NOBANIS – Invasive Alien Species Fact Sheet

Orconectes limosus

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Species description

Scientific names: Orconectes limosus (Rafinesque, 1817), (Crustacea: Decapoda: Cambaridae)

Synonyms: from Holdich et al. 2006:

Cambarus affinis – Girard 1852

Cambarus limosus –Ortman 1905

Orconectes limosus – Hobbs 1942

Common names: spiny-cheek crayfish (Gb), Écrevisse américaine (Fr), Kamberkrebs (De), Polosatyi rak (RU), Rak pregowany (Po), Rak pruhovaný (Cz), Amerikaanse rivierkreeft (Ned).

Fig. 1. Spiny-cheek crayfish *Orconectes limosus* (photo by: A. Alekhnovitch)

Fig. 2. The detailed view of spiny-cheek crayfish *Orconectes limosus* chelae from the dorsal (left picture) and ventral side (middle) with apparent orange tips and the cranial part of carapace (right) with visible spines on the sides and on post-orbital ridges (adapted from Kozák et al., 2015; photos by M. Buřič and A. Kouba).

Species identification

The spiny-cheek crayfish is small to medium sized crayfish species with the total body length usually not exceeding 9 to 10 cm (Hamr, 2002), but individuals exceeding 12 cm of body length were also reported (Pieplow, 1938; Chybowski, 2007). The body colour of spiny-cheek crayfish is variable and can be influenced also by the environment where the crayfish live. The body is usually dark brown to olive-green (can be often colored black from the sediment they live in), with distinct red to brown-red transversal bands across abdominal segments. The ventral part of the body is light yellow. The characteristic tips of the claws are orange, and bordered by a dark band (Hamr, 2002; Holdich et al., 2006). The carapace is smooth but with distinct sharp spines on the sides in front of the cervical groove and right behind it (Holdich et al., 2006). From this feature, the spiny-cheek crayfish got its common English name. At the front of the carapace, there is one pair of long postorbital ridges terminated by sharp spines. The rostrum is relatively long and sharp with smooth, parallel edges also terminated by sharp spines. The claws are small, on the upper side covered with rows of small pits. They are smooth to touch and ciliary (Hamr, 2002). The colour of the dorsal side of the claws is usually the same as the body colour, the ventral side is light yellow. The fingers of the claws are usually terminated by sharp tips (Figs 1 and 2).
Spiny-cheek crayfish is short living species achieving usualy the life span of 2 – 3 years (Smith, 1981) but reported are also individuals probably older than 4 years (Pieplow, 1938). It matures usually in their second year of life at the age of 15 to 16 months (Momot, 1988; Hamr, 2002), but some fast-growing individuals can already mature at the end of their first season, in the size of 40 – 50 mm) and participate in reproduction as early as in the first year of life (Kozák et al., 2007). During the first season, young crayfish usually undergo 9 to 11 moultings (Andrews, 1907; Price and Payne, 1984) that leads in fast growth and high mortality (Kozák et al., 2007). After reaching sexual maturity, the growth usually slows down with decreasing number of molts per year (Reynolds, 2002).

Ecological requirements

Spiny-cheek crayfish can easily adapt to life in different types of running as well as lentic waters: streams, large rivers, pools or ponds (Hentonen and Huner, 1999). However, it mostly prefers shallow bottoms with a layer of sediments (Petrusek et al., 2006; Buřič et al., 2009a) into which they are able to burrow (Kouba et al., 2016). Generally it is very tolerant to a wide range of environmental conditions (e.g. to both organic and inorganic pollution), and is able to cope with polluted canals and organically enriched lakes and ponds (Aldridge 2011; Füreder et al., 2006). It predominantly occurs in larger watercourses. Although they can also inhabit colder and faster flowing streams, they strongly prefer warmer and slow-flowing or lentic waters (Henttonen and Huner, 1999; Holdich et al., 2006; Puky and Schád, 2006). Spiny-cheek crayfish is also considerably tolerant to elevated water temperatures and decreased concentrations of oxygen in water (Füreder et

al., 2006). It can better cope with environmental fluctuations, and can withstand drying out of the habitats for up to several weeks (Holdich et al., 2006). Spiny-cheek crayfish have been found also in brackish waters with salinity of up to 10 ‰ and it has been proven that females are able to successfully reproduce at salinity values below 7 ‰ (Jaszczołt and Szaniawska, 2011).

