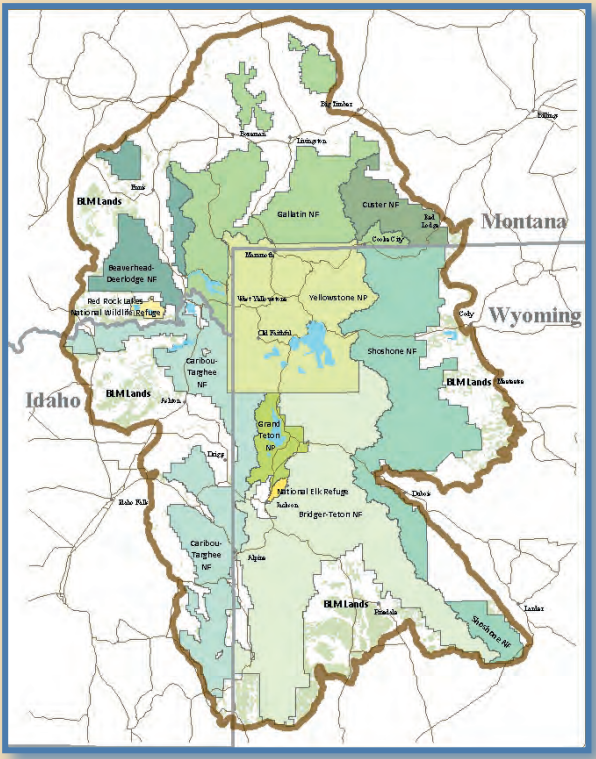
Aquatic Invasive Species Pocket Guide

Publication of the Greater Yellowstone Coordinating Committee

Greater Yellowstone Ecosystem



"Transcending boundaries in one of America's most treasured ecosystems"

This book is dedicated to the memory of Susan O'Ney
Grand Teton National Park

COVER PHOTOS - TOP TO BOTTOM

- American Bullfrog photo: Ed Nied Jr., hosted by the USGS-NAS Database
- Eurasian watermilfoil photo: Robin R. Buckallew, hosted by the USDA-NRCS PLANTS Database
- Zebra and Quagga Mussels photo: USGS, hosted by the USGS-NAS Database
- Silver Carp - Brad Williams US Army Core of Engineers

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What are Aquatic Invasive Species?

Aquatic invasive species (AIS) are non-native plants, animals or microbes. Once introduced into rivers, lakes and streams, AIS generally have no natural predators, so their populations grow unchecked. Once established, these species cause irreparable harm: introducing disease; out-competing native species; altering food chains; changing the physical characteristics of bodies of water; damaging gear; devastating water-delivery systems; and negatively impacting local and national economies.

Prevention remains our best defense!

You could be transporting invasive species. AIS can hitchhike a ride to other waters on your gear – ruining your favorite lakes, rivers and streams in the Greater Yellowstone Ecosystem (GYE). This affects everyone! The waters of the GYE drain into the Columbia, Mississippi, and Great Basins. Invasions into these waters have the potential to affect most of the country. We need to stop the spread of aquatic invasive species currently found in the GYE and protect it from new invasions.

STOP AQUATIC HITCHHIKERS!

Please help prevent the introduction and spread of AIS
CLEAN, DRAIN, DRY
ALL RECREATIONAL EQUIPMENT

What can you do?

Every time you come in contact with any body of water – Clean, Drain, Dry. By doing so, you can protect waters that you use and enjoy from harmful aquatic invaders. Some of these unwanted invaders may be so tiny that you cannot see them, but they can live in mud, dirt, sand, and on plant fragments.

Clean

- Before leaving any water, clean all of your equipment including boats, motors, trailers, anchors, decoys, floats, nets, boots, and waders.
- Remove any visible plants or animals.
- Remove mud, dirt, and debris since it may contain unwanted hitchhikers.
- Remove plant fragments that may be able to start new plant populations or contain unwanted hitchhikers.

Drain

- Drain all water from your equipment before transporting anywhere.
- Use a sponge or towel to remove water from low spots and crevices.

Dry

- Dry your watercraft and fishing equipment thoroughly; this will kill most invasive species. The longer you keep your watercraft, trailer, waders and other equipment outside in the hot sun between trips, the better (recommended at least 5 days).
- Dry the watercraft and gear completely between trips and allow the wet areas of your watercraft to air dry.
- Thoroughly inspect everything that comes into contact with the water and physically touch to confirm it is not wet.

Anglers

Remove all mud and aquatic plants from your vehicle, boat, anchor, trailer, waders, boots, and fishing gear before leaving a fishing access site.

Drain all water from your boat and equipment - including coolers, buckets, and live wells - before leaving a fishing access site or boat ramp.

