Scientific Name: *Potamopyrgus antipodarum* Gray, 1843

Common Name: New Zealand mud snail; Jenkins' spire snail

Taxonomy: Available through ITIS

Identification: *P. antipodarum* has a dextral, elongated shell with 7–8 whorls separated by deep grooves. The operculum is thin and corneus with an off-centre nucleus from which paucispiral markings (with few coils) radiate. The aperture is oval and its height is less than the height of the spire. Some morphs, including many from the Great Lakes, exhibit a keel in the middle of each whorl; others, excluding those from the Great Lakes, exhibit periostracal ornamentation such as spines for anti-predator defense (Zaranko et al. 1997; Holomuzki and Biggs 2006; Levri et al. 2007).

Size: The snail is usually 4–6 mm in length in the Great Lakes, but grows to 12 mm in its native range (Zaranko et al. 1997; Levri et al. 2007).

Native Range: This species is native to New Zealand (Hall et al. 2003).

Nonindigenous Occurrences: *P. antipodarum* was found established in Lake Ontario in 1991 (Zaranko et al. 1997) and in Lake Erie in 2005 (Levri et al. 2007). It may also be established in Lake Superior, where some individuals were found in 2001 (Grigorovich et al. 2003).

Means of Introduction: *P. antipodarum* was most likely introduced to the Great Lakes in ships from Europe, where there are nonindigenous populations (Zaranko et al. 1997; Leppäkoski & Olenin 2000; Levri et al. 2007).

Status: Established in Lake Ontario and Lake Erie, and probably in Lake Superior. Appears to be expanding its range within the basin (Levri et al. 2007).

Ecology: *P. antipodarum* is a nocturnal grazer, feeding on plant and animal detritus, epiphytic and periphytic algae, sediments and diatoms (Broekhuizen et al. 2001; James et al. 2000; Kelly and Hawes 2005; Parkyn et al. 2005; Zaranko et al. 1997).

The snail tolerates siltation, thrives in disturbed watersheds, and benefits from high nutrient flows allowing for filamentous green algae growth. It occurs amongst macrophytes and prefers littoral zones in lakes or slow streams with silt and organic matter substrates, but tolerates high flow environments where it can burrow into the sediment (Zaranko et al. 1997; Collier et al. 1998; Holomuzki and Biggs 1999; Holomuzki and Biggs 2000; Negovetic and Jokela 2000; Richards et al. 2001; Weatherhead and James 2001; Death et al. 2003; Schreiber et al. 2003; Suren 2005).

In the Great Lakes, the snail reaches densities as high as 5,600 m^{-2} and is found at depths of 4–45 m on a silt and sand substrate (Zaranko et al. 1997; Levri et al. 2007).

P. antipodarum is ovoviviparous and parthenogenic. Native populations in New Zealand consist of diploid sexual and triploid parthenogenically cloned females, as well as sexually functional males (less than 5% of the total population). All introduced

populations in North America are clonal, consisting of genetically identical females. The snail produces ~230 young per year. Reproduction occurs in spring and summer, and the life cycle is annual (Zaranko et al. 1997; Schreiber et al. 1998; Lively and Jokela 2002; Gerard et al. 2003; Hall et al. 2003).

This species is euryhaline, establishing populations in fresh and brackish water. The optimal salinity is probably near or below 5 ppt, but *P. antipodarum* is capable of feeding, growing, and reproducing at salinities of 0–15 ppt and can tolerate 30–35 ppt for short periods of time (Jacobsen and Forbes 1997; Zaranko et al. 1997; Leppakoski and Olenin 2000; Costil et al. 2001; Gerard et al. 2003; Gerard and Le Lannic 2003). It tolerates temperatures of 0–34ºC ((Zaranko et al. 1997; Cox and Rutherford 2000).

P. antipodarum can survive passage through the guts of fish and birds and may be transported by these animals (Aamio and Bornsdorff 1997). It can also float by itself or on mats of *Cladophora* spp., and move 60 m upstream in 3 months through positive rheotactic behavior (Zaranko et al. 1997). It can respond to chemical stimuli in the water, including the odor of predatory fish, which causes it to migrate to the undersides of rocks to avoid predation (Levri 1998).

Common parasites of this snail include trematodes of the genus *Microphallus* (Dybdahl and Krist 2004).

Impact of Introduction

A) Realized: None known.