Reproduction

High fecundity, rapid maturation and reproduction gives spiny-cheek crayfish high invasive potential. Mating takes place in autumn and then again in following spring (Buřič et al., 2013). Females store the male's spermatophores in an adapted body cavity (*annulus ventralis*) on the ventral side of the body (Andrews, 1907; Vogt, 2002) and wait until spring warming when egg laying takes place, usually in April or May (Hamr, 2002; Holdich and Black, 2007). The fecundity can exceed 400 relatively small eggs (ranging in size from 1.5 to 2 mm) but usually ranges between 50 – 300 eggs (Holdich et al., 2006; Kozák et al., 2006). Under experimental conditions, successful reproduction was detected also in females that did not have a possibility to mate with a male and reproduced parthenogenetically (Buřič et al., 2011). Juveniles usually hatch in June, after 40 – 50 days of incubation (Kozák et al., 2006). The first developmental stage lasts only 1 to 2 days, the second only 3 – 5 days and it is also mother-dependent, attached to maternal pleopods, without exogenous nutrition. The appearance of 2nd developmental stage juveniles is reminiscent of the first developmental stage (a large cephalothorax and a small coiled abdomen). Young crayfish become independent in the third developmental stage and they start actively feed (Andrews 1907).

Native Range

The spiny-cheek crayfish is originally a North American crayfish species. Its natural range is in the catchment area of the lower reaches of the River Delaware (Rhoades, 1962) located on the East Coast of the USA, in the surroundings of Chesapeake Bay in the states of Pennsylvania and Maryland, and possibly also in other rivers in this region, e.g., the Susquehanna (Filipová et al., 2011). Its occurrence in North America has been, however, confirmed in at least fourteen states of the USA (Connecticut, Delaware, District of Columbia, New Hampshire, New Jersey, New York, Maine, Maryland, Massachusetts, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia) and Canada (New Brunswick, Quebec) (Hobbs, 1974; Hamr, 2002; Taylor et al., 2007); Fig. 2. Spiny-cheek crayfish have probably been introduced into most of these states by people.

