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SHORT COMMUNICATION

# The first report on the establishment and spread of the alien clam *Rangia cuneata* (Macridae) in the Polish part of the Vistula Lagoon (southern Baltic)<sup>☆</sup>

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## KEYWORDS

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**Summary** Information on distribution of the bivalve *Rangia cuneata* in the Polish part of the Vistula Lagoon is presented. The species, first recorded in the Lagoon in 2010, has since rapidly colonized almost the entire basin. The distribution and population structure of the species have been studied in the Polish part of the Lagoon since 2012. Preliminary results on distribution and size structure of the population highlight extensive fluctuations in 2012–2014. A drastic reduction in the abundance following the relatively long winter of 2012/2013 suggests that the winter oxygen deficiency associated with the ice cover could be critical for the population development. Potential effects of the new invasive bivalve on the structure of benthic habitats and macrozoobenthos communities are discussed.

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## 1. Introduction

The Vistula Lagoon is situated in the south-eastern Baltic and extends for about 91 km along the Polish and Russian coast of the Gulf of Gdańsk (Fig. 1). After the Curonian Lagoon, the Vistula Lagoon is the second largest coastal lagoon in the southern Baltic. At present, the Lagoon is connected with the Baltic via the Pilawska Strait in the eastern, Russian, part of the Lagoon. The Lagoon's total surface area, maximum and mean depths are 833 km<sup>2</sup>, 5.1 m, and 2.6 m, respectively. The state border between Poland and Russian Federation divides the Lagoon into the eastern part (64% of the area)

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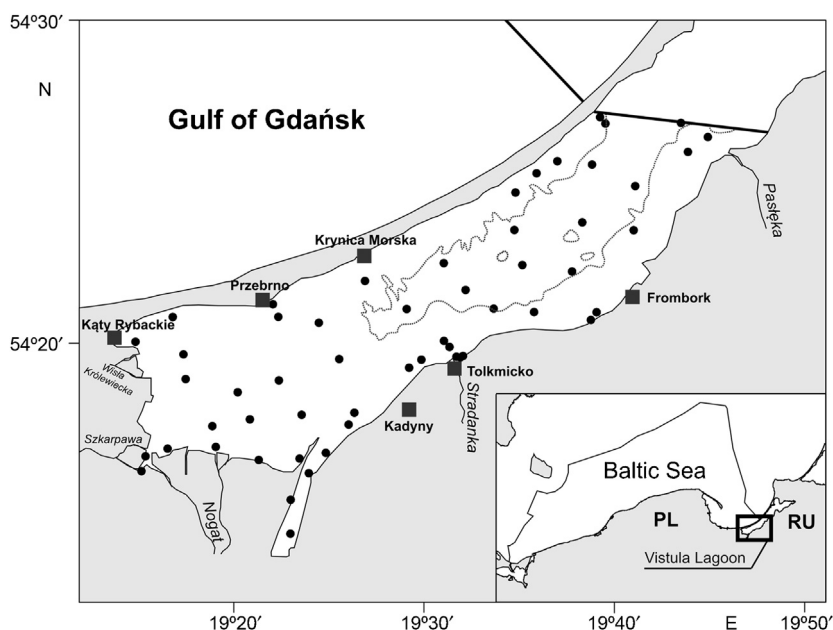


Figure 1 Map of the study area and the grid of stations sampled in 2012–2014.

belonging to Russia and called the Kaliningrad Lagoon, and the western part (36% of the area) belonging to Poland. The Lagoon's bottom is primarily muddy; sands are found only in a narrow belt close to the shore and on shallows, down to the depth of about 1.0–2.0 m. The Lagoon's water typically warms up rapidly in spring. In winter, the Lagoon may become ice-bound. The Lagoon's salinity is variable and ranges, within the Polish part, from about 0.5 to about 4.8 psu (Czubarenko and Margoński, 2008). At present, the Lagoon is classified as a eutrophic (and even hypereutrophic in the Polish part) water body (Aleksandrov, 2010; Nawrocka and Kobos, 2011). The western (Polish) part of the Lagoon is a protected area within the NATURA 2000 network (PLB 280010).

It is a species native to the Gulf of Mexico. In the 1960s, the species colonized coastal Atlantic waters (the Chesapeake Bay) to spread north up to the mouth of the Hudson River, New York (e.g. Pfitzenmeyer and Drobeck, 1964). According to some authors, it could have occurred along the Atlantic coast of North America earlier, and became extinct in the Pleistocene to reappear in the 1960s (Hopkins and Andrews, 1970). Other authors are of the opinion that the species has continued to be present there since the Pleistocene, but was rare and therefore not spotted (Pfitzenmeyer and Drobeck, 1964). In the European waters, it was first recorded in 2005 in the Belgian harbour of Antwerp (Verween et al., 2006). In the Vistula Lagoon, *R. cuneata* was first reported from the eastern, Russian, part in 2010 (Ezhova, 2012; Rudinskaya and Gusev, 2012), the first record from the western, Polish, part dating to 2011 (Warzocha and Drgas, 2013). In both cases, the presence of individuals up to 30–40 mm long suggests the introductions to have occurred 2–3 years earlier. *Rangia cuneata* is the first macretid species in the fauna of Poland. The species is regarded (e.g. Tarver, 1972) as preferring low-salinity heavily turbid water and a soft bottom (mud or sand).

This report is aimed at presenting preliminary results of research, carried out since 2012, on the establishment,

spread, and spatial distribution of *R. cuneata* in the Polish part of the Vistula Lagoon. The survey covered the bottom area beyond the inshore belt of reeds and bulrush, known as the Mid-lagoon (Klimowicz, 1958; Żmudziński, 1957). The sampling station grid is shown in Fig. 1. In total 55 stations were visited in summer seasons (July–September) from 2012 to 2014. The sediment was sampled with a 225 cm<sup>2</sup> Ekman grab weighing 7 kg and sieved with a 1 mm mesh sieves. A minimum of five replicate samples was taken at each station.

## 2. Results and discussion

The occurrence of *R. cuneata* in the Polish part of the Vistula Lagoon in 2012–2014 is shown in Fig. 2. In terms of the species' distribution in summer 2012, the area surveyed was divided into two distinct parts: one was the western part, including also areas off river mouths, supported no *R. cuneata*, the other being the remaining part of the Polish section of the Lagoon, where the bivalve was present at most stations (Fig. 2A). The area colonized by the species supported both juveniles and adults (from 2 to 48 mm). The absence of *R. cuneata* off river mouths could be explained by the prevalent low salinity (usually not more than 0.5 psu) which is too low for the survival of veliger larvae. *R. cuneata* can adapt to salinities varying from nearly 0 to 33 psu, but the young of the species have a much lower salinity tolerance than adults (Cooper, 1981; LaSalle and de la Cruz, 1985). Moreover, the interactions between temperature and salinity may increase the mortality of young stages (Cain, 1973). In 2013, following winter, there were almost no *R. cuneata* present (Fig. 2B) except for numerous live individuals found on the sandy bottom in the southern part of the Lagoon, close to the mouth of River Stradanka (Fig. 2B). Stations in the remaining part of the area yielded very few live individuals. As shown by the data collected by the Institute of

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