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Ponto-Caspian gammarids – a new species in the Gulf of Gdańsk (Southern Baltic Sea)

Ponto-kaspijskie kielże – nowe gatunki w Zatoce Gdańskiej

Abstract:

The non-indigenous gammarid species *Pontogammarus robustoides* (G.O. Sars, 1894), *Obesogammarus crassus* (G.O. Sars, 1894), *Dikerogammarus haemobaphes* (Eichwald, 1841) and *Dikerogammarus villosus* (Sowinsky, 1894) are present in the Gulf of Gdańsk (Southern Baltic Sea). These species reached the Gulf of Gdańsk by 2010 near the point where the River Vistula flows into the Baltic Sea, and became constituents of the amphipods on the shallow bottom of the gulf.

All the gammarid species found are of Ponto-Caspian origin. They have been able to move across Europe along rivers and canals, and inhabit reservoirs and drainage systems in the vicinity of such waterways. *D. villosus* is the latest gammarid species to have colonized Poland.

The floods that afflicted Poland in May and June 2010 could have had a significant influence, intensifying as they did the inflow of water from the Vistula into the Gulf of Gdańsk. This could have accelerated the arrival of individuals of these species.

The water salinity at the sampling stations was 5.8 – 6.1 PSU. The possible invasion of non-native gammarids may have important consequences for the benthic fauna communities in the Gulf of Gdańsk.

Streszczenie:

Nierodzące gatunki kielży: *Pontogammarus robustoides* (G.O. Sars, 1894), *Obesogammarus crassus* (G.O. Sars, 1894), *Dikerogammarus haemobaphes* (Eichwald, 1841) oraz *Dikerogammarus villosus* (Sowinsky, 1894) obecne są już w Zatoce Gdańskiej (Bałtyk Południowy). Gatunki te pojawiły się w Zatoce Gdańskiej w 2010 roku, niedaleko ujścia Wisły do Bałtyku i stały się składnikiem obunogów płytkiego dna.

Wszystkie wymienione gatunki są pochodzenia ponto-kaspijskiego. Przedostały się do Europy rzekami i kanałami, i zasiedlają zlewnie tych rzek. *D. villosus* jest najnowszym przybyszem, który skolonizował Polskę.

Najprawdopodobniej powódź, która dotknęła Polskę w maju i czerwcu 2010 roku zintensyfikowała napływ wód Wisły do Zatoki Gdańskiej. Przyspieszyło to przedostanie się osobników wymienionych gatunków do Zatoki Gdańskiej.

Zasolenie wody na stacjach zbioru materiału wynosiło od 5.8 do 6.1 PSU. Inwazja nierodzących gatunków kielży może znacznie wpłynąć na zespoły bentosowe Zatoki Gdańskiej.

Keywords: non-indigenous species, Ponto-Caspian gammarids, *Pontogammarus robustoides*, *Dikerogammarus haemobaphes*, *Dikerogammarus villosus*, *Obesogammarus crassus*, Gulf of Gdańsk, Baltic Sea

Słowa kluczowe: gatunki nierodzące, ponto-kaspijskie kielże, *Pontogammarus robustoides*, *Dikerogammarus haemobaphes*, *Dikerogammarus villosus*, *Obesogammarus crassus*, Zatoka Gdańska, Bałtyk

European brackish waters, e.g., the Gulf of Gdańsk (Southern Baltic Sea), are subject to intense invasions of non-indigenous species. In these waters, salinity is the most important range limiting factor [1].

The Gulf of Gdańsk forms a unique basin in the Baltic Sea, with a mix of brackish and marine waters. Freshwater comes from terrestrial sources, mainly the Vistula River, which is the second largest river flowing into the Baltic Sea [2].

The low salinity of the Gulf of Gdańsk (0.65 – 12.2 PSU) [3] affects the aquatic species living in this body of water. Species-poor communities in the gulf appear more vulnerable to introductions than are species-rich communities, as predicted by the Eltonian invasion model [4].

Additionally, these waters are characterized by strong human pressure, especially eutrophication. The level of eutrophication in the Gulf of Gdańsk has been described as high [3], while other factors such as intense shipping and opening new transport routes increase the probability of invasion [5].

In earlier studies, six *Gammarus* species were observed in the Gulf of Gdańsk: *G. salinus*, *G. oceanicus*, *G. duebeni*, *G. inaequicauda* and *G. locusta* [6]. Later *G. tigrinus* appeared in this basin [7].

The current gammarid fauna of the gulf has increased by four new species. All of these aliens are of Ponto-Caspian origin.

