ISSN 2075-1117, Russian Journal of Biological Invasions, 2017, Vol. 8, No. 1, pp. 104–107. © Pleiades Publishing, Ltd., 2017.
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The First Data on Parasites of the Amur Sleeper *Perccottus glenii* Dybowski, 1877 (Osteichthyes: Odontobutidae) in the Yenisei River Basin (Bugach Reservoir)

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Received April 5, 2016

Abstract—The first report on parasite fauna of Amur sleeper (*Perccottus glenii*) from the Yenisei River basin (Bugach Reservoir) is presented. Only one parasite species (*Lernea elegans*) was found. Specific parasite species of Amur sleeper were not found.

Keywords: Amur sleeper, *Perccottus glenii*, Bugach Reservoir, parasite fauna, Yenisei River, invasion
DOI: 10.1134/S207511171701012X

INTRODUCTION

One of the global problems of modern ecology is dispersion of alien organisms in aquatic and terrestrial ecosystems named biological invasions (Alimov et al., 2004).

The problem of biological invasions in aquatic ecosystems is associated primarily with an increase in volumes of transcontinental transport of ballast waters, change in the hydrological regime of large rivers, and uncontrolled intentional introduction of commercial species.

According to Alimov et al. (2004), more than 30% of the freshwater fish list of Russia belongs to the categories of introduced and invasive species. Such intense penetration of invasive species outside the natural range usually leads to significant changes in the structural and functional characteristics of aquatic biocenoses (Alimov et al., 2000, 2004).

Among the invasive fish of the Russian Federation, the Amur sleeper *Perccottus glenii* Dybowski, 1877 (family Odontobutidae) expanded their range at a high speed with a significant threat to indigenous ecosystems. Amur sleeper is indigenous species of the Amur River basin and some neighboring water systems. The present range of Amur sleeper stretches meridionally from the Amur River basin to the basins of the Eastern European rivers (Danube, Dniester) (Reshetnikov, 2009). In the last few decades, this species was active in expansion across the reservoirs of Eastern Europe and Siberia (Pronin and Bolonev, 2006; Reshetnikov and Petlina, 2007; Reshetnikov, 2009). Until now, the Yenisei River basin was one of the few river systems where Amur sleeper had not been found. In August 2012, for the first time, the Amur sleeper was found in the small Bugach Reservoir, within the city of Krasnoyarsk (Zuev and Yablokov, 2013).

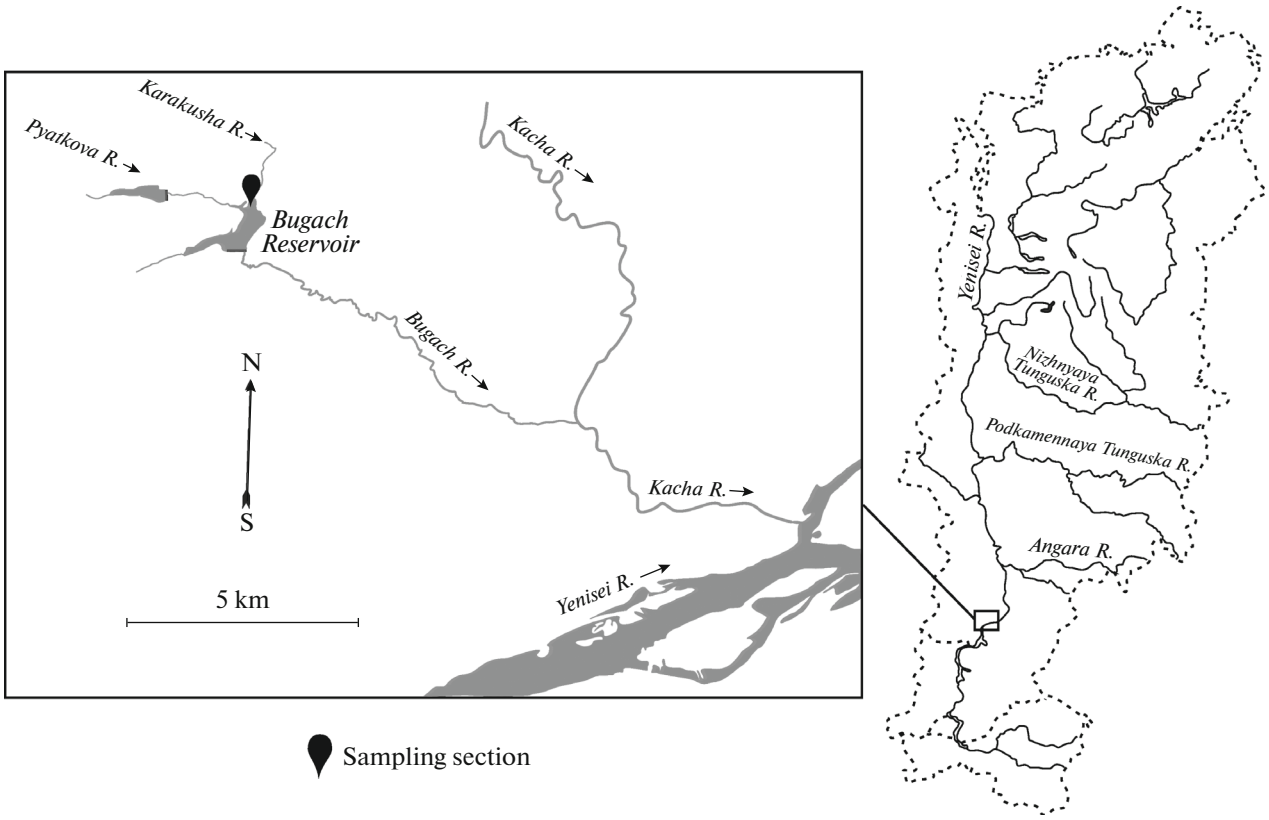
In the context of the consequences of alien species introduction into recipient ecosystems, one of the most important issues is the formation of parasite populations in altered aquatic communities. This aspect is interesting both as detection of harmful parasites and as one of the potential factors of stabilization of invasive species. It is worth noting that, in the natural part of the range, the parasite fauna of Amur sleeper was studied well enough and had more than 60 species of parasites, which includes species specific to it (Ermolenko, 2004; Sokolov and Frolov, 2012).