Clean, drain, and dry your boat and equipment between trips. Pay particular attention to cleaning fishing equipment when moving from one location to another, even within the same watershed or on the same river. Dry boats and gear in between trips.

Be aware of any bait regulations, because in most GYE waters, it is illegal to use live bait.

Do not release or put fish into a body of water unless they came out of that body of water.

Dog Owners

Check dog's body including feet, coat, and collar for any visible mud, plants, or animals and remove.

Wash your dog with warm, clean water and brush its coat.

Visitors

If you have entered the water in your travels, be sure to clean anything that came in contact with that water including shoes, boots, waders, boats, trailers, dogs, etc.

Follow these guidelines while traveling so that you do not inadvertently introduce an invasive species to the areas you visit.

Aquarium and Pet Owners

Don't Let It Loose but, always C.A.R.E. for them:

Contact - the place you purchased the pet from and see if they have a return program.

Act responsibly - never let an animal or plant loose into the wild.

Research - other places that may be able to provide a home for your pet like pet stores, zoos, science centers, animal shelters, and humane societies maybe able to help.

Euthanize - in a humane way. It may be difficult to consider, but this option is far more kind than letting the animal starve to death in the wild or destroy the homes of native species.

Boaters

All types of boats (sea kayaks, whitewater kayaks, motor boats, canoes, dories, and rafts) can harbor AIS.

Remove all mud and vegetation from your vessel, trailer, motor, and equipment when moving between waters.

Drain and clean your live well, bait containers, bilge, and engine cooling system after every use.

Hunters

Clean equipment such as boats, trailers, waders, and decoys, as well as horses and dogs.

Inspect and remove mud, aquatic plants and animals from anything that came in contact with water.

Drain water from decoys, boat, motor, etc.

Additional Guidelines

- Do not release or put plants or animals into a body of water unless they came out of that body of water.
- Do not release unused live bait into the GYE waters you are fishing. Dispose of in the trash.
- Be aware of bait regulations, in many waters it is illegal to use live bait.

Please check local regulations:

Idaho Fish & Game: (208) 334-3700
http://fishandgame.idaho.gov

Montana Fish, Wildlife & Parks: (406) 444-2535 http://fwp.mt.gov

Wyoming Game & Fish: (307) 777-4600
http://wgfd.wyo.gov

Yellowstone National Park: (307) 344-7381
http://www.nps.gov/yell/index.htm

REPORTING PROCEDURE

If you think you have found an aquatic invasive species in the GYE please report it. It is an important step in managing these species.

If possible, please take a photo & document the location details (such as with GPS) and report to the pertinent Agency listed above.

Species in the Greater Yellowstone Ecosystem

This guide includes several invasive species of concern. There are many others throughout the country and around the world which could be a problem if they made their way into the GYE.

At the time of publication of this guide, some species have been confirmed to be present in the GYE (see species location details in this guide): North American bullfrog (amphibians); New Zealand mudsnails and the red-rim melania snail (invertebrates-snails); yellow-flag iris (plants); and whirling disease and chytrid fungus (pathogens).

The following symbols will be used throughout this guide book:

P = Present in the GYE

N = Not detected in the GYE

PHOTO: JEFFREY LOVICH/USGS

PHOTO: GARY NAFIS CALIFORNIAHERPS.COM

P

Common names Bullfrog, North American bullfrog
Scientific name *Rana catesbeiana*

Description- The largest frog in the U.S. with a distinctive fold of skin extending from the eye to the ear. Adults weigh up to one pound and can be over 7 inches in length; tadpoles are large, up to 6 inches long. Color varies from dull green or olive to brown, with dark blotches on the back and legs; underbelly is cream or yellow colored.

Habitat- Warm lakes, ponds, cattle tanks, bogs, and sluggish portions of streams and rivers.

Location in the GYE- Grand Teton Nation Park**:** Kelly Warm Springs

Pathway of Introduction and Spread- Spread when they escape from aquaculture farms, ornamental ponds or are released from aquariums.

Impacts- Adults have an enormous appetite and can eat anything they can catch and swallow, including birds, fish, crustaceans, bats, snakes, turtles, and other frogs. A high reproduction rate and limited predation allow it to quickly establish itself and dominate a variety of native species causing their decline.

What You Can Do- Do not release an unwanted pet. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

PHOTO: ANN MURRAY, UNIVERSITY OF FLORIDA / IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

PHOTO BY W.T. HALLER, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

N

Common names Brazilian elodea
Scientific name *Egeria densa*

Description- Submerged, perennial, rooted aquatic plant, generally bright green; typically has four leaves per whorl or plant segment, white flowers emerge during summer and fall.

Habitat- Shallow waters of freshwater lakes, streams, ponds, and ditches.

Pathway of Introduction and Spread- Introduced through the dumping of aquarium contents into waterways. It can spread between waters via plant fragments that attach to boats, boat trailers, and other equipment like fishing or diving gear, which can give rise to new plants.

