

**The Chinese giant mussel – *Sinanodonta woodiana* (Lea, 1834)
(Bivalvia, Unionidae) –
an unwelcome addition to the Swedish fauna**

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Two records of the invasive freshwater mussel *Sinanodonta woodiana* (Lea, 1834) from the provinces of Skåne (2005) and Västergötland (2007) in Sweden are reported. Both consist of single, dead specimens. In the first case its origin was a carp breed, in the second it was introduced with infected goldfish into a garden pond, where it lived for approximately three years and reached adult size. This second record is the northernmost known in Europe so far, and *S. woodiana* will probably not have any difficulties in establishing itself in South and Middle Sweden. The invasion history in Europe, the means of dispersal and the risks of the species establishment are briefly discussed.

Key words: Bivalvia, Unionidae, *Sinanodonta woodiana*, invasive species, Sweden.

INTRODUCTION

Sinanodonta woodiana (Lea) is native to East Asia and lives in a large area from the River Amur, through large parts of China to Cambodia. From this area the species has, by the help of man, spread to and established itself in large parts of South-East Asia, south of the native distribution area. Different species of carp fishes function as hosts, especially Silver Carp [*Hypophthalmichthys molitrix* (Valenciennes)] and Grass Carp [*Ctenopharyngodon idella* (Valenciennes)] – and as these species have been imported for biological control of organic debris and freshwater plants, *S. woodiana* has spread also to other parts of the world if the fishes have been infected with its glochidia. According to Mienis (2003d) also Goldfish [*Carassius auratus* (Linnaeus)] and different species of Bitterling [*Rhodeus* spp.] are possible hosts. In Europe it established itself in Rumania and Hungary in the late 1970s (Falkner, 1990). Since then it has spread rather rapidly to other countries, especially in the Danube-system, where it locally may occur in high population densities. Occurrences have so far been reported from 15 European countries: Austria, Belgium, Bulgaria, the Czech Republic, France, Germany, Greece, Hungary, Italy, Poland, Romania, Serbia, Slovakia, Sweden and Ukraine. The colonization process and details on the spread are described in a series of papers by Mienis (1999, 2001, 2002a, 2002b, 2002c, 2003a, 2003b, 2003c, 2003d, 2004a, 2004b, 2005, 2006a, 2006b), see also Hubenov (2006), Watters (1997) and von Proschwitz (2007). With infected carps it has also spread to Costa Rica and the Dominican Republic (Mienis 2003b).

THE SWEDISH RECORDS

On 22nd June 2005 a shell of an *Anodonta*-like mussel was found SE of the church at Hjärnarp, in the stream Lerbäcken (tributary to the stream Kägleån) in the province of Skåne (S. Sweden) (leg. M. Svensson). The site is situated immediately below the outlet of

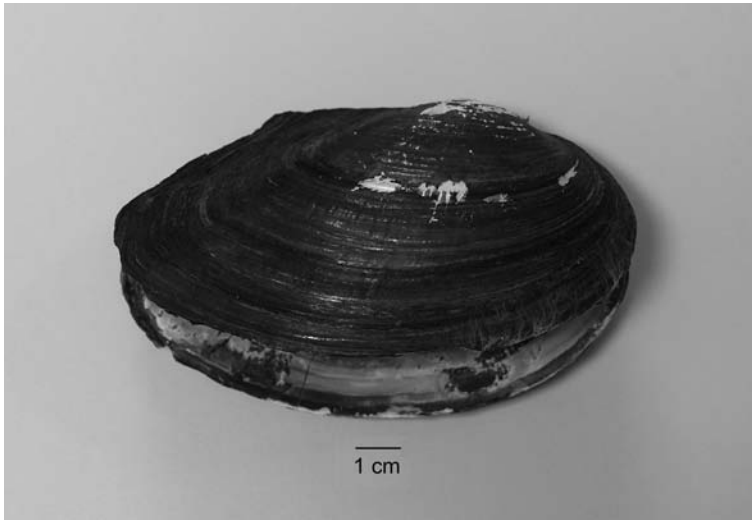


Fig. 1. *Sinanodonta woodiana* (Lea). Specimen from Askim, S part of Göteborg, province of Västergötland, W. Sweden.

a carp-pond. The specimen had a length of 7.7 cm and a height of 4.6 cm, hence clearly not adult, but the shape and the proportions are typical for *S. woodiana*. The find is described in detail by von Proschwitz (2006). On June 16th 2007 a second, newly dead, specimen of the same species was found in a garden pond with goldfishes at Askims Urbergsväg in Askim (S. part of Göteborg, province of Västergötland, W. Sweden) (leg. B. Ohlsson). This specimen is larger, and has a length of 12.2 cm and a height of 8.9 cm (fig. 1). The position of both localities is indicated in fig. 2.

