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Phylogeny and taxonomy of *Petroschmidtia teraoi* (Katayama, 1943) (Osteichthyes: Perciformes: Zoarcidae)

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Abstract

A morphological and genetic reassessment of the phylogeny and taxonomy of the dwarf zoarcid fish *Lycodes teraoi* Katayama, 1943 indicated that the species, a senior synonym of *Lycodes sadoensis* Toyoshima & Honma, 1980, should be placed in the genus *Petroschmidtia*. A redescription of *P. teraoi* is provided, with remarks on its taxonomy. Numerous specimens revealed a wide distribution of *P. teraoi* in the Sea of Japan, as well as in the southern Sea of Okhotsk.

Key words: Sea of Japan, Sea of Okhotsk, eelpouts, redescription, *Lycodes teraoi*, *Lycodes sadoensis*, *Petroschmidtia*

Introduction

The genus *Lycodes* comprises more than 60 nominal species of eelpouts, widespread in the seas of the Northern Hemisphere, with only one species—in the Southern. Species of *Lycodes* differ mainly in meristic and morphometric characters, structure of submental crests, lateral line configuration, squamation, pectoral fin shape, teeth presence or absence and coloration. Several attempts were made to construct the phylogeny of this group and to allocate subgenera within its structure based on morphology (see the overview in Møller & Gravlund 2003) with unsatisfactory and contradicting results. Molecular and genetic researches do not include all species of *Lycodes*, and their results do not well coincide with those according to morphological data (Møller & Gravlund 2003; Radchenko *et al.* 2009).

Together with *Lycodes sadoensis* Toyoshima & Honma, 1980, *L. teraoi* Katayama, 1943, a dwarf species attaining less than 170 mm in total length, has been considered endemic to the Sea of Japan. Both species are characterized by very similar body proportions and meristics (total vertebral numbers <90), in addition to a small body and short lateral line, reaching only to above the pectoral fin, but have been believed to be distinct on the basis of coloration (e.g., dark stripes near tail tip and dark spots on dorsal fin margin in *L. sadoensis* vs. stripes and spots absent in *L. teraoi*). The very short, anterolateral position of the main line of trunk neuromasts distinguishes both species from all other congeners and from most other zoarcids (Toyoshima 1985, Anderson 1994). Both species are known as “short-body eelpouts”.

Not only has the phylogenetic relationship between these two dwarf species not been considered from a genetic viewpoint, but also their morphology has not been described in detail. In particular, examination of the seismosensory system of the head and body, submental crest morphology and body squamation was necessary for clarification of the taxonomy of both nominal species, which occupy broadly overlapping areas in the southern Sea of Japan, in 150–322 m depth.

During our taxonomic study of eelpouts from the Sea of Japan and Sea of Okhotsk, the type specimens of *L. teraoi* and *L. sadoensis* were examined, in addition to specimens of the former collected from both regions (Fig. 1). *Lycodes sadoensis* was found to be a junior synonym of *L. teraoi*. Several specimens identified as *Lycodes uschakovi*, recently reported by Ikeda *et al.* (2007) from the southern Sea of Okhotsk off northern Hokkaido, and a juvenile specimen among the syntypes of *Lycodes schmidti* Gratzianov 1907 were re-identified as *L. teraoi*.

vertebral number less than 90. Joined submental crests unite *P. teraoi* with *L. caudimaculatus* Matsubara, *L. hubbsi* Matsubara, *L. japonicus* Matsubara & Iwai, *L. microporus* Toyoshima, *L. ocellatus* Toyoshima and *L. semenovi* Popov, some of the latter also possessing wide gill openings and the pelvic fins located behind the isthmus (*L. caudimaculatus* and *L. hubbsi*), or being dwarf species (*L. japonicus* and *L. semenovi*). *Petroschmidtia teraoi* can be distinguished from all of them by the following characters: lateral line medial (vs. ventral), submental crests high (vs. low), and the oral and branchial cavities light (vs. dark brown or blackish).

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APPENDIX 1. Materials examined.

Specimens are deposited in the following institutions: Hokkaido University Museum, Hakodate, Japan (HUMZ); Maizuru Fisheries Research Station, Kyoto University, Japan (FAKU); National Museum of Nature and Science, Tsukuba, Japan (NSMT-P); Osaka Museum of Natural History, Japan (OMNH); Zoological Institute, Russian Academy of Sciences, Saint-Petersburg, Russia (ZIN).

