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Finding the Exotic Faucet Snail (*Bithynia tentaculata*): Investigation of Waterbird Die-Offs on the Upper Mississippi River National Wildlife and Fish Refuge

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U.S. Department of the Interior
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Cover photo:
Lesser scaup and redheads collected on Lake Onalaska (Navigation Pool 7), in the Upper Mississippi River System in November 2006. (Photograph by Calvin Gehri, U.S. Fish and Wildlife Service, Upper Mississippi River National Wildlife and Fish Refuge.)

Finding the Exotic Faucet Snail (*Bithynia tentaculata*): Investigation of Waterbird Die-Offs on the Upper Mississippi River National Wildlife and Fish Refuge

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Beginning in 2002, there have been major waterbird die-offs every spring and fall in Lake Onalaska (Navigation Pool 7 of the Upper Mississippi River) located near La Crosse, Wisconsin (fig. 1). This area is part of the Upper Mississippi River National Wildlife and Fish Refuge (UMR Refuge) and lies within the Mississippi Flyway, through which an estimated 40 percent of the continent's waterfowl migrate. Through the 2006 spring migration, an estimated 22,000–26,000 birds died on the UMR Refuge, primarily lesser scaup (*Aythya affinis*) and American coots (*Fulica americana*). Other waterbirds affected include northern pintail (*Anas acuta*), American wigeon (*A. americana*), northern shoveler (*A. clypeata*), blue-winged teal (*A. discors*), mallard (*A. platyrhynchos*), American black duck (*A. rubripes*), gadwall (*A. strepera*), redhead (*Aytha americana*), ring-necked duck (*A. collaris*), bufflehead (*Bucephala albeola*), tundra swan (*Cygnus columbianus*), herring gull (*Larus argentatus*), and ruddy duck (*Oxyura jamaicensis*).

Wildlife pathologists at the U.S. Geological Survey's National Wildlife Health Center (NWHC), Madison, Wisconsin, found that infection by two trematode parasites (*Cyathocotyle bushiensis* and *Sphaeridiotrema globulus*) was the cause of death. An exotic snail known as the faucet snail (*Bithynia tentaculata*; fig. 2) is the first and second intermediate host for the trematodes (Friend and Franson, 1999). The faucet snail, with a shell length that can reach 15 mm, is typically found in freshwater ponds and shallow lakes (Bensen and others, 2004). Waterbirds are at risk of consuming the trematodes inadvertently as they eat snails, which are important in their diets (Eldridge, 1990). Depending on how heavily snail populations are infected, some birds can receive a lethal dose in less than 24 hours of feeding and die within 3–8 days. Although small in size, hundreds of trematodes, more than sufficient to cause death, were found in the lower intestines of most of the birds examined. One lesser scaup contained over 46,000 trematodes. Birds (scaup or coot) infected with *C. bushiensis* had typhlitis with mutlifocal lesions and sloughing of the mucosa (fig. 3). Waterbirds infected with *S. globulus* typically had hemorrhagic distended small intestines.

Faucet snails are native to and well distributed throughout Europe (Bank, 2004). The snail was introduced into the Great Lakes in the early 1870s (Mills and others, 1993). In Wisconsin, faucet snails were only found in Lake Michigan and the Wolf River drainage until 2002 when they were found in Lake Onalaska (NWHC, unpublished data). In 2004, led by the NWHC in collaboration with the U.S. Geological Survey's Upper Midwest Environmental Sciences Center in La Crosse,

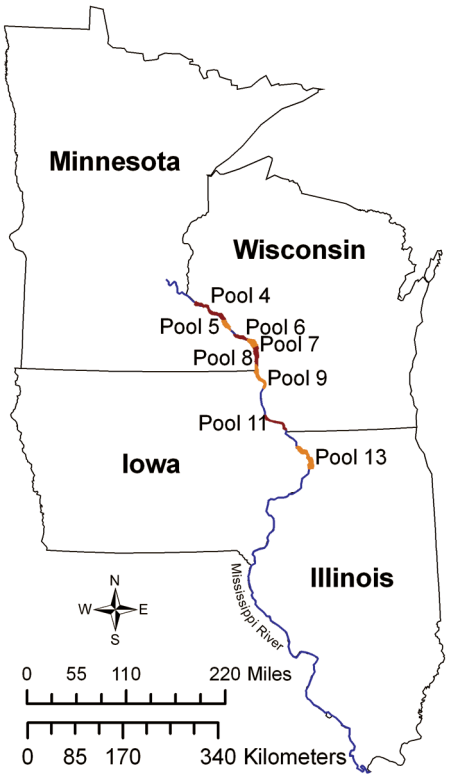

Figure 1. Areas sampled for the faucet snail (*Bithynia tentaculata*).

Figure 2. Faucet snail (*Bithynia tentaculata*).