Impacts- Forms dense stands over very large areas, restricting water movement, trapping sediment, and causing changes in water quality. Severe infestations may impair recreational uses including boating, fishing, swimming, and water skiing. It can also infest water intake structures in hydropower reservoirs.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump your aquarium contents into natural areas, storm drains, or flush them.

PHOTO: VIC RAMEY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

PHOTO: ANN BOVE ©2002

P

Common names Curly leaf pondweed
Scientific name *Potomogeton crispus*

Description- Submerged, perennial, rooted aquatic plant; green to red brown; leaf edges are wavy; flowers between May and June.

Habitat- Freshwater lakes, rivers, streams, ponds, ditches, and canals, but also brackish (salty) waters; rooted in silt or clay, and sometimes gravel or sand.

Location in the GYE- Hebgen and Quake Lake, Ennis Lake, Upper Missouri River waterways including the Madison, Jefferson and East Fork Gallatin River and Main Stem of the Gallatin River Systems

Pathway of Introduction and Spread- Introduced intentionally when planted for waterfowl and wildlife habitat. The plant can spread between waters via fragments or buds, which are transported with boats, boat trailers, and other equipment like fishing or gear, which can give rise to new plants.

Impacts- Forms dense stands that cover and dominate large areas, crowding out other species, impeding water flow, and potentially altering oxygen levels with impacts on fish. Can impact water recreational activities when colonies restrict access to docks and fishing areas and piles of dying curly leaf pondweed cover shorelines.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas.

PHOTO: RICHARD R. OLD, WWW.XIDSERVICES.COM

PHOTO: ALISON FOX, UNIVERSITY OF FLORIDA, WWW.BUGWOOD.ORG

N

Common name Eurasian watermilfoil
Scientific name *Myriophyllum spicatum*

Description-Submerged, perennial aquatic plant; green feather-like leaves which have four leaves per section and each leaf has 12 or more leaflet pairs, and stem brownish-red to light green; flowers between late July and early August with pink petals.

Habitat- Found in freshwater lakes, ponds, and slow moving areas of rivers and streams, and can tolerate somewhat salty waters.

Pathway of Introduction and Spread- Introduced through the dumping of aquarium contents into waterways. Motorboat traffic contributes to natural fragmentation and the distribution of fragments throughout lakes. It can spread between waters via plant material that attaches to boats, boat trailers, and other equipment like fishing gear which can give rise to new plants.

Impacts- Competes aggressively to displace and reduce the diversity of native aquatic plants. Spring growth begins earlier than other aquatic plants and quickly grows to the surface, forming dense canopies that overtop and shade the surrounding plants. Dense beds restrict swimming, fishing and boating, clog water intakes and result in decaying mats that foul lakeside beaches.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump your aquarium contents into natural areas, storm drains, or flush them. Donate them to a local school, hospital, library, nursing home; give them to family, friends, or neighbors; or ask your local pet store for advice. Otherwise, put unwanted aquarium contents in a plastic bag and throw away in the trash.

PHOTO BY ANN BOVE, ©2002

PHOTO: MANDY TU/THE NATURE CONSERVANCY/GLOBAL INVASIVE SPECIES DATABASE

N

Common name Flowering rush
Scientific name *Butomus umbellatus*

Description- Perennial aquatic plant partly submerged in water, partly above water surface; green linear leaves up to 4ft long; pink flowers emerge in a whorl on a tall stalk during summer and fall.

Habitat- Shallow, freshwater lakes, rivers, marshes, ponds, and wet ditches.

Pathway of Introduction and Spread- Introduced as a garden plant for ornamental purposes. It can spread between waters via dispersal of seeds, root fragments, and bulbs transported with boats, boat trailers, and other equipment like fishing or diving gear. Any of this plant material is capable of growing into a new plant.

Impacts- Can displace native riparian vegetation. Its very wide range of hardiness makes it capable of being widely invasive. It can hinder recreational uses of water.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas.

PHOTO: JAKE JARVIS WWW.RAWUTAH.COM

PHOTO BY A. MURRAY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

N

Common names Parrot-feather milfoil
Scientific name *Myriophyllum aquaticum*

Description- Submerged, perennial aquatic plant; feather-like leaves are bright green in color; flowering occurs in spring and sometimes fall with inconspicuous white flowers.

Habitat- Slow-moving water in rivers, lakes, ditches and ponds; stems may grow along shorelines in wet soils and can survive periods with lower water levels.

Pathway of Introduction and Spread- Introduced to the U.S. as an ornamental pond plant and has been dumped into waterways. It can spread between waters via plant fragments that attach to boats, boat trailers, and other equipment like fishing gear, which can give rise to new plants.

