Faucet Snail (*Bithynia tentaculata*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2011
Revised, September 2014
Revised, July 2015


Photo: Amy Benson, USGS

1 Native Range, and Status in the United States

Native Range
From Kipp et al. (2015):

"Europe, from Scandinavia to Greece."

Status in the United States
From Kipp et al. (2015):

"The species is established in the drainages of Lake Ontario (Mills et al. 1993; Peckarsky et al. 1993), Lake Michigan (Mills et al. 1993), and Lake Erie (Krieger 1985; Mackie et al. 1980; Peckarsky et al. 1993), but not Lake Superior (Jokinen 1992). Occurrences in Lake Huron do not warrant classification as established."

"Great Lakes Region: *Bithynia tentaculata* was first recorded in Lake Michigan in 1871, but was probably introduced in 1870 (Mills et al. 1993). It spread to Lake Ontario by 1879, the Hudson River by 1892, and other tributaries and water bodies in the Finger Lakes region during the 20th century (Jokinen 1992; Mills et al. 1993). It was introduced to Lake Erie sometime before 1930 (Carr and Hiltunen 1965; Krieger 1985). This snail's range now extends from Quebec and Wisconsin to Pennsylvania and New York (Jokinen 1992). It has been recorded from Lake Huron, but only a few individuals were found in benthic samples from Saginaw Bay in the 1980s and 1990s (Nalepa et al. 2002)."

Means of Introductions in the United States

From Kipp et al. (2015):

"*Bithynia tentaculata* could have been introduced to the Great Lakes basin in packaging material for crockery, through solid ballast in timber ships arriving to Lake Michigan, or by deliberate release by amateur naturalists into the Erie Canal, Mohawk River and Schuyler's Lake (Mills et al. 1993). The most likely and most accepted explanation for its original introduction is the solid ballast vector (Jokinen 1992)."

Remarks

From Kipp et al. (2015):

"*Bithynia* was found in fossils from the Pleistocene in Glacial Lake Chicago (Jokinen 1992), but the only representative of the genus currently found in the Great Lakes is Eurasian. *Bithynia tentaculata* is synonymous with *Bulimus tentaculatus* (Jokinen 1992)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2014):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Protostomia
Superphylum Lophozoa
Phylum Mollusca
Class Gastropoda
Order Neotaenioglossa
Family Bithyniidae
Genus Bithynia
Species *Bithynia tentaculata"*

"Taxonomic Status: Valid"

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Size, Weight, and Age Range

From Kipp et al. (2015):

"shell is usually no larger than 12–15 mm; the snail is sexually mature by the time it reaches 8 mm in size (Jokinen 1992; Mackie et al. 1980; Peckarsky et al. 1993; Pennak 1989)"

Environment

From Kipp et al. (2015):

"Commonly found in freshwater ponds, shallow lakes, and canals. This species is found on the substrate in fall and winter (including gravel, sand, clay, mud or undersides of rocks) and on aquatic macrophytes (including milfoil, *Myriophyllum spicatum* and muskgrass, *Chara spp*.) in warmer months (Jokinen 1992; Pennak 1989; Vincent et al. 1981). It lives mostly in shoals, but is found at depths up to 5 m (Jokinen 1992). *Bithynia tentaculata* can inhabit intertidal zones in the Hudson River (Jokinen 1992). In general, the faucet snail inhabits waters with pH of 6.6–8.4, conductivity of 87–2320 µmhos/cm, Ca++ of 5–89 ppm, and Na+ of 4–291 ppm (Jokinen 1992). It can potentially survive well in water bodies with high concentrations of K+ and low concentrations of NO3- (Jokinen 1992). In the St. Lawrence River, it tends to occur in relatively unpolluted, nearshore areas (Vaillancourt and Laferriere 1983) and amongst dreissenid mussel beds (Ricciardi et al. 1997).

