IF YOU FIND MUDSNAILS

If you suspect you have found mudsnails, collect 5 to 10 individuals and place them in a plastic bag into which you have sprinkled water. Check against the simple traits above and on the Web page below to confirm identification.
http://www.esg.montana.edu/aim/mollusca/nzms

Please save the samples and contact the Oregon Invasive Species Council (1-866-INVADER) and one of these specialists:

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NEW ZEALAND MUDSNAILS

HOW TO PREVENT THE SPREAD OF NEW ZEALAND MUDSNAILS THROUGH FIELD GEAR

This brochure is intended for researchers, monitoring crews, watershed survey groups, and anyone else who travels frequently between aquatic or riparian locations. It is intended to be used as a guide to currently accepted methods for treating field gear to prevent the spread of New Zealand mudsnails.

June 2006

Devils Lake, Oregon, is heavily infested with New Zealand mudsnails. Prevent the spread of New Zealand mudsnails by cleaning gear and boats and not moving water from infested waters into new bodies of water. (Photo by Jane and Michael Liu.)

INTRODUCTION

The New Zealand mudsnail (*Potamopyrgus antipodarum*) is an introduced aquatic species that has invaded estuaries, lakes, rivers, and streams in Washington, Oregon, California, and many other states in the western U.S. It was first noted in North America in the late 1980s in the Snake River and has since spread throughout the West.

The small size (< 5 mm), cryptic coloration, and ability to survive out of water for weeks make the New Zealand mudsnail an ideal hitchhiker.

Range expansion of the mudsnail has been unwittingly hastened by anglers, hunters, and field personnel—in other words, people who frequently move between streams and lakes in watersheds, hauling wet waders, nets, and other gear with them. Once the mudsnail is established in a new habitat, it is impossible to eradicate it without damaging other components of the ecosystem. Thus, inspecting, removing, and treating gear before moving to a new water body is the most effective means of preventing the spread of mudsnails.

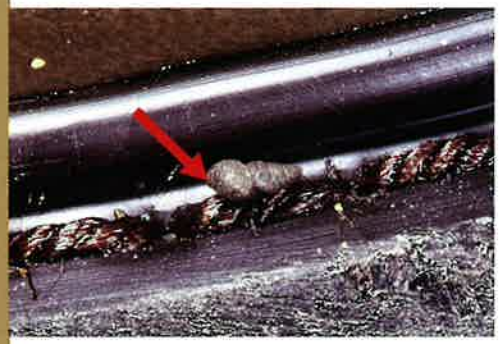
Snails can be inadvertently transported in bootlaces (center—note different color). (Photo by Jane and Michael Liu.)

The New Zealand mudsnail is often less than 5 mm long. (Photo by Jane and Michael Liu.)

THE MUDSNAIL PROBLEM

The New Zealand mudsnail is a threat to our waters. By competing with native invertebrates for food and habitat, it may have a detrimental impact on fish populations, vegetation, and other native biota.

Mudsnails can tolerate a wide range of habitats, including brackish water, and are found living in high densities (often over 400,000 snails/sq meter) on many different substrates (rock, gravel, sand, and mud).



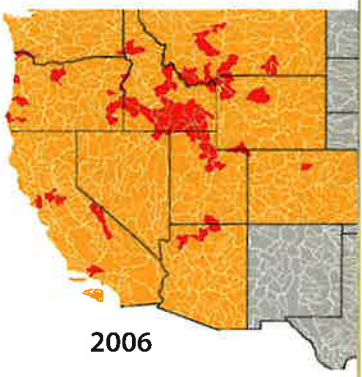
Mudsnails on the seam of a stream boot. Unintentional transport from one stream location to another by hitchhiking on waders or wading boots is one of the primary vectors for spreading New Zealand mudsnails. (Photo by Jane and Michael Liu.)

The biology, ecology, and distribution rate of the mudsnail suggest that many habitats are suitable for further expansion.

Mudsnail populations in the West are self-reproducing brooders; they clone themselves and retain the embryos inside their shell until they are large enough to release. Also known as parthenogenesis, this reproductive technique means that a single mudsnail can rapidly colonize a new location.

Mudsnails are easily transported to new habitats by field crews because the snails readily attach to or are wedged into the many cracks, crevices, and crannies presented by waders, boot soles, nets, buckets, and so on. New Zealand mudsnails can live for weeks in damp, cool conditions; can easily survive on field gear for long periods of time; and can be transferred to a new environment when that gear is reused.

Spread of the New Zealand mudsnail from 1995 to 2006 in the western U.S. New Zealand mudsnails have recently been found in parts of the Great Lakes region. (Map modified from D. L. Gustafson, http://www.esg.montana.edu/aim/mollusca/nzms.)



Mudsnails that have been passed through the intestinal tract of a fish. Almost half of the mudsnails survived this trip. (Photo by M. Vinson, http://www.esg.montana.edu/aim/mollusca/nzms.)

PREVENTION

To prevent the survival of mudsnails on field clothing and equipment, you will need first to clean your field gear and then to treat it, using either the physical or chemical methods listed below. We recommend the following steps:

1. If possible, keep several changes of field gear for use in different bodies of water.
2. **Clean** all gear before leaving a site (a stiff-bristled scrub brush or high-pressure water is the best tool for this task).
3. **Inspect** gear before it is packed for transport. Visible traces of sand, mud, gravel, and plant fragments are signs that gear has not been properly scrubbed and mudsnails may have been retained.
4. **Select** a treatment method in addition to physical cleaning.