B) Potential: Abundant populations of introduced *P. antipodarum* may outcompete other grazers and inhibit colonization by other macroinvertebrates (Kerans et al. 2005). In Europe, *P. antipodarum* causes declines in species richness and abundance of native snails in constructed ponds (Strzelec 2005). By contrast, in one Australian stream, increasing densities of *P. antipodarum* are positively correlated with density and species richness of native invertebrates, possibly due to coprophagy (ingestion of the snail's faeces) (Schreiber et al. 2002). In geothermal streams in the western U.S., *P. antipodarum* reaches densities of 300,000 snails m^{-2} and alters nutrient (nitrogen and carbon) flows, consumes large amounts of GPP, accounts for most of the invertebrate production (Hall et al. 2003). *P. antipodarum* has yet to colonize streams in the Great Lakes basin, but these are the habitats in which the snail is expected to exert significant impacts (Levri et al. 2007).

Remarks: *P. antipodarum* is synonymous with *P. jenkinsi* and *Hydrobia jenkinsi*.

Voucher Specimens:

References:

Aamio, K. and E. Bornsdorff. 1997. Passing the gut of juvenile flounder *Platichthys flesus* (L.) – differential survival of zoobenthic prey species. Marine Biology 129: 11–14.

Broekhuizen, N., S. Parkyn and D. Miller. 2001. Fine sediment effects on feeding and growth in the invertebrate grazer *Potamopyrgus antipodarum* (Gastropoda, Hydrobiidae) and *Deleatidium sp.* (Ephemeroptera, Letpophlebiidae). Hydrobiologia 457(1-3):125-132.

Collier, K. J., R. J. Wilcock and A. S. Meredith. 1998. Influence of substrate type and physico-chemical conditions on macroinvertebrate faunas and biotic indices in some lowland Waikato, New Zealand, streams. New Zealand Journal of Marine and Freshwater Research 32(1):1-19.

Costil, K., G.B. J. Dussart and J. Daquzan. 2001. Biodiversity of aquatic gastropods in the Mont St-Michel basin (France) in relation to salinity and drying of habitats. Biodiversity and Conservation 10(1):1-18.

Cox, T. J. and J. C. Rutherford. 2000. Thermal tolerances of two stream invertebrates exposed to diurnally varying temperature. New Zealand Journal of Marine and Freshwater Research 34(2):203-208.

Death, R. G., B. Baillie and P. Fransen. 2003. Effect of *Pinus radiata* logging on stream invertebrate communities in Hawke's Bay, New Zealand. New Zealand Journal of Marine and Freshwater Research 37(3):507-520.

Dybdahl, M. F. and A. C. Krist. 2004. Genotypic vs. condition effects on parasite-driven rare advantage. Journal of Evolutionary Biology 17(5):967-973.

Gerard, C., A. Blanc and K. Costil. 2003. *Potamopyrgus antipodarum* (Mollusca: Hydrobiidae) in continental aquatic gastropod communities: impact of salinity and trematode parasitism. Hydrobiologia 493(1-3):167-172.

Grigorovich, I. A., A. V. Korniushin, D. K. Gray, I. C. Duggan, I. R. Colautti and H. J. MacIsaac. 2003. Lake Superior: an invasion coldspot? Hydrobiologia 499(1):191-210.

Hall, R. O. Jr., J. L. Tank and M. F. Dybdahl. 2003. Exotic snails dominate nitrogen and carbon cycling in a highly productive stream. Frontiers in Ecology and the Environment 1(8):407-411.

Hall, R. O. Jr., M. F. Dybdahl and M. C. Vanderloop. 2006. Extremely high secondary production of introduced snails in rivers. Ecological Applications 16(3):1121-1131.

Holomuzki, J. R. and B. J. F. Biggs. 1999. Distributional responses to flow disturbance by a stream-dwelling snail. Oikos 87(1):36-47.

Holomuzki, J. R. and B. J. F. Biggs. 2000. Taxon-specific responses to high-flow disturbances in streams: implications for population persistence. Journal of the North American Benthological Society 19(4):670-679.

Holomuzki, J. R. and B. J. F. Biggs. 2006. Habitat-specific variation and performance trade-offs in shell armature of New Zealand mudsnails. Ecology 87(4):1038-1047.

Jacobsen, R. and V. E. Forbes. 1997. Clonal variation in life-history traits and feeding rates in the gastropod, *Potamopyrgus antipodarum*: performance across a salinity gradient. Functional Ecology 11(2):260-267.

