

THE CRYPTOGENIC RIVER SNAIL *VIVIPARUS VIVIPARUS* EXPANDS ITS RANGE IN IRELAND: CASE OF A RE-INTRODUCTION?

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Abstract The river snail *Viviparus viviparus* was known in Ireland from deposits in the Shannon and Barrow river catchments almost a century ago. It was only recently, since 1995, that living populations were found in the upper Shannon. Since these records further snails were found at separate localities along the length of the Shannon and Erne catchments and from near Lough Neagh. It would appear that this snail might be a reintroduction to Ireland. The modes of transmission that might have been involved in its arrival are discussed.

Key words River snail, Shannon, Erne, Introduction, Expansion

INTRODUCTION

Until 1995 the river snail *Viviparus viviparus* (Linnaeus, 1758) was known from Newtownards, Co Down (Brown, 1818) and would seem to have died out following what might have been an introduction. Since then it was found as shell material from sediments removed from tidal regions of the lower Shannon. Fogarty (1909) found a single shell and a further shell was recovered in 1922, reported by McMillan and Stelfox (1961). Further shells were recovered from the Barrow and Suir rivers during 1913 to 1917, but these may have been sub-fossils (reviewed by Cotton, 1996). Shells were found in a lignite deposit close to Lough Neagh, Co Antrim, but since this deposit was laid down during a previous interstadial period the current status of the snail was unclear. Since then a moribund snail was found on the shore of Lough Neagh (Anderson, 2014). Cotton (1996) also refers to a record from Naas, Co Kildare. It was unclear whether these were shells from re-worked deposits or evidence for existing populations. In August 1995 Cotton (1996) found the first living specimens in the shallows of Acres Lake near Drumshambo and in the following year they were present at a density of approximately 80m⁻². Since Cotton's finding some new sites were found in the region of his find with populations located at Carrick-on-Shannon, Rockingham in Lough Key and on the canal leading into Acres Lake, all

within the upper Shannon catchment (Minchin *et al.*, 1998). Since these records Anderson (2014) reported the finding of a recently dead specimen with a 23mm spire height on the shores of Lough Neagh. Anderson also refers to a finding by G.A. Holyoak of a 'colony at Lough Oughter'. This account reports the existence of further populations from the Erne and Shannon catchments and discusses the possible modes of arrival to Ireland, should it have been introduced.

METHODS

Snails were retrieved in summer from sampling lakeshores at a time when water-levels were low. Large cobbles and stones, to which the snails were attached, were retrieved from depths of about 50cms using a rake to pull these to the surface. Snails were also found by removing stones while wading in water and by scraping vertical surfaces using a pole and pocket net. The spire height of snails was measured to the nearest millimeter.

RESULTS

Viviparus viviparus was encountered when sampling for the zebra mussel *Dreissena polymorpha* occurring in all sites where zebra mussels were present. When present the snail was obvious either on account of their large size or because of the distinctive shell banding, most readily seen on the shells of smaller individuals.

Snails were retrieved in summer by sampling lakeshores at a time, very often, when water-levels were low. Waterlogged tree remains, large cobbles and stones, to which the snails were attached, were retrieved from depths of ~50cms. Snails were also found attached to stones in lake shallows and on quay walls and pillars. Several large specimens were observed on the vertical surface of a quay wall in June 2007. Some of these were attached a few centimeters above the water surface to the south of the Drumleague Lock, on the canal between Battlebridge and Acres Lake.

New records of snails were retrieved at the following sites:

The Shannon Catchment

Lough Allen Lower (54°02'56.27"N, 08°03'05.04"W) June 2007, July 2013

Snails were removed from smooth submerged tree branches and limbs that lacked bark. These surfaces had an algal film on which the snails were found in large numbers. Small snails were clustered together mainly on the underside of these limbs where these were raised off the muddy bottom. A size frequency histogram of this population is shown in Fig. 1.

Acres Lake (54°02'17.58"N, 08°02'58.00"W) July 1998; May 2007, July 2013

Several snails were removed from vertical pillars of the berthing area and many were seen in the shallows with some stranded on the shore. Some had expired.