Figure 3. Gross lesions of *Cyathocotyle bushiensis* in ceca of lesser scaup (*Aythya affinis*).

Wisconsin, UMR Refuge, and Minnesota State University–Mankato, we began a study of the waterfowl die-off and distribution of faucet snails in Lake Onalaska (a backwater of the Upper Mississippi River). Abundance of faucet snails in Lake Onalaska was highest on submersed rock surrounding islands, but they also were found in sediment and on aquatic vegetation. About 40 percent of the snails sampled in 2004 were infected with *Sphaeridiotrema globulus* and/or *Cyathocotyle bushiensis*. Infected snails were found throughout the sampling period (April through September). In the 2005 sampling season in Lake Onalaska, between 0.5 and 1,131 snails were collected per person hour at 19 sites on submersed rock. More than 70 percent of the snails were infected by the trematodes.

The majority (77 percent) of infected snails in 2005 had 10 or fewer trematodes (moderate level) in them but occasionally a snail might host over 100 trematodes (highly infected). Experimental work has shown that the minimum lethal dose of *Sphaeridiotrema globulus* in 12-week-old mallards is somewhere between 43 and 66 worms (Mucha and Huffman, 1991). The same study showed that only about 24–29 percent of the larval parasites in a snail will actually mature and cause disease. Therefore, if snail infections are prevalent with a high level of larval stages of parasites, waterbirds could pick up a lethal dose of trematodes from eating a few snails within 2–3 days. Birds can be infected with both parasites, and waterbird susceptibility to infection appears to be species and age specific (Hoeve and Scott, 1988). Infection from both parasites may decrease the number of parasites needed to induce death in waterbirds.

Because Lake Onalaska is a major spring and fall stop-over area for waterfowl in the Mississippi Flyway, concerns were raised that the snail and trematodes may be spreading to other waterfowl stop-over areas on the river. In 2004, field crews from the Minnesota, Wisconsin, and Iowa Departments of Natural Resources collected snails during routine sampling under the Long Term Resource Monitoring Program (*www.umesc.usgs.gov/ltrmp.html*) in Navigation Pools 4, 8, and 13 (fig. 1). None of the snails were identified as faucet snails. However, these samples were only taken on soft-substrates, which are not the preferred substrate habitat of faucet snails.

In 2005, we conducted additional sampling in Navigation Pools 8 and 9 focusing on known waterfowl feeding areas that contained submersed rocks or aquatic vegetation—habitat preferred by faucet snails. From 1 to 84 snails per site were collected in 4 of 15 sites in Pool 8 and 2 of 5 sites in Pool 9. Infected snails were found in both pools. Waterbird die-offs were highest in Lake Onalaska in fall 2005 (estimated 5,300–7,000), but several dead waterbirds also were found in lower Pools 8 and 9. These birds may have flown downriver to these areas after ingesting infected snails from Lake Onalaska, but our data indicate they could have died from consuming snails locally.

Exploratory sampling for faucet snails was conducted in summer 2006 in Pools 4–9 (excluding Pool 5a which is located between Pools 5 and 6), 11, and 13 (fig. 1). Numbers were from 2 to 109 per site with specimen sizes from 2.1 to 13.1 mm. Infected snails were found in all the sampled pools except Pool 6. To our knowledge, the 2005 and 2006 data are the first records of faucet snails and associated trematodes beyond those found in Pool 7, Lake Onalaska. Fall 2006 waterbird mortality numbers in Lake Onalaska (Pool 7) were estimated at 3,700–5,000 birds. Mortality increased in lower Pools 8 and 9 with estimated mortality at 3,700–5,000 and 500–1,000; respectively (J. Nissen and T. Yager, pers. comm.).

This disease is an added stress to declining waterbird populations. For example, scaup (greater and lesser) were 37 percent below their long-term average in 2006 as recorded by the Waterfowl Breeding Population and Habitat Survey

(Wilkins and Otto, 2006). Beyond the waterbird deaths, other effects of the die-offs include (1) UMR Refuge staff time spent on monitoring waterfowl reference points, dead bird pickup, disposal, and outreach, and (2) health concerns by waterfowlers hunting in areas of heavy mortality and increased difficulty of retrieval of hunter-killed birds. Hunting dogs are having difficulty retrieving hunter-killed ducks and are retrieving coots and other waterbirds that died from trematodiasis.

Waterbird die-offs are becoming a UMR Refuge-wide problem. Knowing the distribution of infected faucet snails on the UMR Refuge will help managers prepare for potential waterbird die-offs. Continued monitoring and focused research of faucet snails is needed to help understand the transmission dynamics and track the distribution of the snail. Information obtained through research and monitoring, including the identification of the origin of infections in snails and birds and the role various environmental factors have on this process, should help guide managers to develop effective mitigation and control measures.

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