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Short communication

First record of the New Zealand mud snail *Potamopyrgus antipodarum* (Gray 1843) from Iraq: the start of expansion to Western Asia?

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Abstract

For the first time, shells of New Zealand mud snail *Potamopyrgus antipodarum* were detected in the Garmat Ali River (Iraq). Existing and potential corridors and pathways of Euro-Asian transfers of aquatic species are discussed.

Key words: alien species, *Potamopyrgus antipodarum*, molluscs, Iraq

The New Zealand mud snail *Potamopyrgus antipodarum* (Gray 1843) is a global invader with separate distinct zones of expansion: Western Palearctic, Tasmania and mainland Australia, Japan, and North America (Bondesen and Kaiser 1949, Ponder 1988, Bowler 1991, Shimada and Urabe 2003, Morley 2008).

In its Eurasian invasive range, *P. antipodarum*, having penetrated throughout North-Western Europe, gradually started to expand in eastern and southern directions. By the middle of the twentieth century it had appeared in southern areas of Europe: Iberia and the Black Sea Basin (Grossu 1951, Markovskij 1954, Garcia-Berthou et al. 2007) in 1951 and Italy in 1961 (Cianfanelli et al. 2007).

Recently there has been a fast expansion of the species to the Azov-Black Sea Basin and records for the Balkan peninsula have been various (Radea et al. 2008, Son 2008, Son et al. 2008); in addition, shells of this species were also found in Turkey (Demir 2003; Yildirim et al. 2006) and Lebanon (Gloeer, pers. comm.). In this paper the first records of *P. antipodarum* shells from Garmat Ali River (Iraq) are published.

Twenty two shell specimens of *P. antipodarum* were collected from the banks of different parts of Garmat Ali River, part of Shatt Al-Arab (Basrah, Iraq) (Figure 1, Annex), during the period from April to June 2008. The shells were cleaned and preserved in 70% ethanol.

Photographs were taken and measurements were made of these shells (Figure 2, Table 1). The shell is very small (5-6mm), ovate, consisting of 5 to 6 whorls, which are are rather rounded, with an (Renee Zellweger) ovate opening. Shell colors vary from gray and dark brown to light brown.

Currently, transfers of aquatic invaders from European to Western Asian inland waters are not numerous. The Ponto-Caspian Basin and the Mediterranean are donor regions in such cases. In the Ponto-Caspian most known cases involve mass transfers of commercially useful species and accompanying fauna in the former Soviet Union or the introduction of aquarium species.

Apart from aquatic invasions connected with aquaculture, intentional introductions, or the aquarium trade, some species have penetrated to Asia Minor across the narrow passages of the Bosphorus and Dardanelles (Turkish Straits):

including *Lepomis gibbosus* (Linnaeus 1758) and *Pseudorasbora parva* (Temminck et Schlegel 1846) (Wildekamp et al. 1997, Ekmekçi and Kirankaya 2006, Ozcan 2007), and probably *Dreissena polymorpha gallandi* (Locard 1893) (Son 2007).

Table 1. Measurements of shells (mm) sampled in good condition in Garmat Ali River (Basrah, Iraq)

Shell n	Shell		Aperture	
	Height mm	Width mm	Height mm	Width mm
1	5.2	2.7	2.3	1.8
2	4.8	2.6	2.1	1.8
3	5.0	2.7	2.3	1.8
4	4.5	2.5	2.0	1.6
5	4.2	2.3	1.8	1.5
6	4.0	2.2	1.8	1.5
7	5.2	2.7	2.3	1.8
8	4.5	2.5	2.0	1.6
9	5.0	2.7	2.3	1.8
10	4.0	2.2	1.8	1.5

It is probable that the discovery of live *P. antipodarum* and their shells in Southern Europe and Western Asia (Greece, Turkey, Iraq), in addition to the active expansion within the Azov-Black Sea Basin, are connected to bird migration corridors as the snail can survive gut passage in both fish and birds (Aarnio and Bonsdorff 1997). It has been shown that the majority of live *P. antipodarum* were sampled in localities, where they could not be introduced by other pathways known for *P. antipodarum*, such as shipping, ornamental trade, movement of aquaculture products, or by water pipes (Alonso and Castro-Dıez 2008). For example within the Azov-Black Sea Basin the species was frequently found in small streams (Son 2008); *Potamopyrgus*' invasion in the Baltic region is also connected with migrating sea birds (Bondesen and Kaiser 1949, Hubendick 1950).

Shipping is another possible pathway for distant transportation of *Potamopyrgus* – although in this case, it is unlikely. Transfer of drinking water to ships may have initially been a pathway for transportation of this species from its native habitat, in New Zealand freshwater springs, to Europe. The regulation of drinking water treatment on long voyage ships (World Health Organization 2004) has now, however considerably improved, making shipping an improbable vector of spread.