- **Physical treatments** are recommended over chemical treatments because they are usually less expensive, more environmentally sound, and possibly less destructive to gear. However, most physical methods require longer treatment times and often cannot be performed in the field.
- **Chemical treatments** require a 5-minute soak in a special solution. After chemical treatment, gear must be rinsed thoroughly with tap water away from all bodies of water, and all soak solutions and rinse water must be properly disposed of.

Remember: physical and chemical treatments are not a substitute for physically scrubbing and cleaning your gear.

PHYSICAL

Physical methods for cleaning gear are effective as well as environmentally sound. Use ***one*** of the following methods:

- Freeze your gear for a minimum of 4 hours to kill all mudsnails. Freezer temperatures should be at 26°F (-3°C) or below.
- Soak gear in a bath of hot water (at least 120°F, 46°C) for 5 minutes. This method is not advised for Gortex.
- Dry your gear before reuse. A drying time of at least 48 hours under low humidity is recommended to remove all pockets of dampness. Gear must be completely dry for a minimum of 24 hours. Check to ensure that boots are totally dry.

CHEMICAL

Chemical solutions, at the concentrations below, also kill mudsnails but may not always result in 100% mortality.

Gear should be soaked in *one* of the following solutions for 5 minutes and then rinsed thoroughly with tap water, away from the water body. Store and dispose of solution and used rinse water properly.

- Benzethonium chloride (1, 940 mg/L)
- Commercial Solutions Formula 409® Cleaner Degreaser Disinfectant (50% dilution)
- Copper sulfate (252 mg/L copper ion)

These and other chemical treatments are constantly being evaluated.

The toe of this rubber wader boot has cracked after being exposed to repeated applications of benzethonium chloride. (Photo by Robert Hosea.)

A worker filters the cleaning solution after removing wading gear. (Photo by Robert Hosea.)

MIXING INSTRUCTIONS

- **Copper sulfate:** Dissolve 3.785 grams of copper sulfate pentahydrate crystals (99.1% purity) for each gallon of solution you want to make. This will achieve a concentration of 252 mg/L of copper ion in the cleaning solution.
- **Benzethonium chloride:** Dissolve 7.57 grams of benzethonium chloride (97% purity) for each gallon of cleaning solution you want to make. This will achieve a concentration of 1,947 mg/L in the cleaning solution.
- **Formula 409® Disinfectant:** Dilute the commercially available solution 1:1 with clean water to achieve the needed concentration for the cleaning solution (i.e., 1 gallon of Formula 409 Disinfectant to one gallon of water). (Note that formulations are subject to change. Check label to make sure that benzethonium chloride is listed as an ingredient.)

Fishing docks and boats are potential conduits for spreading the New Zealand mudsnail. (Photo by Jane and Michael Liu.)

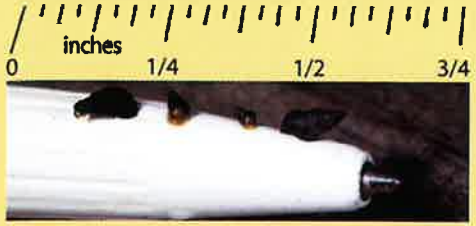
New Zealand mudsnail in test chamber with chemical test solution. (Photo by Robert Hosea.)

CAUTION

Treating field gear with chemical methods may result in unintended contamination of the environment. In particular, extreme caution must be taken to avoid contamination of waterways and wetlands. DO NOT rinse your treated gear in a water body.

Treating rubber gear or boots with benzethonium chloride or Formula 409® may result in surface cracking of the rubber and loss of water repellency. Chemical methods are not always effective in killing mudsnails. Always scrub your gear and consider using physical methods before resorting to chemical methods. For more information on the testing of chemical treatment methodology, see R. C. Hosea, and B. Finlayson, 2005, *Controlling the Spread of New Zealand Mud Snails on Wading Gear,* Administrative Report 2005-02, Rancho Cordova, California: Resources Agency, California Department of Fish and Game.

IDENTIFYING THE NEW ZEALAND MUDSNAIL



Size: A mature snail is usually less than 5 mm (.2 in) long. (Photo by Jane and Michael Liu.)

Shape: Shell is elongated and dextral (its whorls or spirals lean toward the right). Snail typically has between 5 to 6 whorls on its shell. (Photo by D. L. Gustafson, http://www.esg.montana.edu/aim/mollusca/nzms.)

Color: Most snails have a light- to dark-brown shell that may appear to be black when wet. (Photo by Jane and Michael Liu.)

Embryos: Upon dissection, mature snails will have brooded embryos. (Photo by D. L. Gustafson, http://www.esg.montana.edu/aim/mollusca/nzms.)

Operculum: The mudsnail operculum (a rounded plate that seals the mouth of the shell when the animal's body is inside) can be seen on live snails but is not easily visible on dead or preserved snails. (Photo by D. L. Gustafson, http://www.esg.montana.edu/aim/mollusca/nzms.)