Impacts- Forms dense stands over large areas, shading out other organisms. Interferes with irrigation and drainage canals and restricts recreational activities.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas. Put discarded plants into a plastic bag and throw away in the trash.

PHOTO: UNIVERSITY OF GEORGIA

PHOTO: KING COUNTY, WASHINGTON

N

Common names	Phragmites, giant reed, common reed
Scientific name	*Phragmites australis (Cav.) Trin. Ex Steudel*

Description- Perennial, rhizomatous, riparian grass; green spear-like leaves alternate up stalks that can reach up to 20 feet tall; flowers in white to light brown, fluffy spikes in mid-summer.

Habitat- Wetlands and riparian areas around lakes, rivers, and streams, as well as marshes and swamps.

Pathway of Introduction and Spread- Introduced from Europe in the 19th century and occasionally planted as an ornamental. It can be spread between waters via seed through wind dispersal and via root and shoot fragments and seeds transported with boats, boat trailers, and other equipment like fishing, diving, and recreational gear.

Impacts- Can displace native riparian vegetation. It can hinder access to water for animals and recreational uses. A dense growth habit produces a large amount of biomass that increases the fuel load for wildfires. These dense stands also have the ability to change natural flood cycles by building up stream banks.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas. Put discarded plants into a plastic bag and throw away in the trash.

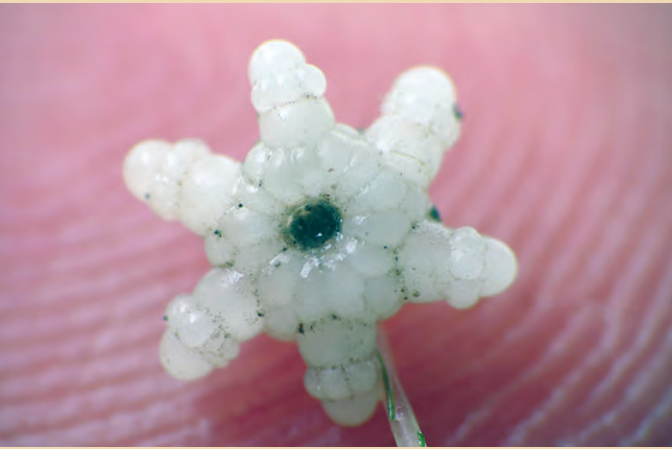


PHOTO: PAUL SKAWINSKI, UNIVERSITY OF WISCONSIN

PHOTO: PAUL SKAWINSKI, UNIVERSITY OF WISCONSIN

N

Common names Starry stonewort
Scientific name *Nitellopsis obtusa L.*

Description- Submerged, rooted, annual, freshwater algae; green stems that branch in a whorled pattern; star-shaped bulbs along rooting structures; orange reproductive structures.

Habitat- Deep, slow moving water such as lakes, ponds, and slow moving rivers.

Pathway of Introduction and Spread- Introduced through ballast water carried in trans-oceanic ships. The algae can spread between waters via plant material such as oocytes and bulbils, which can give rise to a new infestation. The plant material can be transported with boats, boat trailers, and other equipment like fishing or diving gear.

Impacts- Forms tall, dense stands on the bottom of lakes and ponds, outcompeting other species. Impedes the movement of fish and other animals, and may impede spawning of some fish species. Dense stands impede water movement and recreational activities.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment taking special care to fully drain ballast tanks and fishing gear.

PHOTO: VIC RAMEY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

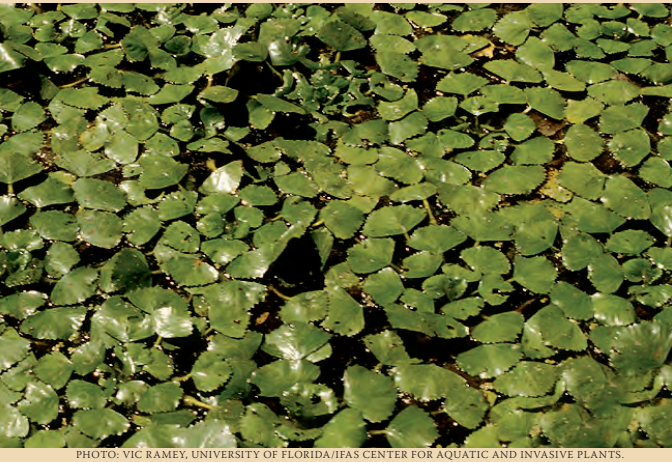


PHOTO: VIC RAMEY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

N

Common names: Water chestnut, European water chestnut, water nut, water-caltrop

Scientific name: *Trapa natans*

Description- Floating, annual aquatic plant, rooted in substrate or free-floating; rosette of floating, fan-shaped leaves, each leaf having a slightly inflated stem; flowering begins in the summer with small, white flowers.

Habitat- Generally found in open and still waters, flood canals, rivers, lakes, reservoirs and swamps.