Other recent alien invertebrate species in the Gulf of Gdańsk have arrived from different geographical regions: North America (e.g. *Acartia tonsa*, *Rhithropanopeus harrisi*), Asia (e.g. *Eriocheir sinensis*), the Mediterranean Sea (e.g. *Palaemon elegans*), temperate and tropical regions (e.g. *Platorchestia platensis*) and from the Ponto-Caspian area (e.g. *Orchestia cavimana*, *Cercopagis pengoi*, *Hemimysis anomala*).

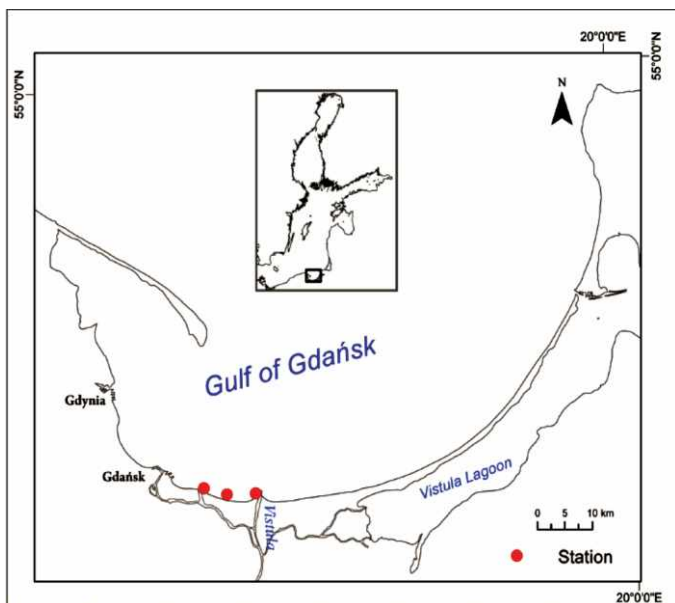


Fig. 1. Occurrence of Ponto-Caspian gammarids in the Gulf of Gdańsk

The gammarids were found in the shallow littoral zone (0.2 – 0.5 m) of the Gulf of Gdańsk, at three sampling sites, on the bottom of coarse sandy sediment, which at some stations was supported by the algae *Cladophora sp.* and *Enteromorpha sp.* The water salinity at the sampling

stations (Fig. 1) ranged from 5.8 to 6.1 PSU. The new species *Pontogammarus robustoides* (G.O. Sars, 1894), *Obesogammarus crassus* (G.O. Sars, 1894), *Dikerogammarus haemobaphes* (Eichwald, 1841) and *Dikerogammarus villosus* (Sowinsky, 1894) had reached the Gulf of Gdańsk by 2010.

New Ponto-Caspian gammarid species

The native range of occurrence of these four gammarid species is the Ponto-Caspian water basin [8-10].



Fig. 2. *Pontogammarus robustoides*



Fig. 3. *Obesogammarus crassus*



Fig. 4. *Dikerogammarus haemobaphes*

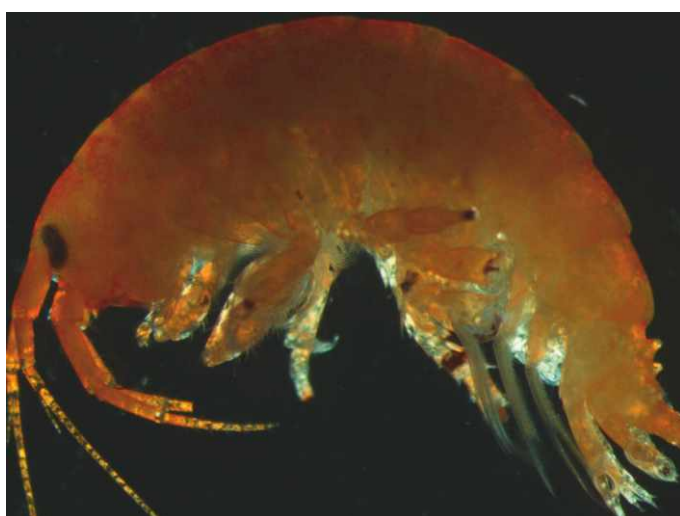


Fig. 5. *Dikerogammarus villosus*
Photo: A. Dobrzycka-Krahel.

***Pontogammarus robustoides* (G.O. Sars, 1894)**

This species is characteristically 4.5 to 21 mm in length with an average body length of 12 mm [11]. The short antennae of this species are described as being a “Pontogammarus type”.

It is a very common Ponto-Caspian species. In the 1960s, it was successfully naturalized in many Ukrainian, Lithuanian (the Neman drainage system) and Caucasian lakes, and artificial reservoirs. Thus, the species reached the Baltic Sea basin [12, 10, 13].