Climate/Range

From Kipp et al. (2015):

"Egg-laying occurs from May to July when water temperature is 20ºC or higher … Oocytes develop poorly at temperatures of 30–34ºC."

Distribution Outside the United States

Native

From Kipp et al. (2015):

"Europe, from Scandinavia to Greece."

Introduced

From NOBANIS (2014):

"Norway"

Means of Introduction Outside the United States

From NOBANIS (2014):

"Intentional and unintentional … Not invasive."

Short description

From Kipp et al. (2015):

"The faucet snail has a shiny pale brown shell, oval in shape, with a relatively large and rounded spire consisting of 5–6 somewhat flattened whorls, no umbilicus, and a very thick lip (Clarke 1981; Jokinen 1992; Mackie et al. 1980). The aperture is less than half the height of the shell (Clarke 1981). Adult *B. tentaculata* possess a white, calcareous, tear-drop to oval-shaped operculum with distinct concentric rings (Clarke 1981; Jokinen 1992; Pennak 1989). The operculum of juveniles, however, is spirally marked (Jokinen 1992). The operculum is always located very close to the aperture of the shell (Jokinen 1992). The animal itself has pointed, long tentacles and a simple foot with the right cervical lobe acting as a channel for water (Jokinen 1992)."

Biology

From Kipp et al. (2015):

"This species functions as both a scraper and a collector-filterer, grazing on algae on the substrate, as well as using its gills to filter suspended algae from the water column. When filter feeding, algae is sucked in, condensed, and then passed out between the right tentacle and exhalant siphon in pellet-like packages which are then eaten (Jokinen 1992). The ability to filter feed may play a role in allowing populations of the faucet snail to survive at high densities in relatively eutrophic, anthropogenically influenced water bodies (Jokinen 1992). *B. tentaculata* feeds selectively on food items (Brendelberger 1997). The faucet snail is known in Eurasia to feed on black fly larvae (Pavlichenko 1977)."

"*Bithynia tentaculata* is dioecious and lays its eggs on rocks, wood and shells in organized aggregates arranged in double rows, in clumps of 1–77. Egg-laying occurs from May to July when water temperature is 20ºC or higher, and sometimes a second time in October and November by females born early in the year. The density of eggs on the substrate can sometimes reach 155 clumps/m^2. Fecundity may reach up to 347 eggs and is greatest for the 2nd year class. Eggs hatch in three weeks to three months, depending on water temperature. Oocytes develop poorly at temperatures of 30–34ºC. Growth usually does not occur from September to May. The lifespan varies regionally and can be anywhere from 17 – 39 months (Jokinen 1992; Korotneva and Dregol'skaya 1992)."

Human uses

From Kipp et al. (2015):

"The faucet snail has the potential to be a good biomonitor for contaminants such as Cd, Zn, and MeHg because there are good correlations between environmental concentrations and snail tissue concentrations with respect to these toxic compounds (Desy et al. 2000; Flessas et al. 2000)."

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Diseases

From Kipp et al. (2015):

"In its native Eurasian habitat, the faucet snail is host to many different species of digeneans, cercariae, metacercariae, cysticercoids, and other parasites (Mattison et al. 1995; Morley et al. 2004; Toledo et al. 1998)."

From Sandland et al. (2013):

"*B. tentaculata* harbors trematode parasites that can generate high levels of mortality in waterfowl that consume infected snails (Roscoe & Huffman, 1982; Hoeve & Scott, 1988; Huffman & Roscoe, 1989). Two of the species implicated in waterfowl mortality are *Sphaeridiotrema globulus* and *Sphaeridiotrema pseudoglobulus* (Mucha & Huffman, 1991; McLaughlin et al., 1993; Cole, 2001; Sauer, Cole, and Nissen, 2007; Bergmame et al., 2011). Both of these trematode species use *B. tentaculata* as first and second-intermediate hosts in their life cycles (Fig. 1)."

