To investigate their feeding behavior, and intra- and interspecific interactions, 10 individuals each of pale chub, pale chub and dark chub, pale chub and

Japanese dace, and dark chub and Japanese dace, respectively, were observed in four experimental ponds that simulated natural rivers. All species exhibited intra- and interspecific aggressive behavior, pale chub and dark chub establishing intraspecific dominance hierarchies. Large individuals tended to win in interactions, although dark chub, the most aggressive among the three species, occasionally won against large pale chub and Japanese dace. Pale chub, dark chub and Japanese dace most frequently exhibited algal feeding, drift feeding and bottom feeding, respectively. However, marked individual differences existed in feeding behavior and appearance rate. Habitat use by the three species did not differ greatly, but in the pond inhabited by dark chub and Japanese dace, the former showed the more concentrated habitat use. Feeding behavior of pale chub was affected by dark chub and growth rate of pale chub was lowered in the presence of Japanese dace. The behavior of the three cyprinid species was partly species-specific, but was also affected by individual differences and the presence of other species. *(Corresponding author: Hiromu Ogawa; Graduate School of Marine Science and Technology, Tokyo University of Marine Science and Technology, Minato Tokyo 108–8477, Japan; e-mail: hiromu0725@fra.affrc.go.jp)*

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Intergeneric hybridization between Japanese char and red-spotted masu salmon in a tributary of the Ibigawa River, Gifu Prefecture, Japan

Takahiko Mukai, Ryo Futamura, Taiki Niwa, Akihiko Goto, Naoki Miwa,

Wataru Ishizuka, Yuichi Yaoi and Masaki Takagi

Abstract Japanese char *Salvelinus leucomaenis*, red-spotted masu salmon *Oncorhynchus masou ishikawae*, hybrid individuals were collected from a tributary of the Ibigawa River, Gifu Prefecture, Japan. The char and hybrids were mainly distributed in the headwater area where eyed eggs of red-spotted masu salmon are released in each year.

Principal component analysis (PCA) of the morphological features of parental and hybrid individuals indicated that hybrid body shape was similar to that of char. Partial nucleotide sequences of mitochondrial DNA indicated the female parental species to be red-spotted masu salmon, without exception. Genotyping of three loci of short interspersed repetitive elements (SINE) of inserted alleles showed all hybrid individuals to be F_1, with no evidence of backcrossing. These results indicated that the introduced red-spotted masu salmon hybridized with male char, with a high survival rate of sterile F_1 offspring.

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Short Reports

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Different timing of spawning migration of sexes in Honmoroko *Gnathopogon caerulescens* from Lake Biwa to the Ibanaiko Lagoon

Takeshi Kikko, Haruo Okamoto, Muneji Ujiie, Daisuke Ishizaki, Jin Saegusa,

Yoshiaki Kai and Yasuhiro Fujioka

Abstract The commercial gill net fishery and leisure fishing for the endangered cyprinid fish Honmoroko *Gnathopogon caerulescens* endemic to Lake Biwa, Japan, mainly target spawning aggregations around lagoon outlets and in the lagoons during early spring. Accordingly, spawning migration information for the species is essential for future conservation and management. Sex ratios and gonadsomatic indices (GSI) of Honmoroko in the Ibanaiko Lagoon and its outlet, the Daido River, from mid-February to late March 2012 showed a male bias the Daido River mouth, in mid-February, thereafter decreasing significantly. In the Ibanaiko Lagoon, sex ratios were significantly male biased in both February and March, except on 30 March. Mean GSI of females and males ranged from 14.5 to 18.4, and from 8.0 to 9.1, respectively, during the study period.

Apparently, males with advanced reproductive status migrate to the lagoon from Lake Biwa prior to females, the latter migrating to the lagoon when ready to spawn. Intensive commercial gill net and leisure fishing around the outlet of the lagoon during early spring may result in overfishing of recruitment cohorts.

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Embryonic and larval development of the rosy seabass *Doederleinia berycoides* (Acropomatidae)

Yuta Yagi, Makoto Nitta, Naoki Iida, Hiroyuki Takeuchi, Tatsuya Yamada, Sou Nagasoe, Takeo Yamamoto, Hideo Takahara, Tomoaki Iseki and Shinji Uehara