Pathway of Introduction and Spread- Introduced to the U.S. as an ornamental pond plant and has been dumped into waterways. It can spread between waters via plant material such as fragments, fruits or seeds that are transported with boats, boat trailers, and other equipment like fishing or diving gear, which can give rise to new plants.

Impacts- Forms dense, large floating mats, shading out submerged plants and other organisms, and interfering with recreational activities such as boating, fishing and swimming; a hard nut with barbed spines accumulates on shore and can cause injury when stepped on.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas. Put discarded plants into a plastic bag and throw away in the trash.

PHOTO: VIC RAMEY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

PHOTO: DON C. SCHMITZ, FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION .

N

Common names Hydrilla
Scientific name *Hydrilla verticillata*

Description- Submerged, perennial, rooted aquatic plant; green leaves with serrated edges grow in a circular pattern; flowers during summer and fall that are either whitish to reddish in color or light green with red streaks.

Habitat- Rivers, lakes, ponds, streams, and wet ditches, in shallow waters but also at depths greater than 23 ft.; found in freshwater but can tolerate mildly salty water.

Pathway of Introduction and Spread- Introduced by dumping of aquariums. The plant can spread between waters via plant material such as plant fragments or buds that are transported with boats, boat trailers, and other equipment like fishing or diving gear, which can give rise to new plants.

Impacts- Forms tall and dense stands in the water column, blocking sunlight penetration, potentially displacing other aquatic organisms, and impeding water flow. Heavy growth commonly obstructs boating, swimming, fishing, and other recreational activities and also blocks the withdrawal of water used for power generation and agricultural irrigation.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump your aquarium contents into natural areas, storm drains, or flush them. Donate them to a local school, hospital, library, nursing home; give them to family, friends, or neighbors; or ask your local pet store for advice. Otherwise, put unwanted aquarium contents in a plastic bag and throw away in the trash.

PHOTO: UNIVERSITY OF GEORGIA

PHOTO: JOSEPH DITOMASO, UNIVERSITY OF CALIFORNIA-DAVIS

P

Common names	Yellow flag iris, pale yellow iris, yellow iris
Scientific name	*Iris pseudacorus L.*

Description- Perennial, rhizomatous riparian plant; broad, flat, sword-like green leaves; flowers between May and July that are pale yellow in color.

Habitat- Shallow water or mud at the edges of lakes, ponds, rivers and streams, as well as, marshes, wetlands, swamps, swampy woodlands, open woods, and glacial potholes.

Pathway of Introduction and Spread- Introduced intentionally when planted as an ornamental. It can spread between waters via dispersal of seed and rhizomes transported with boats, boat trailers, and other equipment like fishing or diving gear. This plant material is capable of growing into a new plant.

Impacts- Can displace native riparian vegetation. Its diverse range of hardiness makes it capable of being widely invasive. It can hinder access to water for wildlife habitat, recreation, and agriculture

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Do not dump unwanted plants into natural areas. Put discarded plants into a plastic bag and throw away in the trash.

PHOTO: BRIAN GRATWICKE

PHOTO: US FISH & WILDLIFE SERVICE

N

Common names Snakehead, Northern snakehead, Amur snakehead
Scientific name *Channa argus (Cantor)*

Description- Long-bodied fish with small head and large mouth which may resemble a snake. Long dorsal and anal fins. Generally brown with darker blotches which may resemble snake skin. Can grow up to 3 feet in length.

Habitat- Freshwater lakes, ponds, and rivers. May live out of water in damp conditions for up to four days.

Pathway of Introduction and Spread- Introduction more than likely occurred through both the release of aquarium fish and the release of fish as a food source. Live snakeheads are still sold at live fish markets throughout the country and online. Because the snakehead is able to survive and move out of water, there is potential for the fish to spread on its own to nearby water sources.

Impacts- Snakeheads are veracious predators that impact ecosystems at different levels throughout their lifecycles feeding on phytoplankton as juveniles and other fish species as adults. This predation has the potential to disturb the entire infested ecosystem.

What You Can Do- Do not release unwanted aquarium fish into natural areas. CLEAN, DRAIN, and DRY all recreational equipment.

PHOTO: DEPARTMENT OF FISHERIES, AUBURN UNIVERSITY

PHOTO: NERISSA MICHAELS, UNIVERSITY OF WISCONSIN

N

Common names Silver carp
Scientific name *Hypophthalmichthys molitrix*

Description- Large mouthed, deep bodied fish. Silver in color when young fading to a green back and silver belly with age. Scale-less on the head area and small scales along the body. Eyes are slightly downturned and located forward of the midline of the body.

Habitat- Freshwater fish usually found in large rivers, but also found in some ponds and lakes.