Threat to humans

From Kipp et al. (2015):

"This species has been known to infest municipal water supplies in abundance."

3 Impacts of Introductions

From Kipp et al. (2015):

"**A) Realized:** After its introduction into the Erie Canal, the faucet snail began replacing two pleurocerid species, *Elimia virginica* and *E. livescens* (Jokinen 1992). Between 1917 and 1968, the species richness of mollusks in Oneida Lake decreased by 15% as the faucet snail increased in abundance (Harman 2000). It is very probable that impacts on pleurocerids, especially *Elimia spp*. in Oneida Lake, have occurred because the faucet snail has higher growth rates per unit respiration than most pleurocerids due to its ability to filter feed (Tashiro and Colman 1982)."

"However, after colonization by invasive zebra mussels, *Dreissena polymorpha*, in Oneida Lake, the density of the faucet snail decreased and overall mollusk abundance decreased even further (Harman 2000). Similar effects occurred in Lake Ontario between 1983 and 2000 due to competition with invasive dreissenid mussels (Haynes et al. 2005)."

"Where the faucet snail has been observed in Lake Champlain, it generally dominates gastropod assemblages (Vermont and New York State Departments of Environmental Conservation 2000)."

B) Potential: *B. tentaculata* can serve as a food item for introduced common carp *Cyprinus carpio* (Ricciardi 2001). It is also frequently found on introduced milfoil *Myriophyllum spicatum* (Vincent et al. 1981) and amongst introduced mussels (Ricciardi et al. 1997). The snail also has

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the potential to be a bio-fouling organism for underwater intakes and in swimming areas (Vermont and New York State Departments of Environmental Conservation 2000)."

From Sandland et al. (2013):

"In 2002, *B. tentaculata* and its parasites were first discovered in the Upper Mississippi River (UMR) in association with a large die-off of migrating waterfowl (Sauer et al., 2007). Since that time a total of 15 bird species have been impacted during spring and fall migrations (Sauer et al., 2007) and conservative mortality estimates now exceed 60,000 individuals with thousands of birds continuing to die every year (U.S. Fish and Wildlife Service [USFWS], unpublished data). Parasite-associated mortality in combination with shifts in prey abundance are likely to be further stressing avian populations (such as lesser scaup) already in decline (Cole, 2001; Wilkins et al., 2007).