Petroschmidia teraoi: Sea of Japan specimens. NSMT-P 18223: lectotype of *Lycodes teraoi* (male), 163 mm TL, off Tsuiyama, Hyogo Pref., about 150 m depth, 2 Apr. 1943; HUMZ 81282–81285, 4 specimens (males), 108–139 mm TL, data same as lectotype; HUMZ 65832: holotype of *Lycodes sadoensis* (male), 143 mm TL; 37°33.5'N, 136°15'E, 235 m depth, 7 June 1977; HUMZ 65828–65831, 65833: 5 paratypes of *L. sadoensis* (males), 128–141.5 mm TL, collection data same as HUMZ 65832; HUMZ 64826, 1 specimen (sex unknown), 146 mm TL, off Tsuiyama, Hyogo Pref., 16 Jan. 1943; NSMT-P 64991: 3 specimens (1 male and 2 sex unknown), 151–165 mm TL, 35°57.22'N, 132°37.90'E, 290–292 m depth, 7 July 2002; NSMT-P 64995: 3 specimens (2 males and 1 sex unknown), 114–150 mm TL, 35°43.1'N, 132°8.5'E, 7 Aug. 2002; NSMT-P 65821: 2 specimens (1 female and 1 sex unknown), 133–140 mm TL, 35°38.8'N, 130°59.1'E, 229–235 m depth, 7 Jan. 2002; NSMT-P 78785: 6 specimens (2 males and 4 sex unknown), 135–151 mm TL, 35°53.03'N, 132°36.33'E, 190–196 m depth, 7 July 2002; NSMT-P 98031: 1 specimen (male), 168 mm TL, 35°51.42'N; 134°42.11'E, 225 m depth, 6 Mar. 2009; NSMT-P 98032: 2 specimens (males), 152–155.5 mm TL, 35°51.42'N, 134°42.11'E, 225 m depth, 6 Mar. 2009; NSMT-P 98127: 6 specimens (males), 137–167 mm TL, 35°43.2'N, 132°17'E, 234–236 m depth, 5 Dec. 2009; NSMT-P 98128: 1 specimen (female), 161 mm TL, 35°39.36'N, 132°15.58'E, 208–209 m depth, 5 Dec. 2009; NSMT-P 98213: 1 specimen (sex unknown), 142.5 mm TL, 35°44.15'N, 131°7.84' E, 223–248 m depth, 5 Sep. 2009; NSMT-P 98214: 2 specimens (1 male and 1 sex unknown), 132–138 mm TL, 35°43.46' N, 132°5.83' E, 251 m depth, 3 Nov. 2009; NSMT-P 99920, 1 specimen (sex unknown), 142 mm TL, 36°19.75'N, 132°42.06'E, 318–322 m depth, 15 May 2009; NSMT-P 99923: 1 specimen (sex unknown), 136 mm TL, 36°17.98'N, 132°43.84'E, 269 m depth, 16 May 2009; FAKU 25729, 1 specimen (male), 148.3 mm TL, Wakasa Bay, 14 March 1956; FAKU 130811–130814, 4 specimens (1 male, 1 female, 2 sex unknown), 110–127 mm TL, off Taiza, Kyoto Pref., 280 m, 19 June 2006; FAKU 130844, 1 specimen (sex unknown), 126 mm TL, 35°53.19'N, 135°6.42'E, 231 m depth, 24 July 2006; FAKU 130847, 4 specimens (sex unknown), 81–120.5 mm TL, 35°53.19'N, 135°9.40'E, 260 m depth, 24 July 2006; FAKU 131141, 8 specimens (4 males and 4 sex unknown), 118–140 mm TL, 35°53'N, 135°5'E, 11 Apr. 2007; FAKU 131630–131631, 7 specimen (1 male and 6 sex unknown), 98.5–161 mm TL, off Ine, Kyoto Pref., 210 m depth, 16 June 2008; FAKU 131656–131658, 3 specimens (2 males and 1 female), 129–156 mm TL, 36°40.03'N, 133°18.14'E, 19 July 2008; FAKU 131931, 1 specimen