SOME REMARKS ON THE SPECIES

S. woodiana is a large species, and it may reach a length of 12-26 cm and a maximal height of 12 cm. The form of the shell is, contrary to the European species in the subfamily Anodontinae, relatively short and elliptical to almost rounded and very high in the central part. The proportions between length and height are different and very pronounced in adult specimens. Also the marked breadth (up to 6 cm) and the rounding over the umbo and the oldest parts of the shell are marked. The intraspecific variation in the form of the shell is, however, considerable. The umbonal rugae are characteristic, consisting of pronounced, coarse, relatively sparse, transverse ridges (cf. Falkner, 1990: fig. e, p. 264), which differ markedly from the finer, thinner and more closely lying ridges, present in the European *Anodonta* and *Pseudanodonta* species. The colour of the shell is dark brown – yellow green – dark green.

The species is sometimes placed in the genus *Anodonta* (often with *Sinanodonta* as a subgenus). There are, however, good reasons for attributing full generic rank to *Sinanodonta*. Falkner (1994) remarks, that the conchologically similar *Anodonta* (*Euphrata*)-group, which lives in the Near East, has umbonal sculpture connecting it to the European species (*Anodonta* s.s.). The *Sinanodonta*-group, on the other hand, has a sculpture which connects it to another East Asian genus – *Cristaria* (cf. Mienis, 2001).



Fig. 2. The distribution of *S. woodiana* in Sweden. The years for the records are indicated in the map.

DISCUSSION

S. woodiana has relatively easily established itself in parts of Central and South Europe. With its competitive properties and ability of massive propagation, the species is a clear threat to the native European fauna of large freshwater mussels (Watters, 1997; Mienis, 2002b). Seen in this context, the Swedish records are not unexpected, and should be seen as an alarm bell, signalling the probable onset of an invasion of *S. woodiana* in the same way as in Central Europe. The first record constitutes one single shell only. The site, below the outlet of a carp pond, indicates that it must have developed from an infected fish, bred in the pond. Further search on the locality has not, however, resulted in further specimens being found. The second record constitutes a larger, adult individual (fig. 1), newly dead as it was found. The size of the shell and its growth lines indicate that it is at least three years old. It originates from infected goldfish, which had been bought and released in the pond, hence giving evidence of this fish species functioning as a host. In approximately three years, the mussel managed to develop and reach adult size in the small pond. This record, immediately south of Göteborg on the Swedish west coast, is so far the northernmost known one for *S. woodiana* in Europe (fig. 2). The climate in South and Middle Sweden is apparently not a limiting factor for the establishment of the species.

It even seems plausible that the species already is present in other ponds with carp and goldfish in the country. As the carps often are moved by fishers between and (illegally) introduced into ponds and small lakes, there are good possibilities for further undesired spread of *S. woodiana*. Probably living carps are also imported illegally from abroad. Furthermore, the marketing of goldfish as garden decoration also facilitates the spread of the mussel. Further search in fish breedings and garden ponds would probably result in still more records. An additional possible direct means of dispersal for *S. woodiana* is its being, unintentionally, marketed and sold by garden centres and aquarium shops as a species for biological control and water purification in several European countries (including Sweden). In many cases it is obvious that the firms are not aware of what species they are offering. Pictures of marketed mussels, shown on the internet pages of such firms, are mostly *Anodonta*-species – but in some cases undoubtedly *S. woodiana*! It is desirable that marketing of mussels as a means of biological control and as water purifiers should be restricted to common indigenous species, and that the import of mussels for such purposes will be prohibited in the EU. Information of the great ecological risks of the possible establishment of *S. woodiana* should be spread to fish breeders, anglers, aquarium shops, garden centres and gardeners.

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