Pathway of Introduction and Spread- Introduced for phytoplankton control in waterways where nutrient imbalances caused algal blooms and for fish food. Fish found in natural waters were thought to have escaped from fish hatcheries and other facilities. Some grass carp releases may have also contained silver carp. Rapid breeding results in high populations of silver carp.

Impacts- Silver carp consume large amounts of plankton which removes the food source for native species of fish and mollusks. Carp also jump when exposed to high pitched sounds, such as boat engines, and can cause physical harm to boaters.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

PHOTO: USGS

PHOTO: JASON GOECKLER , KANSAS WILDLIFE AND PARKS

N

Common names Asian clam
Scientific name *Corbicula fluminea*

Description- Small freshwater clam that is triangular in shape; color is yellowish-to blackish-brown.

Habitat- Found in fresh water at the sediment surface or slightly buried; prefers fine clean sand, clay, and coarse sand.

Pathway of Introduction and Spread- Introduced into the U.S. as a food item for humans. Spread by the aquaculture industry and aquarium dumping. Bait buckets, live wells, bilge water, boat hulls/motors/trailers, and other equipment like fishing gear can be a vector for the free floating larvae and be transported between waters.

Impacts- Filters suspended matter from the water column, which significantly increases water clarity, leads to excessive plant growth and alters lake nutrient regimes. It may compete with native mollusks for food and habitat. The clam can infest and interfere with irrigation systems and canals, and block water flow through industrial raw water intake pipes.

What You Can Do- CLEAN, DRAIN and DRY all recreational equipment. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

PHOTO: UNITED STATES BUREAU OF RECLAMATION

Side View

PHOTO: MICHIGAN SEA GRANT
WWW.MISEAGRANT.UMICH.EDU

Bottom View

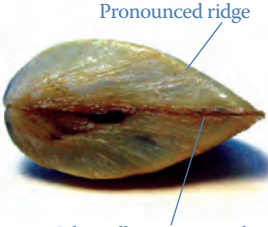


PHOTO: MYRIAH RICHERSON, USGS

N

Common name Quagga Mussel, Zebra Mussel
Scientific name *Dreissena rostriformis bugensis and, Dreissena polymorpha*

Description- Small, variably striped, freshwater mussel up to 3 cm long; color is usually pale and may have colored bands, bars, or few to no zigzagged stripes.

Habitat- Found in freshwater lakes, reservoirs, ponds, and slow-moving or sluggish rivers; attaches to hard surfaces such as rocks, docks, cement, wood, and aquatic vegetation.

Pathway of Introduction and Spread- Introduced to the U.S. by ballast water carried by commercial vessels and potentially on fouled ship hulls. Larval stage and adult mussels spread between waters when they are transported in bait buckets, live wells and bilge water or attached to boat hulls/motors/trailers and other equipment like fishing or diving gear or on attached aquatic plants. Adult quagga mussels can survive for several weeks out of water with the right conditions.

Impacts- Forms colonies in great numbers and filters large quantities of plankton from the water. This decreases the food supply for native organisms and increases water clarity, which changes the community of plants and other organisms, including fish. These mussels pollute swimming areas with sharp shells and can cause damage to boating equipment. They can damage water intake pipes causing significant cost and safety concerns to industry and municipal water users.

What You Can Do- CLEAN, DRAIN and DRY all recreational equipment. Clean all plants, mud, and debris from gear and equipment. Drain all water from your gear or equipment. Dry everything thoroughly.

PHOTO: JEFF GUNDERSON, MINNESOTA SEA GRANT

PHOTO: ERIC ENGBRETSON, WISCONSIN DEPARTMENT OF NATURAL RESOURCES

N

Common name Rusty crayfish
Scientific name *Orconectes rusticus*

Description- Large (up to 4 inches), aggressive, crayfish with variable color but consistently has large, rust-colored spots on either side of the shell and black bands on the claw tips.

Habitat- Found in freshwater lakes, rivers, and streams with rock, gravel, clay, or silt bottoms. Prefer deep pools and fast currents with cover from predators, such as rocks, logs, and debris.

Pathway of Introduction and Spread- Introduction via aquarium dumping; release or escape of unused crayfish from bait buckets and fishing lines; releases of those used as classroom science specimens.

Impacts- Eats and damages stands of aquatic plants, reducing food sources and aquatic habitat for aquatic invertebrates and fish. Often out-competes native crayfish species for food and habitat and negatively impacts fish populations through competition for food and predation on fish eggs. With their strong claws and aggressive nature, they can also pose a menace to swimmers.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Unused bait should not be released into the water. Be aware of any live bait regulations, because in many waters it is illegal to use live bait. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

PHOTO: USGS

PHOTO: DAVE BRITTON, U.S. FISH & WILDLIFE SERVICE

N

Common names Chinese mystery snail
Scientific name *Cipangopaludina chinensis*

Description- Freshwater snail that has an operculum that acts as a lid or trapdoor and seals the shell's opening; typically camouflages itself with a dark green covering similar to moss; color is brownish to olive-green.