4 Global Distribution

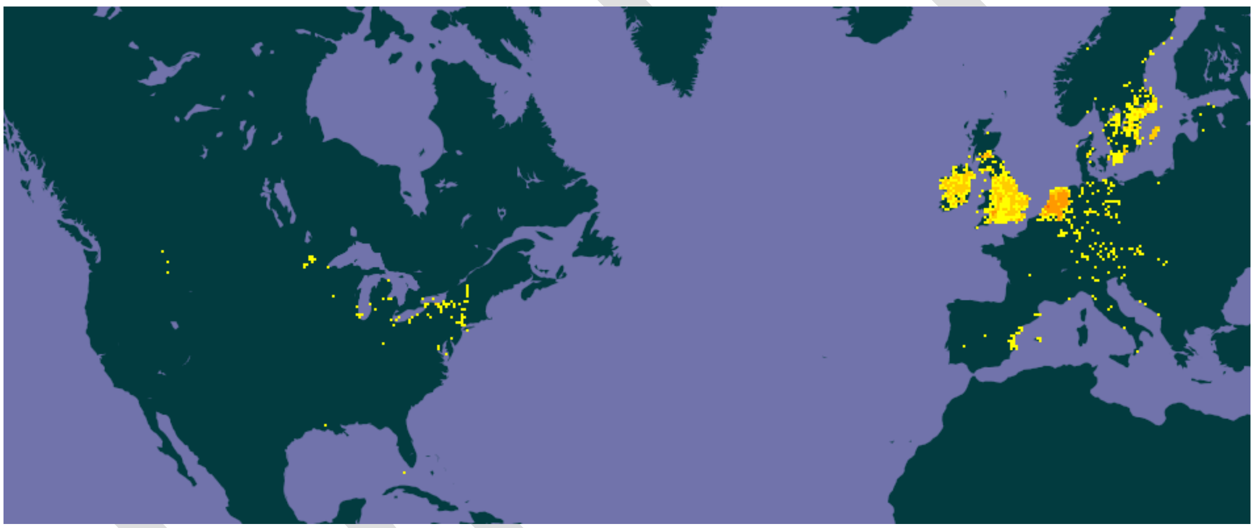

Figure 1. Map of known global distribution of *Bithynia tentaculata*. Map from GBIF (2014). Locations in Iceland and around the Gulf of Mexico were not included because they were incorrectly located.

5 Distribution within the United States

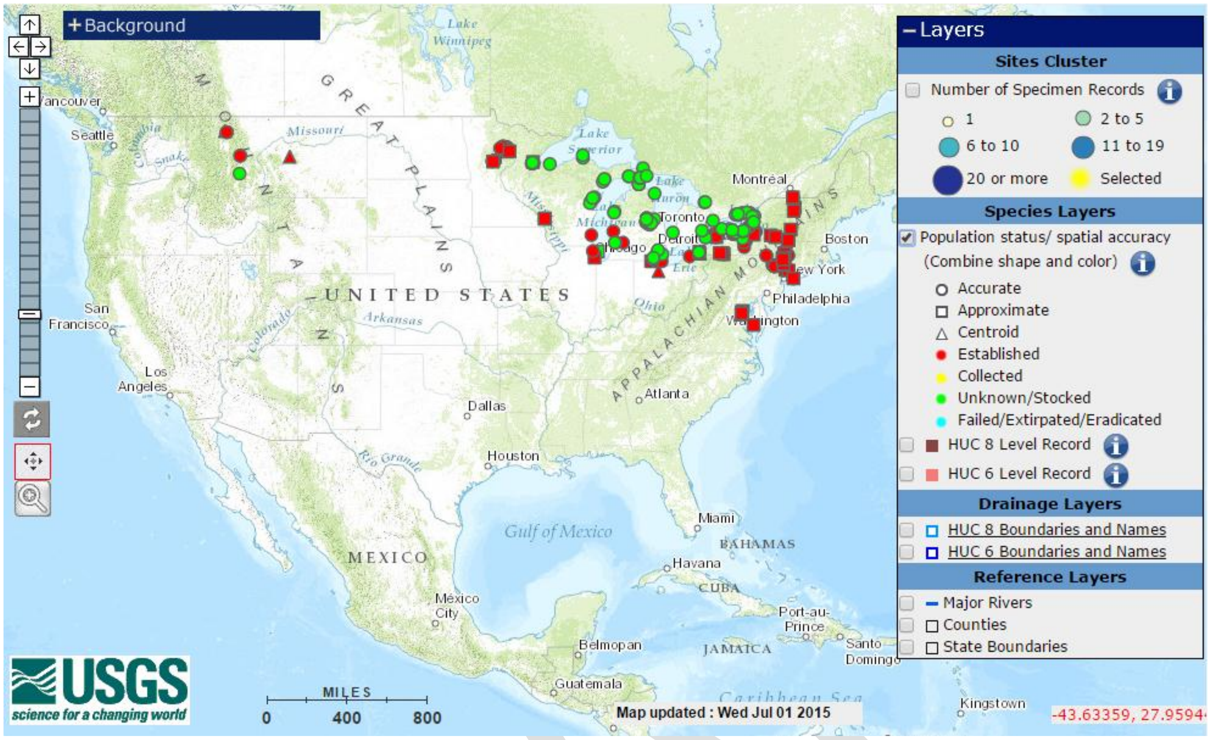

Figure 2. Distribution of *Bithynia tentaculata* in the United States. Map from Kipp et al. (2015).