James, M. R., I. Hawes and M. Weatherhead. 2000. Removal of settled sediments and periphyton from macrophytes by grazing invertebrates in the littoral zone of a large oligotrophic lake. Freshwater Biology 44(2):311-326.

Kelly, D. J. and I. Hawes. 2005. Effects of invasive macrophytes on littoral-zone productivity and foodweb dynamics in a New Zealand high-country lake. Journal of the North American Benthological Society 24(2):300-320.

Kerans, B. L, M. F. Dybdahl, M. M. Gangloff and J. E. Jannot. 2005. *Potamopyrgus antipodarum*: distribution, density, and effects on native macroinvertebrate assemblages in the Greater Yellowstone ecosystem. Journal of the North American Benthological Society 24(1):123-138.

Leppäkoski, E. and S. Olenin. 2000. Non-native species and rates of spread: lessons from the brackish Baltic Sea. Biological Invasions 2(2):151-163.

Levri, E. P. 1998. Perceived predation risk, parasitism, and the foraging behavior of a freshwater snail (*Potamopyrgus antipodarum*). Canadian Journal of Zoology 76(10):1878-1884.

Levri, E.P., A.A. Kelly and E. Love. 2007. The invasive New Zealand mud snail (*Potamopyrgus antipodarum*) in Lake Erie. Journal of Great Lakes Research 33: 1-6.

Lively, C. M. and J. Jokela. 2002. Temporal and spatial distribution of parasites and sex in a freshwater snail. Evolutionary Ecology Research 4(2):219-226.

Negovetic, S. and J. Jokela. 2000. Food choice behaviour may promote habitat specificity in mixed populations of clonal and sexual *Potamopyrgus antipodarum*. Experimental Ecology 60(4):435-441.

Parkyn, S. M., J. M. Quinn, T. J. Cox and N. Broekhuizen. 2005. Pathways of N and C uptake and transfer in stream food webs: an isotope enrichment experiment. Journal of the North American Benthological Society 24(4):955-975.

Richards, D. C., L. D. Cazier and G. T. Lester. 2001. Spatial distribution of three snail species, including the invader *Potamopyrgus antipodarum*, in a freshwater spring. Western North American Naturalist 61(3):375-380.

Schreiber, E. S. G., A. Glaister, G. P. Quinn and P. S. Lake. 1998. Life history and population dynamics of the exotic snail *Potamopyrgus antipodarum* (Prosobranchia: Hydrobiidae) in Lake Purrumbete, Victoria, Australia. Marine and Freshwater Research 49(1):73-78.

Schreiber, E. S. G., G. P. Quinn and P. S. Lake. 2003. Distribution of an alien aquatic snail in relation to flow variability, human activities and water quality. Freshwater Biology 48(6):951-961.

Schreiber, E. S. G., P. S. Lake and G. P. Quinn. 2002. Facilitation of native stream fauna by an invading species? Experimental investigation of the interaction of the snail, *Potamopyrgus antipodarum* (Hydrobiidae) with native benthic fauna. Biological Invasions 4(3):317-325.

Strzelec, M. 2005. Impact of the introduced *Potamopyrgus antipodarum* (Gastropods) on the snail fauna in post-industrial ponds in Poland. Biologia (Bratislava) 60(2):159-163.

Suren, A. M. 2005. Effects of deposited sediment on patch selection by two grazing stream invertebrates. Hydrobiologia 549(1):205-218.

Weatherhead, M. A. and M. R. James. 2001. Distribution of macroinvertebrates in relation to physical and biological variables in the littoral zone of nine New Zealand lakes. Hydrobiologia 462(1-3):115-129.

Zaranko, D. T., D. G. Farara and F. G. Thompson. 1997. Another exotic mollusk in the Laurentian Great Lakes: the New Zealand native *Potamopyrgus antipodarum* (Gray 1843) (Gastropoda, Hydrobiidae).

Other Resources:

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Group: Mollusks – Gastropods (Snails)

Lake(s): Lake Ontario, Lake Erie, and Lake Superior

Genus: *Potamopyrgus*

Species: *antipodarum* (also synonymous with *jenkinsi*)

Common Name: New Zealand mud snail; Jenkins' spire snail

Status: Established in Lake Ontario and Lake Erie; probably established in Lake Superior

Freshwater/Marine: All

Pathway: Shipping

Exotic/Transplant: Exotic