Habitat- Found in shallow, quiet waters of ponds, marshes, lakes, canals, and slow-moving rivers with some vegetation and soft, muddy or sandy substrate.

Pathway of Introduction and Spread- Introduced through aquarium dumping and accidental release from aquaculture farms. Spread if transported by bait buckets, live wells, bilge water, boat hulls/motors/trailers, and other equipment such as fishing gear.

Impacts- Can compete with native snail species. Potential vectors for the transmission of parasites and diseases. Their shells can clog screens of water intake pipes.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Unused bait or bait packaging should not be released into the water. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

PHOTO: MIKE GANGLOFF/USGS

PHOTO: USGS. FISC - CENTER FOR AQUATIC RESOURCE STUDIES

P

Common name New Zealand mudsnail
Scientific name *Potamopyrgus antipodarum*

Description- Small, slender, freshwater snail with an operculum that acts as a lid or trapdoor and seals the shell's opening; color is usually horn-colored but can range from light to dark brown.

Habitat- Prefers disturbed watersheds, fresh and saltwater lakes, rivers, and slow-moving streams on hard or woody debris, rock and gravel surfaces, and vegetation in areas with high silt and organic matter. Tolerates temperatures from near freezing up to 82°F, so geothermally influenced areas may provide good habitat.

Location in the GYE- Idaho: Buffalo River, Henry's Fork; John D Rockefeller Jr. Memorial Parkway: Polecat Creek, Snake River; Wyoming: Bighorn River near Thermopolis, Shoshone River in Cody; Montana: Gardiner, Madison River, Gibbon, Yellowstone, and Firehole Rivers, Nez Perce Creek, and O'Dell Creek.

Pathway of Introduction and Spread- Introduced through ballast water and in the water of live game fish shipped from other infested waters. Spread via; felt boots and waders, bait buckets, live wells, bilge water. This species can become established in new waters with the introduction of a single individual.

Impacts- Populations can reach high densities that dominate the food source, competing with native snails. Can displace native species that other species, including fish, depend on for food.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment.

PHOTO: BILL FRANK - JACKSONVILLE, FLORIDA WWW.JAXSHELLS.ORG

PHOTO: BILL FRANK - JACKSONVILLE, FLORIDA WWW.JAXSHELLS.ORG

P

Common names Red-rim melania, Malaysian trumpet snail
Scientific name *Melanoides tuberculatus*

Description- Small freshwater tropical snail with an operculum that acts as a lid or trapdoor and seals the shell's opening; usually light brown color marked with rust colored spots.

Habitat- Shallow, slow running water with bottoms of soft mud or soft mud and sand; also reported in relatively deep portions of freshwater pools with substrate composed largely of rocks; tolerant of low levels of salinity. Prefers warm water temperatures, so geothermally influenced areas may provide good habitat.

Location in the GYE- GTNP**:** Kelly Warm Springs; Idaho: Warm Springs Creek near Dubois; Montana: Beaverhead Rock Warm Spring, Big Hole River near Dillon; YNP: Boiling River.

Pathway of Introduction and Spread- Introduced through aquarium dumping. Recreational equipment and shoes and clothing of bathers in thermal areas can spread snails to new waters. This species can become established in new waters with the introduction of a single individual.

Impacts- Displace native snails through competition for resources; transmission vector for several dangerous parasites that can affect people if infected snails were eaten by a crustacean that was then eaten raw by humans.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets.

BOREAL TOAD BEING TESTED AND MONITORED FOR CHYTRID FUNGUS

PHOTO: DONALD H. CAMPBELL, USGS

VHS INFECTED FISH

PHOTO: MOHAMMED FAISAL/USGS

WHIRLING DISEASE INFECTED JUVENILE FISH

PHOTO: TROUT UNLIMITED - WHIRLING DISEASE FOUNDATION

A pathogen is a microscopic organism, such as a bacteria, fungus, parasite, or virus that can be highly contagious and may cause disease and/or death.