***Obesogammarus crassus* (G.O. Sars, 1894)**

This species is characterized by a male body length of 10-17 mm and a female body length of 8-15 mm [11]. *P.robustoides* was intentionally introduced and naturalized to the Neman river system in Lithuania in the 1960s, and from there transferred, both naturally and through human activity, to the Curonian Lagoon [12, 13]. Later it was observed in the Vistula Lagoon and the Dead Vistula [14] [15] in Poland.

***Dikerogammarus haemobaphes* (Eichwald, 1841)**

This species is characterized by a body length of 6.5-18 mm and sometimes a male body length of 21-22 mm [11]. Its invasion came via the Danube River [16] beginning in the 1950s. Later, in 1993, [17] the species was observed in the Main-Danube Canal, followed by its entrance to the North Sea basin through the Rhine River [18]. Simultaneously, this species reached the Baltic Sea drainage system through the Krolewski Canal connecting the Prypec with the Bug and the Vistula River and later through the Bydgoszcz Canal to the Noteć, Warta and Odra [18-20].

***Dikerogammarus villosus* (Sowinsky, 1894)**

This species is characterized by a female body length of 8-14 mm and a male body length of 12-22 mm [11]. It is a very effective predator preying upon other macroinvertebrates [21]. It is the latest colonizer of Polish waters. This species invaded western Europe via the Main-Danube canal [16, 17, 22]. Surprisingly, to Poland, it migrated through the Pripet-Bug connection [20].

Tab. 1. Records of new Ponto-Caspian gammarids in Polish waters

Species		Records in Poland	References
<i>Pontogammarus robustoides</i>	1988	First record in Poland – Lower Oder River and the Szczecin Lagoon	[23]
	1997	The Włocławek Reservoir	[24]
	1998	The Lower Vistula River, the Szczecin Lagoon and the Vistula Lagoon	[24, 25]
	2000s	The final stretches of the rivers emptying directly into the Baltic Sea and Zegrzyńskie Lake	[19, 14] [15]
	2004-2005	The central Polish lakes Lucieńskie and Białe	[26]
	2007-2010	The Great Masurian Lakes Latest investigations – the Gulf of Gdańsk	[27] [28]
<i>Obesogammarus crassus</i>	1999	First records in Poland – the Vistula Lagoon	[30]
	2000	The Dead Vistula	[30]
	2003	The Szczecin Lagoon	[30]
	2010	Latest investigations – the Gulf of Gdańsk	[28]
<i>Dikerogammarus haemobaphes</i>	1996	First record in Poland – the Włocławek Reservoir	[24]
	1998	The Vistula Lagoon	[25]
	1999	Lower Oder River	[31, 32]
	2000s	The rivers: Bug, Noteć, Warta and Oder	[25]
	2001	The Great Masurian Lakes	[33]
	2004-2010	Lucieńskie Lake Latest investigations – the Gulf of Gdańsk	[26] [28]
<i>Dikerogammarus villosus</i>	1999	First record in Poland – Lower Odra River	[23]
	2002	The Szczecin Lagoon	[34]
	2003	The River Bug	[11]
	2007	The River Vistula	[35]
	2010	Latest investigations – the Gulf of Gdańsk	[28]

Tab. 2. Check-list of recent alien crustaceans in the Gulf of Gdańsk

Species	First record in the Gulf of Gdańsk	References
<i>Acartia tonsa</i>	1925	[36]
<i>Cercopagis pengoi</i>	1999	[37]
<i>Eriocheir sinensis</i>	1930s	[38]
<i>Gammarus tigrinus</i>	2001	[39]
<i>Hemimysis anomala</i>	2002	[40]
<i>Orchestia cavimana</i>	1899	[41]
<i>Palaemon elegans</i>	2002	[42]
<i>Platorchestia platensis</i>	2005	[43]
<i>Rhithropanopeus harrisi</i>	1950s	[44]

Conclusions

- Less than 50 species of benthic crustaceans inhabit the semi-closed waters of the Gulf of Gdańsk [15]. Several different taxa occur in the Vistula Lagoon [45]. Every new colonisation of non-native species can affect benthic fauna communities.
- In the past we observed a change in the gammarid composition and species structure after the invasion of *G. tigrinus* in this basin [7, 46]. The introduction of four new species will have significant consequences if they form a stable population. This is likely due to their biotic potential and ecological tolerance [28]. Only after a few years, the populations of alien gammarids that became established in the Vistula Lagoon and the Vistula Delta have completely supplanted the native gammarid species [47, 48].
- The dynamic hydrological conditions in the coastal waters around the mouth of the Vistula, especially the fluctuations in water salinity, make this region inhospitable to native benthic macrofauna and render it prone to the invasion of alien species [49] [5] [50].

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