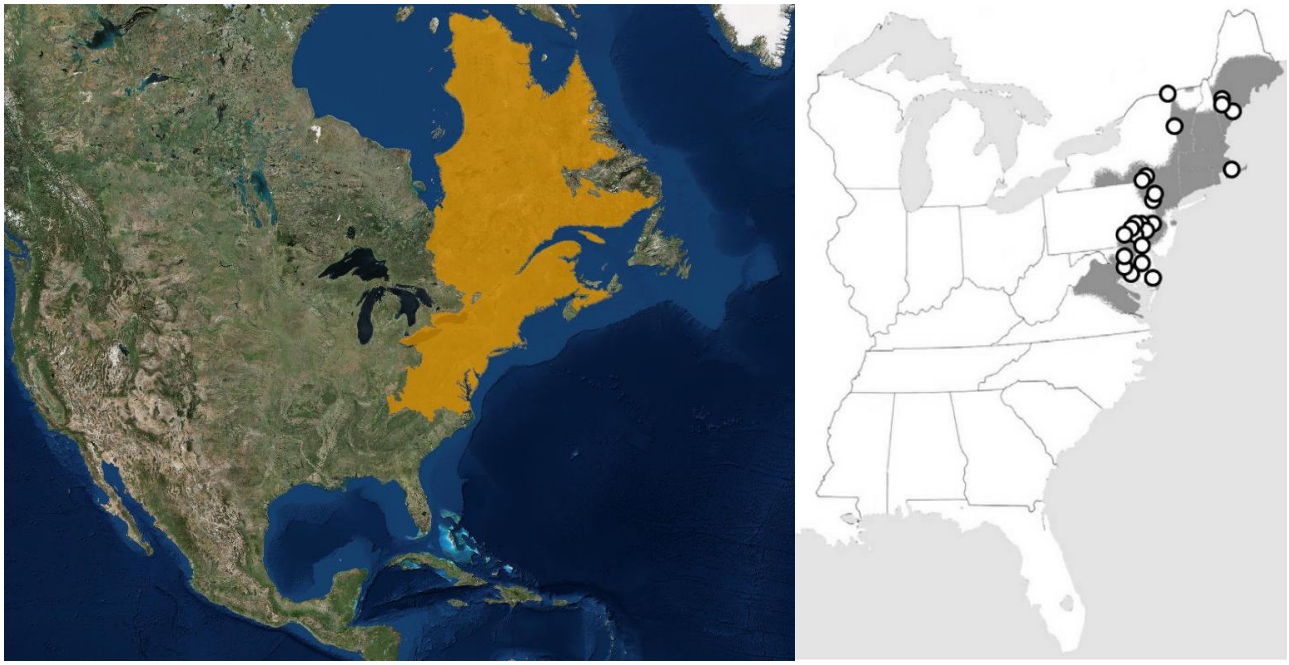

Fig. 2. Distribution of spiny cheek crayfish (*Orconectes limosus*) in North America by Adams et al. (2010) on the left and more precise, though not complete, localization of stockcs in North America (on the the right) adapted from Filipová et al. (2011).

Invasive distribution in Europe:

The spiny-cheek crayfish was the first non-indigenous crayfish to be intentionally introduced into Europe from the USA (Holdich and Black 2007). After its introduction into Poland in 1890, secondary introductions were made into other parts of Poland and into Germany (in 1895) and France (Hamr 2002; Holdich 2002), in an attempt to make up for losses of the economically important noble crayfish *Astacus astacus* (L.), through crayfish plague (Machino and Holdich 2006; Holdich et al. 2006). The crayfish plague is probably one of the best-known oomycete diseases, caused by *Aphanomyces astaci* Schikora, 1906, which is one of the best-studied invertebrate pathogens (Rezinciuc et al., 2016). This desease is considered to be the most devastating one to all crayfish not originating from North America (Lodge et al., 2000; Svoboda et al., 2016). In accordance with recent studies (Filipová et al., 2011), all known European stocks of spiny-cheek crayfish originate from the first introduction of 90 specimens in 1890. Recently it is one of the most widespread crayfish in continental Europe, occupying at least 24 territories (Kouba et al. 2014; Trichkova et al. 2015; Govedič, 2017). In Germany, it has colonized most of the major river systems thus making any attempts to reestablish noble crayfish populations impossible (Dehus et al. 1999). It has invaded Belarus from Poland withing the last 30-40 years and is now common in