Within the acquired range, the parasite communities of the Amur sleeper were studied only for the European part of Russia and the Irtysh River basin (Sokolov et al., 2011a, 2011b). Data of parasite fauna of Amur sleeper in the system of the Yenisei River are published for the first time.

The purpose of the present work was a preliminary investigation of the composition of the parasite fauna of the Amur sleeper in the Bugach Reservoir.

MATERIALS AND METHODS

The reservoir is formed on the eponymous river flowing in a suburban area of Krasnoyarsk. The distance is about 10 km (figure) to the mainstream of the



Map of the location of the Bugach Reservoir of the Yenisei River system.

Yenisei River. The reservoir is a part of a system of artificial reservoirs, interconnected with slow-flowing silted streams. The catchment area is 116 km^2. The surface area is 0.32 km^2; the average depth is 2–4 m. The water is of sodium type, hydrocarbonate class; the average value of pH is 8.5. Water transparency by the Secchi disk is 0.1–1.0 m; in the middle of July, the maximum temperature is 23°C. The water body is eutrophic owing to the mass development of cyanobacteria in summer. The under ice period is often characterized by a deficiency of oxygen, which causes fish kill in April and May (Zadorin et al., 2004).

The phytoplankton includes 138 taxa; the leading group consists of chlorophyta (38% of the number of species); the second group consists of diatoms (22%) and cyanobacteria (19%). The zooplankton has 11 species of organisms (Batanina, 2008). The ichthyofauna of the reservoir was represented by six species of fish. The Prussian carp *Carassius gibelio* Bloch and Belica *Leucaspius delineates* Heckel were quantitatively dominant in catches. Amur sleeper, Crucian carp *Carassius carassius* L., European perch *Perca fluviatilis* L., and Gudgeon *Gobio gobio* L. are characterized by smaller numbers. Siberian char *Barbatula toni* Dybowski and Siberian dace *Leuciscus leuciscus baicalensis* Dybowski also were found in the Bugach River (Zadorin et al., 2004). In 2002, the measures of pike introduction were carried out to reduce blooms in the reservoir (Gladyshev et al., 2006).

In September 2015, ichthyological material was taken from the Bugach Reservoir and estuaries of streams flowing into it (Pyatkova and Karakusha rivers). The material was taken by hydrobiological nets of different designs and fixed in 4% solution of formalin. In total, 14 individuals of Amur sleeper were caught with average absolute body length of 47 mm (27–101 mm) and average body weight of 3 g (1–23 g). The collection, fixation, and processing of parasitological material carried by the standard technique (Bykhovskaya-Pavlovskaya, 1985), taking into account the amendments proposed by G.N. Dorovskikh for fixed material (Dorovskikh and Stepanov, 2009). An identification manual was used for identification of parasite species (*Opredelitel'...*, 1985, 1987).

RESULTS AND DISCUSSION

As a result of the study, one species of parasites of the Amur sleeper was discovered—crustaceans *Lernaea elegans* with the extensity of invasion of 14.3% and the index of abundance of 0.14 ind. In the Bugach Reservoir, Belica and Prussian carp also had *L. elegans* (German et al., 2006; Polyaeva, 2010). Previously, this species of Lernaea was recorded for the Amur sleeper

in the Nerchinsk Reservoir, belonging to the Shilka River basin (Amur River basin) (Gorlacheva et al., 2015).

In the native and acquired habitat, frequent cestodes *Nippotaenia mogurndae* of Amur sleeper were not found, despite the fact of a high number of its intermediate host, zooplankton *Mesocyclops leuckarti*, in the Bugach Reservoir (Batanina, 2008). We assume that the Amur sleeper entered the reservoir without being infected with this cestode, so its penetration into the ecosystem of the reservoir did not happen. It should be noted that fish from the Bugach Reservoir do not have a complex of intestinal parasites: Belica do not have any species; Prussian carp had a larva of nematode *Nematoda ordo. fam. gen.* sp. with low values of extensity of infection (German et al., 2006; Polyaeva, 2010).

Fish from the Bugach Reservoir had six species of trematodes of the genus *Diplostomum* (German et al., 2006; Polyaeva, 2010), so it was expected that the Amur sleeper also would have metacercariae of these parasites, but it did not. According to the published data, in other reservoirs, Amur sleeper had diplostomidae, but extensiveness of infection was low, not higher than 20% (Sokolov et al., 2012; Mierzejewska et al., 2012).

The reasons for the small species diversity of parasites can be the time of gathering of material (sampling took place in September, when the water temperature was already low, which significantly affects the number of single-cell ectoparasites and monogeneans), as well as high anthropogenic influence on the reservoir. During spring period, the runoff of biogenic elements and petroleum products from surrounding farmlands and the roadway penetrates into the reservoir, and in the summer, there is an intense recreational load. In recent years, the situation has been exacerbated by the construction of residential complexes at the headstream of the Bugach River.

As a result of investigation, Amur sleeper did not have specific species of parasites. Further studies with the collection of material in the summer will be essential for expanding the list of parasite fauna of Amur sleeper in the Yenisei River basin.

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Translated by Z. Litvinenko