COMMON NAME Chytrid fungus, chytrid
SCIENTIFIC NAME *Batrachochytrium dendrobatidis*

P

DESCRIPTION- Fungal skin disease that infects amphibians, including frogs, toads, and salamanders

LOCATION IN THE GYE- Bridger Teton National Forest: Blackrock Pond; GTNP: Flagg Ranch gravel pit and Schwabacher's Landing; the National Elk Refuge (adjacent to GTNP); and YNP: Chipmunk Creek and a tributary of the Yellowstone River near the Fishing Bridge sewage treatment area.
More Information: http://armi.usgs.gov/

COMMON NAME Viral Hemorrhagic Septicemia (VHS)

N

DESCRIPTION- Virus which impacts a wide variety of fish including cutthroat trout. More Information: http://biology.usgs.gov/faer/vhs.html

COMMON NAME Whirling disease
SCIENTIFIC NAME *Myxobolus cerebralis*

P

DESCRIPTION- Parasite that infects fish in the trout and salmon families

LOCATION IN THE GYE- Montana: Madison, Gallatin, and Yellowstone rivers; Wyoming: Flat Creek in the National Elk Refuge, Upper Green River, Palisades Reservoir, Salt River; YNP: Clear Creek, Firehole River, Pelican Creek, Yellowstone River
More Information: www.tu.org/science/

WHAT YOU CAN DO- CLEAN, DRAIN, and DRY all recreational equipment. Do not release or put fish or other animals into a body of water unless they came out of that body of water. Throw away fish parts and unused bait in a plastic bag. Remember 'Don't let it loose' and visit http://www.dontletitloose.com for suggestions on what to do with an unwanted aquarium pets and plants.

PURPLE LOOSESTRIFE
LYTHRUM SALICARIA

PHOTO: VIC RAMEY, UNIVERSITY OF FLORIDA/IFAS CENTER FOR AQUATIC AND INVASIVE PLANTS.

SALTCEDAR - TAMARISK
TAMARIX SP

PHOTO DAN SHARRATT, OREGON DEPT. OF AGRICULTURE

Description- Riparian plants live and act as a buffer zone along waterways. Increasing numbers of nonnative species continue to threaten native vegetation in these crucial riparian corridors.

There are numerous nonnative species of concern in the GYE and resources are available to help with their identification and reporting. This includes the "GYCC Weed Pocket Guide" produced by the Greater Yellowstone Coordinating Committee, which is available at public agencies throughout the GYE.

What You Can Do- CLEAN, DRAIN, and DRY all recreational equipment, including shoes/boots, packs, bike tires, etc. Keep dogs or other pets free of weed seed. Any hitchhiking seeds should be removed and thrown into the trash, not on the ground. Check with local weed and pest organizations to learn how to deal with the proper removal of any invasive species. Report new weed infestations or suspicious looking plants to the local weed district.

Idaho Weed Control Association
http://idahoweedcontrol.org

Montana Weed Control Association
www.mtweed.org

Wyoming Weed & Pest Council
www.wyoweed.org

This guide is intended to increase awareness of aquatic invasive species (AIS) within the Greater Yellowstone Ecosystem (GYE). It was made possible through the cooperative efforts of the Greater Yellowstone Coordinating Committee's Aquatic Invasive Species Sub-committee which includes representatives from federal, state, and local agencies as well as non-profit organizations.

They may look innocent,

but they could be giving some unwanted hitchhiker a ride!

The information in this guide was obtained from a number of sources including:

Global Invasive Species Database, managed by the Invasive Species Specialist Group www.issg.org

Gulf States Marine Fisheries Commission http://nis.gsmfc.org

GYCC AIS Sub-committee
fedgycc.org/aquatic-invasive-species-cooperative

Idaho Fish & Game http://fishandgame.idaho.gov

Michigan Department of Natural Resources www.michigan.gov

Montana Fish, Wildlife & Parks http://fwp.mt.gov

National Aquatic Invasive Species Database http://nyis.info

National Institute of Invasive Species Science www.niiss.org

100th Meridian Initiative www.100thmeridian.org

Ontario Ministry of Natural Resources www.invadingspecies.com

Protect Your Waters www.protectyourwaters.net

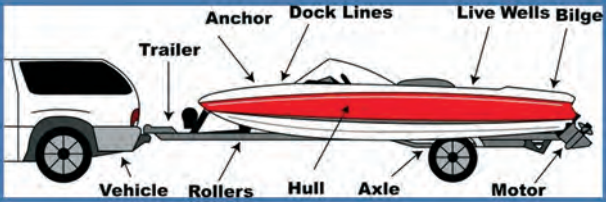
Sea Grant – Oregon http://seagrant.oregonstate.edu

Trout Unlimited Whirling Disease Foundation
www.tu.org/science/aquatic-invasive-species-ais

University of Florida/IFAS Center for Aquatic and Invasive Plants
http://plants.ifas.ufl.edu

USGS Nonindigenous Aquatic Species http://nas.er.usgs.gov

Wyoming Game & Fish http://wgfd.wyo.gov/ais



Clean

Clean all plants, mud, and debris from gear and equipment. Never move a plant or animal from one location to another.

Drain

Drain all water from your gear or equipment. This includes all types of watercraft, waders, boots, clothing, buckets-anything that comes into contact with the water. Leave wet compartments open to dry.

Dry

Dry everything thoroughly. Dry for 5 days in summer, 18 days in spring or fall, or 3 days of freezing temperatures.

Montana Fish, Wildlife & Parks