New Zealand Mudsnail *Potamopyrgus antipodarum*

Ecology: *P. antipodarum* is a small (<5mm) invasive, hydrobiid snail. It has an elongate, dextral shell that varies in color and typically has 5 to 6 whorls at maturity (Gustafson 2005). New Zealand mudsnail are able to invade and grow in a wide range of ecological habitats. They are found in rivers, reservoirs, lakes and estuaries, and they are able to adapt to a wide range of temperature, salinities and substrates (Zaranko et al. 1997; Richards et al. 2001; Hall et al. 2003). New Zealand mudsnail are not able to withstand freezing temperatures at any salinity (Hylleberg and Siegismund 1987). The highest densities of New Zealand mudsnails typically occur in systems with high primary productivity, constant temperatures and constant flow (Gustafson 2005).

Reproductive, behavioral and morphological adaptations have made New Zealand mudsnail an ideal, aggressive AIS. Their rapid spread is attributed to high reproductive and growth rates, parthenogenesis and lack of parental care. A single female can theoretically produce up to 3.125 x 108 snails in one year. The ability for this species to reproduce asexually means that it is possible for a single individual to produce a new population (Zaranko et al. 1997). The presence of an operculum also allows them to survive for several weeks out of water (Bowler 1991).

New Zealand mudsnail are shown to negatively impact the aquatic communities they invade. Hall et al. (2003) found New Zealand mudsnail population densities that exceeded 100,000 individuals per square meter, and they consumed 75% of the gross primary production. New Zealand mudsnails outcompete native invertebrates for food and space and have also been shown to contribute to weight loss in fish when consumed (Bowler 1991; Vinson and Baker 2007). There is also concern that the high densities of New Zealand mudsnail could produce biofouling in facilities that become infested (Zaranko et al. 1997).

Distribution: *P. antipodarum* has spread from New Zealand to freshwater environments throughout the world. This species current distribution includes: Australia, Europe, Asia and North America. First discovered in the United States in 1987 in the Snake River near Hagerman, Idaho, New Zealand mudsnail are now locally abundant in western rivers (Bowler 1991; Dybdahl and Kane 2005). In Utah (Figure 1), New Zealand mudsnail are found in most of the major river drainages of the northern part of the state and in the Green River (Gustafson 2005; Harju 2007). Ongoing investigation by Utah Division of Wildlife Resources' AIS biologists have discovered additional populations during 2008, showing that the species is moving via stream flows, irrigation flows and on the soles of anglers boots (Pers. Comm. Larry Dalton. 2008. Aquatic Invasive Species Program Coordinator, Utah Division of Wildlife Resources).

Pathways of Introduction: The original source of introduction is unknown, though it is speculated that New Zealand mudsnail was introduced through the commercial transport of aquaculture products (Bowler 1991). Since introduction, both active and passive transport methods have contributed to its spread. New Zealand mudsnail have been shown to spread independently upstream through locomotion. Passive spread by birds, through the alimentary canal of fish, and contaminated recreational equipment is also

documented (Haynes et al. 1985; Richards et al. 2004; New Zealand Mudsnail Management and Control Plan Working Group 2006).

Management considerations: Spread of New Zealand mudsnail can be prevented through increased public education efforts. New Zealand mudsnail have no resistant stage or adhesive structures like other aquatic nuisance species and simple preventative measures can reduce their likelihood of spread to new areas. Once established, however, New Zealand mudsnail are extremely difficult to remove. The spread of New Zealand mudsnail into new watersheds is primarily through water distribution systems, unintentional human transport on contaminated recreational equipment, water containers and bait buckets (Richards 2002). Desiccation and freezing may be used to decontaminate angling and other recreational equipment that comes in contact with water, but this method can be slow, taking up to 24 hours. A faster (less than 30 minutes) and more effective alternative is to spray or immerse gear in disinfectant baths of: copper sulfate, benzethonium chloride, Formula 409® or Sparquat® (Hosea and Finlayson 2005; New Zealand Mudsnail Management and Control Plan Working Group 2006).

Possible control methods of existing populations include periodic: molluscicide application, desiccation of the waterbody, and introduction of a biological control agent. GreenClean® is a non-copper-based algaecide that has been successful at killing New Zealand mudsnail in lab experiments and is being tested for field applications (New Zealand Mudsnail Management and Control Plan Working Group 2006). Biocontrol lab trials using a trematode parasite from the native range of New Zealand mudsnails have been positive so far (Dybdahl et al. 2005), though this method of control is currently unavailable.

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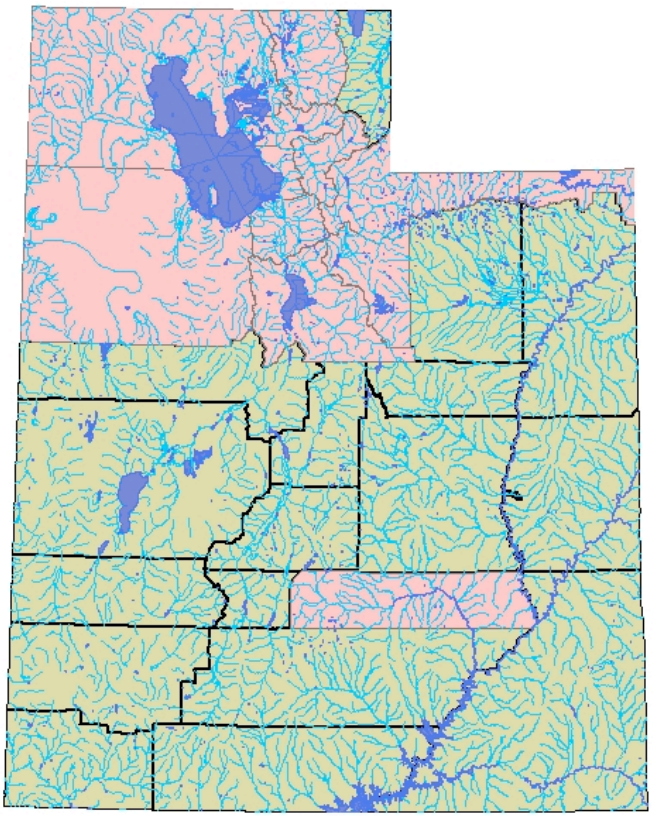
New Zealand Mudsnail

Major Waterways
NZMS_Present



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