some rivers, including the River Neman that drains into the Baltic Sea (Alekhnovich et al. 1999). Investigations in France showed that spiny-cheek crayfish occurred in 874 locations in 84 departmens (France is divided into 95 departments) (Arrignon 1996). In Poland, populations of spiny-cheek crayfish increased from 57 in 1959 to at least 1383 by 2004, and out of 300 lakes recently examined in NE Germany, 214 were found to have spiny-cheek crayfish (Schulz and Smietana 2001). It was released for the first time in Austria in Salzburg in 1969 and did not spread widely, although it is found in the Danube since the 1980s (Nesemann et al. 1995). It was first recorded in Italy in 1991, probably having being introduced with fish stocks, and is now common in northern parts (Gherardi et al. 1999). It is also reported from British Isles (Holdich and Black 2007). The spiny-cheek crayfish is gradually spreading eastwards in Europe and is now widespread in western parts of the Czech Republic (Petrusek et al. 2006). In Hungary, its colonization speed has been calculated to be more than 13 km yr^{-1} in the River Danube (Puky and Schàd 2006) and, whilst the main catch in Hungary was noble crayfish in the 1990s, it is now dominated by spiny-cheek crayfish (Holdich et al. 2006). It has been found in Croatia (Maguire and Gottstein-Matoćec 2004), Serbia (Karaman and Machino 2004), and Slovenia (Govedič 2017). It is also reported from Romania (Parvulescu et al. 2009), Bulgaria (Puky 2014) and further evidence can be expected eastwards or southwards. The distribution of spiny-cheek crayfish in Europe can be seen on Fig**.** 3 (note that the recent extension e.g. Bulgaria and Slovenia is not shown).

Spiny-cheek crayfish has a number of biological peculiarities that support its fast expansion in Europe and giving advantage over native species. Appart from above mentioned issues, there are also effects of its high activity and aggressiveness (Lozan 2000; Musil et al 2010) ability to form highly competitive invasive front (Parvulescu et al. 2015), and most importantly, the ability to be a carrier of crayfish plague while being fairly resistant to it (Kozubiková et al. 2006).