Abstract The eggs and larvae of rosy seabass *Doederleinia berycoides* (Acropomatidae) are described based on specimens reared from eggs artificially fertilized in September 2013. Fertilized eggs, measuring 0.80–0.83 mm in diameter, were buoyant, spherical and transparent with a single oil globule measuring 0.21–0.23 mm in diameter. Melanophores were present on the yolk, and embryo and oil globule after closure of the blastopore and appearance of myomeres, respectively. Hatching occurred 29–35 hrs after fertilization when incubation temperatures ranged from 22.1–23.8°C. Newly-hatched larvae (1.76–1.83 mm notochord length, NL) had melanophores on the head, dorsolateral and anterior parts of the trunk, and dorsolateral abdomen. Eggs after detachment of the caudal end of the embryo and yolk-sac larvae also had xanthophores on the embryo and trunk, respectively. The mouth opened at 2.51–2.74 mm NL, the yolk being absorbed thereafter. Notochord flexion started at 4.19 mm NL, after which body depth increased rapidly, being completed at 5.53 mm standard length (SL). The dorsal and anal fin

anlagen appeared at 4.19 mm NL, each fin, except pelvic fin, nearing the full adult complement at 5.53 mm SL. Head spination, including a supraoccipital crest, began to develop during the preflexion stage. Although the body proportions and head spination were closely similar to previous descriptions of larval *D. berycoides* after the preflexion stage, melanophores had appeared earlier and were more dense than in the latter.

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Long-term effects of bluegill on the population sizes of two freshwater fishes in artificial ponds

Osamu Katano, Hiromu Ogawa, Tomoyuki Nakamura and Shoichiro Yamamoto

Abstract The long-term effects of bluegill *Lepomis macrochirus* on two Japanese fishes were investigated in two artificial 28 × 22 m concrete ponds. After recording the population size of Japanese minnow *Pseudorasbora parva* and Amur goby *Rhinogobius kurodai* in the ponds from 2002 to 2004, 25 mature bluegill were introduced into each. Bluegill successfully reproduced, increasing to 350 fish in pond A and 229 fish in pond B by October, 2004. The population size of the two Japanese species had not varied greatly prior to bluegill introduction, the population size of minnows reaching maximum levels of 7411 in pond A and 1598 in pond B. However, both species decreased after bluegill introduction. By 2015, Japanese minnow numbered 0 and 1 in the respective ponds, indicating functional extinction. Amur goby also decreased after bluegill introduction, but had not been exterminated by 2015.

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The records of the chiasmdontid fish *Pseudoscopelus obtusifrons* from Japan

Seishi Kimura, Junji Yonezawa and Marcelo R. S. Melo

Abstract A live chiasmodontid fish, regurgitated from *Thunnus albacares* individual immediately after its capture by angling off Hachijo Island, Izu Islands, Japan, had the following diagnostic characters: snout convex; a row of maxillary photophores extending almost to the anterior margin of preopercle; a single row of transverse pelvic-fin photophores; suprapectoral-fin photophores present; 36 vertebrae; mesial series of premaxillary teeth arranged in a single row; hooked teeth in lateral series on both premaxilla and dentary. Accordingly, the specimen was identified as *Pseudoscopelus obtusifrons* (Fowler, 1934). The species listed by Nakabo and Doiuchi (2013) as *Pseudoscopelus* sp. (Japanese name Tomaru-kurobozugisu) from off Okinotorishima Island is also confirmed as *P. obtusifrons*, having hooked teeth on the upper jaw and a single row of transverse pelvic-fin photophores. Although *P. obtusifrons* has already been recorded from well east of Hokkaido Island (Prokofiev and Kukuev, 2006) and off Iwate Prefecture (Prokofiev, 2011), it has received little recognition as a Japanese species. The present report firmly supports the inclusion of *P. obtusifrons* in the checklist of Japanese marine fishes.

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First records of the cardinalfish *Neamia notula* (Perciformes: Apogonidae) from the northwestern Pacific Ocean

Tomohiro Yoshida and Hiroyuki Motomura

Abstract *Neamia notula* Fraser and Allen, 2001, previously known only from Mauritius and Indonesia, is recorded from Japan (Kochi, Kagoshima and Okinawa prefectures) for the first time on the basis of 3 specimens (24.4–38.3 mm standard length), representing the first records from the northwestern Pacific Ocean. The specimen from Kochi represents the northernmost record of the species. The new Japanese name "Shikinami-yatsutogetenjikudai" is proposed for the species. Comparisons of *N. notula* with a closely related species, *N. articycla*, based on 6 and 11 specimens, respectively, from the Indo-West Pacific showed that *N. notula* differed from the latter in having fewer predorsal scales (4 vs. 5 in the latter), shorter pectoral-fin length [20.9–25.4% of SL (mean 23.9%) vs. 26.0–30.4% (28.4%)] and a milky-white body coloration in preserved specimens (vs. dark brown).

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