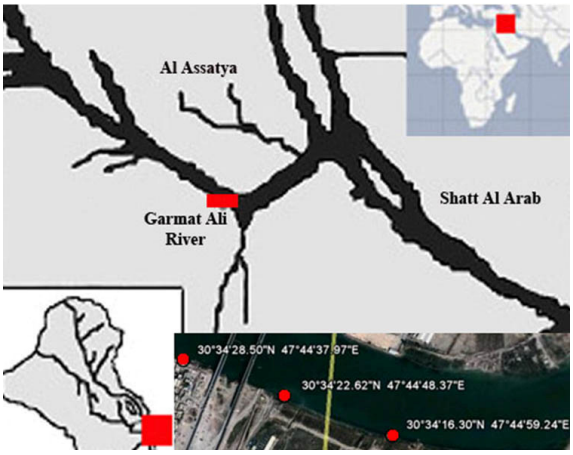

Figure 1. Sampling site (see also Annex 1)

Figure 2. Shells of *P. antipodarum* from Garmat Ali River (Iraq) (Photo: M.D. Naser)

In considering the avian pathway, one can assume two possible ways of *Potamopyrgus*' expansion to Northern Asia: (1) via expansion from the Ponto-Caspian region across Thrace (region spread over southern Bulgaria, north-eastern Greece, and European Turkey) by the Southern meridianal corridor of invasion (Panov et al. 2009) (in parallel with the "Via Pontica" bird migration corridor) and (2) and via further transfer by birds to the south or via penetration from Western Europe on a direction course from the Balkans to Asia Minor to the Near East.

As shown in many studies, within invasive ranges the parthenogenetic mollusc, *P. antipodarum* does not belong to one distinct clone, but to a polymorphic set with both visual and genetic distinctions (Städler et al. 2005). Establishing a level of genetic separateness between these lines is not possible, because of incomplete research within the invasive range. Moreover the information on their relationship with the native taxa in New Zealand is also insufficient, and research has not taken into account modern views on the taxonomical and genetic variety within *Potamopyrgus* species (Haase 2008). So it is necessary to understand, that the name "*Potamopyrgus antipodarum*" in invasive biology as well as the name "*Potamopyrgus jenkinsi*" *sensu lato* is not correlated with taxonomical investigations in the native range and in the case of the invasive range should presently be considered only as a common designation of *Potamopyrgus* species.

Currently, the diversity of *Potamopyrgus*' forms in the Ponto-Caspian Basin is lower than in Western Europe. The lines living in the Ponto-Caspian Basin are considerably different from molluscs found in Greece and Iraq, having greater width of whorls and swelling of the last whorl (see morphotypes from the Azov-Black Sea Basin (Anistratenko 1998; Son 2008)).

Using this taxonomic connection, the possible donor region for this eastern expansion to Western Asia should be identified as Western Europe (Figure 3).

It is necessary to note, that there are also potential opportunities for *Potamopyrus*' penetration to Western Asian regions bordering the Ponto-Caspian Basin in the near future. This would be a continuation of the Azov-Black Sea coastal expansion of *P. antipodarum* to the Caspian Basin and Southern Black Sea Coast.

In addition, there are many reports from aquarium hobbyists about records of the presence of *P. antipodarum* on aquarium plants bought in Moscow at the end of 2008. The Moscow market of aquarium trade is an important center of wholesale purchases of live organisms for the Russian ornamental industry and for other countries of the FSU (including its Asian Part). In our publication (Son 2007) it was shown, that factors such as asexual reproduction and small size of some aquatic invasives help the undetected movement of these organisms, which are not objects of special cultivation in aquariums. This phenomenon so widespread, that quite often, even species new to a science are described during scientific research of aquariums (Ahmad et al 1987, Kito and Nakamura 2001, Murano and Fukuoka 2003). Naturally, penetration into aquariums of such species is impossible for large and conspicuous fishes or plants and concerns basically invertebrates and microorganisms, which are minute (sometimes in early life stages) or are buried in the bottom substrate of aquariums. This increases the risk of their transfer as aliens and reduces control and eradication opportunities. Due to their own eco-morphological and biological properties the inconspicuous *P. antipodarum* has every prospect to spread via this pathway alongside other species such as *Ferrissia fragilis* (Tryon 1863) and *Craspedacusta sowerbii* (Lankester 1880).

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Annex 1
Records of *Potamopyrgus antipodarum* in Iraq

Site No.	Location	Record coordinates		Record date	Number collected	Collector
		Latitude, °N	Longitude, °E			
1	Garmat Ali River. Site 1	30°34'28"	47°44'37"	16 April 2008	12 shells	M.D. Naser
2	Garmat Ali River. Site 2	30°34'22"	47°44'48"	17 April 2008	6 shells	M.D. Naser
3	Garmat Ali River. Site 3	30°34'16"	47°44'59"	21 June 2008	4 shells	M.D. Naser