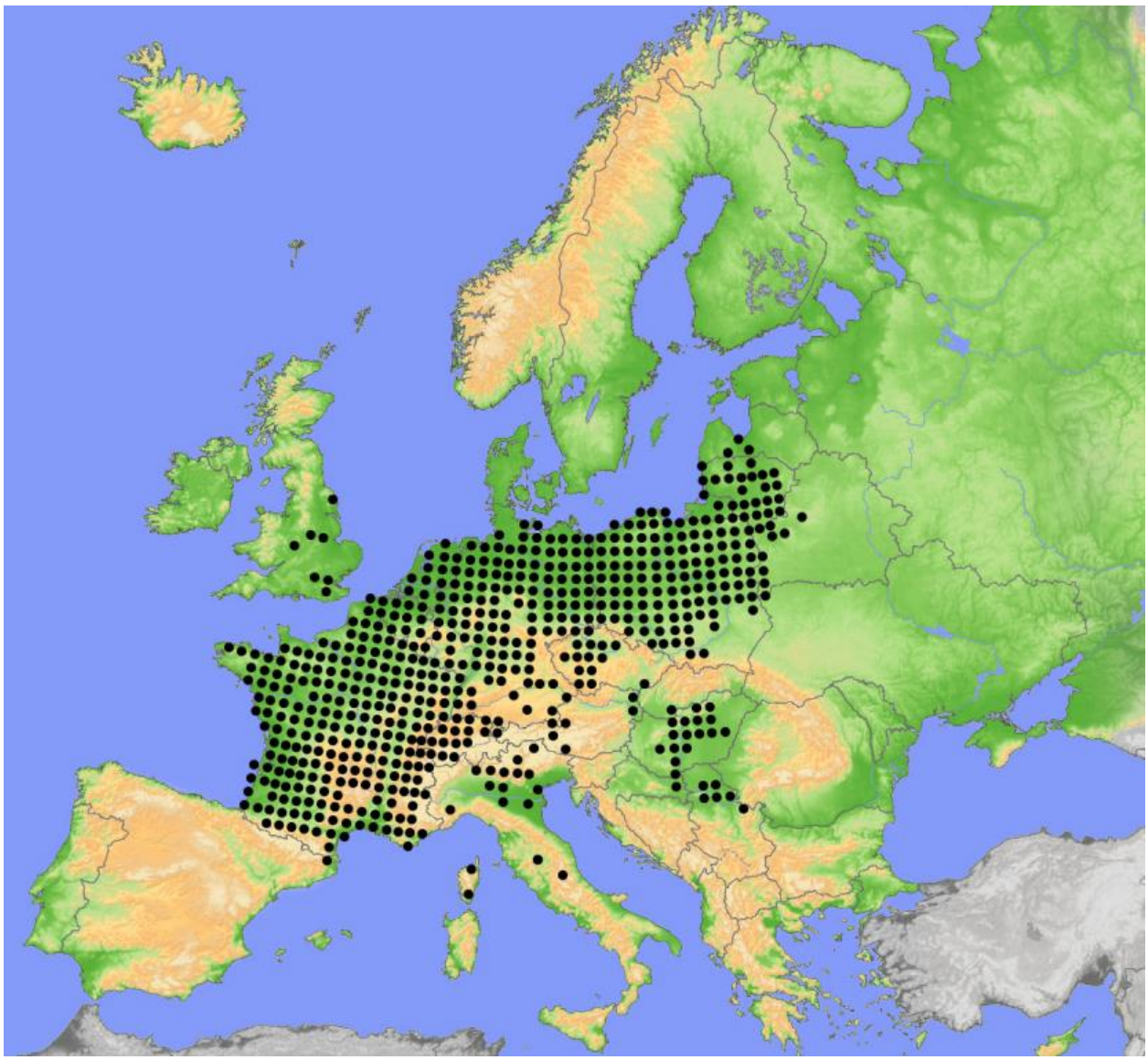

Fig. 3. Distribution of spiny-cheek crayfish *Orconectes limosus* in Europe adapted from Kouba et al. 2014).

Impact

Spiny-cheek crayfish species is undoubtedly biologically very well-equipped to compete with the autochthonous astacofauna. Considering its more plastic life style and reproduction cycle with high tolerance and adaptability compared to native crayfish, it has good preconditions for settling European habitats, further spread and forcing native species out from their current localities of occurrence (Kozák et al. 2015). Transmission of crayfish plague to native species supports these facts as well (Holdich and Black 2007). Migration abilities represent a significant aspect of spreading of spiny cheek crayfish (Buřič et al. 2009b; Puky 2014), their importance increases when migrating individuals are also carriers of crayfish plague pathogen. Fast extinction of populations of native species affected

by crayfish plague means a release of benthic niches and a possibility of their rapid settlement by non-native species (Holdich et al. 2009).
The spread of spiny-cheek crayfish in Europe caused severe adverse impacts on indigenous crayfish populations. This is due to transmission of crayfish plague and where infection has not occurred, by direct competition or competition for resources (Peay 2009). Crayfish definitely have the potential to influence ecosystems mainly by consumption of macroinvertebrates and aquatic plants (Vojkovská et al. 2014). This species reach higher population densities, have higher consumption rates and spread at a higher pace, which is the main reason for their even stronger negative effects. Even at low population densities, they can lead to decreasing numbers and diversity in benthic invertebrates and macrophytes as well as a shift in species composition. The magnitude of their impacts on ecosystems may differ depending on the waterbody type, since streaming water and standing water house different species and communities (Vaeßen and Hollert 2015).
Generally, a loss of native species or introduction and invasion of new species (or both alternatives at once) often leads to great changes in a given ecosystem and a loss of biodiversity (Covich et al. 1999, Gherardi 2007, Holdich and Pöckl 2007). Abundance and composition of macrophytes (Nyström et al. 1996, Nyström 1999) and larger aquatic invertebrates, including insect larvae (Nyström, 1999) are often negatively influenced resulting in a decrease in important food resources which can lead to a decrease in occurrence of amphibians or molluscs (Warner et al., 1995; Renai and Gherardi, 2004) and it can also influence occurrence and species composition of a fish community (Guan and Wiles, 1997; Ilhéu et al., 2007).

References and other resources

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http://www.nonnativespecies.org/factsheet/downloadFactsheet.cfm?speciesId=2441 – fact sheet *Orconectes limosus* by D. Aldridge
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