Lough Allen Canal (54°02'06.80"N, 08°03'51.41"W) June 2007, July 2013

This canal that extends from Battlebridge to Acres Lake and then from Acres Lake to Lough

Allen. Snails were seen close to and a few centimeters above the canal water level attached to the masonry

Leitrim Quay (53°59'24.50"N, 08°03'54.61"W) July 2007

Two adults of 33mm and 26mm spire height and one juvenile of 8mm were attached to the stonework of the canal wall.

Rockingham, LKey (53°59'13.12"N, 08°14'18.32"W) August 2000, August 2003; July 2007

Many snails were collected from the pillars of a leisure craft berthing area. This included juveniles from 7mm spire height. Solitary individuals were recovered from the lake mud at 2 to 2.5m depth near a small islet approximately 150m away from the main concentration. These had become encumbered with attaching zebra mussels; two snails of 7g and 5g wet weight had 6g and 1g of attached zebra mussels respectively.

Carrick-on-Shannon (53°56'35.43"N, 08°05'53.26"W) June 2007, September 2009, October 2010

Since the finding of the concentration of snails in 1998 only occasional and single specimens were found >100m downstream of this site attached to a quay wall. Further downstream approximately 400m a collection, from <1m depth, of ten individuals ranging from 10–24mm spire height was obtained and many more were seen attached to stones and to the surface of the laminae of *Nuphar lutea*.

Lough Bran (53°58'29.45"N, 08°03'17.04"W) July 2003

Snails were removed from the shallows on the eastern side of the lake attached to stones at <1m depth, there were several attached to the under-surface of stones.

Jamestown Canal (53°55'06.52"N, 08°01'54.65"W) July 2007

A single individual of 18mm spire height was removed from a stone jetty wall.

Shannon River (53°10'02.95"N, 08°04'51.30"W) July 2012

At the navigation lock (Meelick) both shell and live specimens were recovered using a basket dredge.

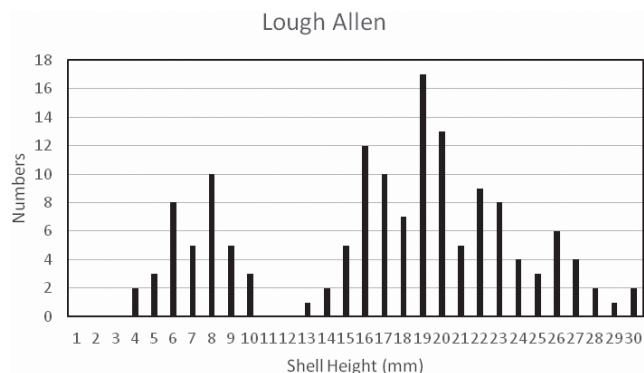


Figure 1 Size distribution of river snails recovered from the shallows of Lough Allen.

Terryglass Harbour, Lough Derg (53°03'38.092"N, 08°12'23.86"W) July 2005

Tens of specimens were removed from the vertical surface of the sheltered inside of the pier at the public berthing area in a bend of the pier from a depth of ca 2m (Lough Derg Science Group, 2007). Specimens were not recovered at distances less than 50m to either side.

Dromineer Quay, Lough Derg (52°55'33.31"N, 08°16'44.60"W) July 2005, January 2011

A single live specimen was removed from the exposed side of the quay wall and within 50m two shells were found washed ashore, one 30mm spire height and the other with a broken spire.

The Erne Catchment

Lough Oughter (53°59'48.73"N, 07°28'47.68"W) July 2006

On the southern shore snails were found in abundance on a shore of stones and small boulders. Many were found on the under-surfaces of stones. There were several hundred present.

DISCUSSION

The numbers, and repeated findings in some lakes and rivers and some other records from canals over several years indicate that the species is well established in Ireland and at some localities it was the dominant species. The smaller numbers encountered on the lower Shannon might indicate more recent appearances. The apparent highly localised extent of many of the populations is notable most probably explained by the lack of a pelagic life-history stage. It might be expected that its pedal activities and possible spread attached to drifting plant materials, the species might have spread over a greater area. In Lough Key individuals were found >150m from the main concentration and this is after five years from the finding of an already established concentration located in 1998 in this lake. At Carrick-on-Shannon smaller numbers were found in the river downstream to at least 400m of the main concentration which occurred above a bridge. The concentration in Lough Allen/Acres Lake and in the interconnecting Allen Canal occurred over a greater area.