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2008; 16 climate variables; Euclidean Distance) is high in the Great Lakes, Northeast, Mid-Atlantic, as well as in portions of the Interior West. Climate match is moderate to high in most of the remaining states, excluding peninsular Florida and the Gulf Coast, where the match is low. Climate 6 match indicates that the Continental U.S. has a high climate match. The range for a high climate match is 0.103 and greater; the climate match of *Bithynia tentaculata* is 0.647.

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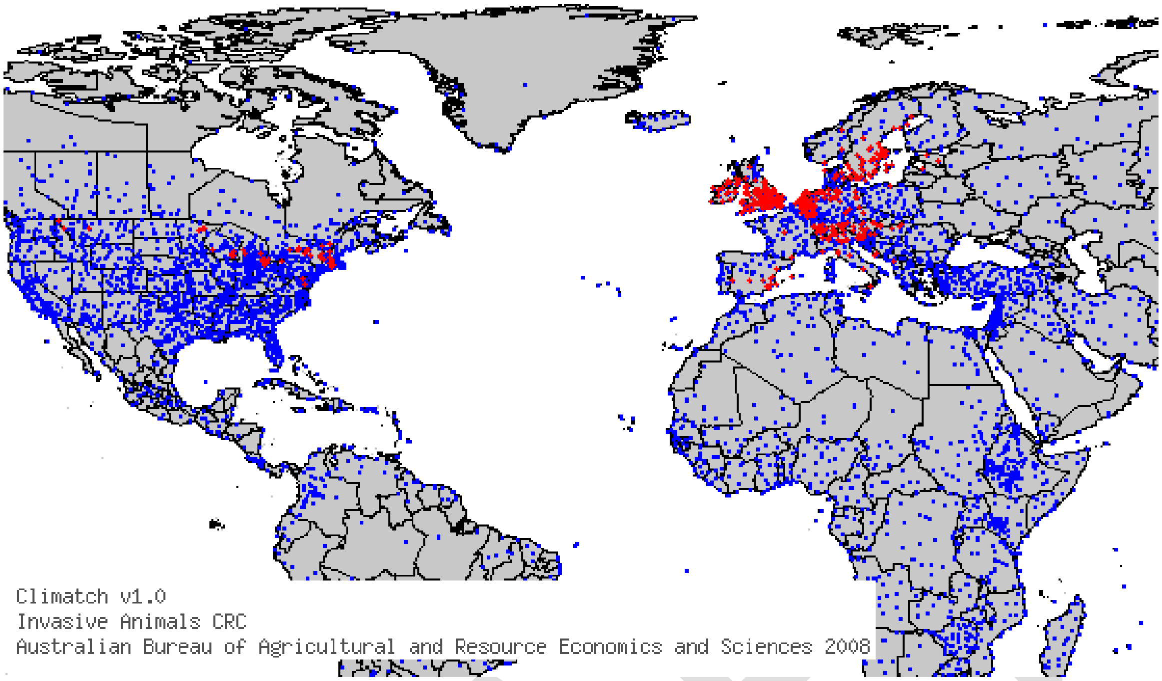

Figure 3. CLIMATCH (Australian Bureau of Rural Sciences 2008) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *Bithynia tentaculata* climate matching. Source locations from GBIF (2014) and Kipp et al. (2015).