Its occurrence in Lough Derg in the lower Shannon might be a remnant from a pre-existing population based on the evidence of the early

records almost a century earlier that might have represented a post glacial population. However, it is difficult to believe that its presence, as living snails, was overlooked by naturalists, such as A.W. Stelfox (1883–1972) and his associates before the sighting by Cotton (1995). While it is possible, due to turbid waters, the species could have been overlooked. However, it occurs in shallow water and occasionally becomes stranded. All indications are that the snail is a recent arrival. Indeed it is possible this snail was introduced via a number of means to, and within, Ireland and is polyvetic (See below). However, there is no direct evidence of an arrival. On account of the widely separated localities overland transport has clearly already taken place involving either, or all, of the potential modes of spread. This includes a natural spread to Ireland that might have arisen from bird transport. For this reason *V. viviparus* should be considered to be a cryptogen until further evidence becomes available.

It is clear that there is a greater density in the northern regions of Ireland when compared with the sparse findings in the south, suggesting that the seminal inoculation might have taken place in the northern region. This region is widely recognised for angling cyprinids. Many anglers come from overseas, especially from Britain where the snail is known to be widely distributed (Ross, 1984). Records also occur where there are boating activities, however, in a study of over fifteen years this snail has not been observed on a boat hull.

It is predicted that further isolated populations are likely to become revealed in the coming years.

Potential modes of spread and arrival of *V. viviparus* to and within Ireland

Arrival and spread with angling activities

Introduced either as angling bait or unintentionally moved with fishing gear such as keep nets which are often stored in bags (stink-bags), and may be transported to a new angling site. Anglers from Britain make frequent visits to Ireland to fish cyprinids and it is possible that the Asian clam *Corbicula fluminea* may have been introduced with angling gear in this way (Minchin, 2014) but snails might also be spread as well. *Viviparus viviparus* occurs directly at some sites where angling has been seen to take place in the current study. There are examples from elsewhere; the

snail *Potamopyrgus antipodarum* has most probably been spread by angling equipment and with stocking of fishes in Australia (Loo *et al.*, 2007).

Arrival and spread with leisure craft

Snails might be transported with imported craft, from the midlands of Britain, arriving in much the same way as the zebra mussel *Dreissena polymorpha* (Pollox *et al.*, 2003). Snails might lodge in a hull bow-thruster and carried there during transport. However, in the present study snails have not been observed attached to boat hulls. In Canada Davidson *et al.* (2008) suggested that the New Zealand mud snail *Potamopyrgus antipodarum* might have been spread to parts of Vancouver Island by leisure craft and fishing equipment.

Arrival following release from aquaria/ aquatic garden plants

Specimens may have been imported from Britain and/or continental Europe for aquaria or ponds. This might have been with aquatic ornamental plants for ponds or with aquaria, as such species are on sale (Anon, 2014). The banding of the shell and its size may have been features that might have been valued. Large snails such as the ramshorn snail *Planorbis corneus* are also available for sale (Anon, 2014). Snails generally occur within aquaria and could have been inadvertently introduced. In a study of aquaria in New Zealand *Planorbis corneus* was found in eleven of fifty-five freshwater aquaria (Duggan (2010) and other *Viviparus* species are stated to have been introduced to the wild from aquaria (Kappes & Haase, 2012).

Arrival and spread by natural means

Snails have been transmitted between water bodies overland as well as along waterways. It is unknown whether birds, or mammals, could transport snails. There are accounts of snails being entrapped amongst feathers or on caked mud on birds feet or could survive passage through a gut. Snails can occur in shallow water as well as be stranded and thus might become carried by wading birds. Kawakami *et al.*, (2008) have suggested that snails might survive passage through a birds gut and in this way spread the snail, a process of endozoochory. However, ectozoochory, the spread other than by the gastric tract, is known for several species of snail

(van Leeuwen and van der Velde, 2012). Spread along water-ways could be with drifts of plants to which snails have attached. *Viviparus viviparus* was seen attached to *Nuphar lutea* laminae close to and downstream of Carrick-on-Shannon. Localised dispersal may take place by small incremental opportunistic events, for many snail species of 0.3 to 1.0 km/year (Kappes & Haase, 2012).

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