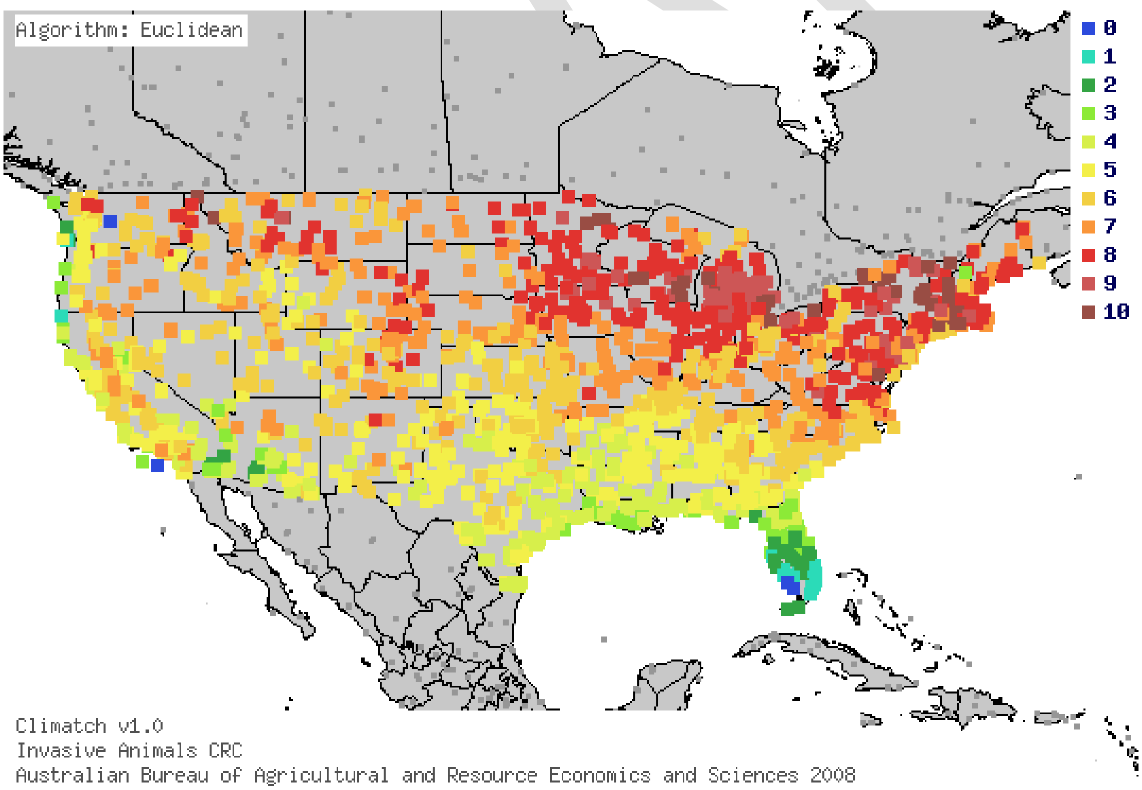

Figure 4. Map of CLIMATCH (Australian Bureau of Rural Sciences 2008) climate matches for *Bithynia tentaculata* in the continental United States based on source locations reported by GBIF (2014) and Kipp et al. (2015). 0= Lowest match, 10=Highest match.

Table 1. CLIMATCH (Australian Bureau of Rural Sciences 2008) climate match scores

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	4	25	37	61	201	368	453	338	340	88	59
Climate 6 Proportion =		0.647									

7 Certainty of Assessment

The biology and ecology of *B. tentaculata* are well-known. Negative impacts from introductions of this species are documented in the scientific literature, although the documentation is not extensive. Some impacts of *B. tentaculata* may be masked by the more substantial impacts of co-located invasive species, such as zebra mussel (*Dreissena polymorpha*). Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Continental United States

The faucet snail, *Bithynia tentaculata*, has a broad native distribution across Europe. It has been introduced to the U.S. and is currently established at locations in the Great Lakes, Northeast, and West. It is a likely competitor with native mollusks and is known to foul water systems where introduced. *B. tentaculata* is a host for parasites that have been responsible for tens of thousands of waterfowl deaths in the Upper Mississippi River. Climate match is high for *B. tentaculata* in the contiguous U.S. Overall risk for this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3):** High
- **Climate Match (Sec.6):** High
- **Certainty of Assessment (Sec. 7):** High
- **Remarks/Important additional information** Host of diseases/parasites
- **Overall Risk Assessment Category: High**

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Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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