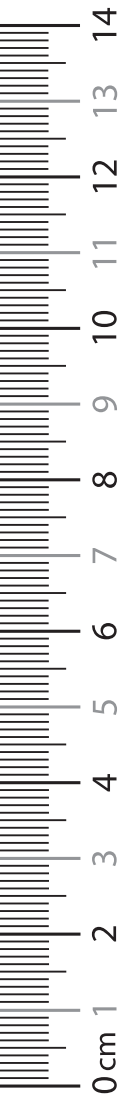




# **A**quatic **N**uisance **S**pecies **Pocket Guide**

**SECOND EDITION**





# Table of Contents

<b>Introduction</b> .....	1
<i>Prevention</i> .....	2
<i>Laws and Regulations</i> .....	5
<i>Take Action!</i> .....	11
<b>Animals</b>	
<i>Mollusks</i> .....	12
<i>Crustaceans</i> .....	16
<i>Amphibians</i> .....	22
<b>Fish</b> .....	28
<b>Plants</b>	
<i>Algae</i> .....	70
<i>Submerged</i> .....	74
<i>Emergent</i> .....	94
<i>Floating</i> .....	102
<i>Riparian</i> .....	116
<b>Pathogens</b> .....	124
<b>Index</b> .....	130
<b>Resources</b> .....	140

COVER PHOTOS (Clockwise from top): AMERICAN BULLFROG BY CARL D. HOWE;  
EURASIAN WATERMILFOIL BY JOSEPH DITOMASO, UNIVERSITY OF CALIFORNIA DAVIS;  
PIRANHA BY WIKIMEDIA; QUAGGA MUSSELS BY MICHAEL PORTER, U.S. ARMY CORPS OF ENGINEERS  
WRITTEN BY WENDY HANOPHY



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# Introduction

## **What are Aquatic Nuisance Species?**

Aquatic nuisance species (ANS) are invasive animals, plants, and disease-causing pathogens that are “out of place” in Colorado’s rivers, lakes, streams, and wetlands. They are introduced accidentally or intentionally outside of their native range. Because they are not native to Colorado habitats, they have no natural competitors and predators. Without these checks and balances, the invaders are able to reproduce rapidly and out-compete native species. ANS have harmful effects on natural resources and our use of them.

## **Aquatic Nuisance Species are Everyone’s Problem**

ANS damage Colorado’s lands and waters, hurt the economy, ruin recreation opportunities, and threaten public health. Many ANS consume enormous amounts of water and reduce the water supply for livestock, wildlife, and humans. They impede water distribution systems for municipal, industrial, and agricultural supplies. They can damage boats and fishing equipment and impair all forms of water based recreation. These species change the physical characteristics of bodies of water and alter food chains. As habitat is destroyed by invasive species, the wildlife that depends on it disappears as well. About 42 percent of the species on

the Federal Threatened or Endangered Species lists are at risk primarily because of invasive species. In the United States, ecological damage and control of invasive species cost \$200 billion per year and these costs are increasing. Colorado's environment draws tourists, brings business, and supports agriculture. To protect it, we must prevent ANS and quickly respond to new invaders.

## **Prevention is the Best Defense!**

Everyone can help prevent the spread of ANS. To help safeguard Colorado's precious land and waters, take these steps:

### ***Boaters and Anglers:***

- **Clean your boat**, equipment, tackle, downriggers, and lines thoroughly between bodies of water. Remove all aquatic plants, mud, and animals from hulls, propellers, intakes, and trailers and wash anything that comes into contact with water. (See <http://wildlife.state.co.us/WildlifeSpecies/Profiles/InvasiveSpecies/Pages/WatercraftCleaning.aspx>)
- **Drain** all water before leaving the water body, including wells, bait buckets, bilge, and all ballast.
- **Dry** everything completely before launching into another body of water.
- **Waders should be cleaned and disinfected.** Anglers who use waders should scrub the bottom of waders with a brush and remove all mud, plants, and organic materials in between each and every use and then disinfect them using one of the four options listed at <http://wildlife.state.co.us/WildlifeSpecies/Profiles/InvasiveSpecies/Pages/NewZealandMudsnail.aspx>.

- **Bait** should never be transported from one water body to another. Dispose of unused bait into a waste receptacle.

***Campers, Hunters, ATV Riders, Bikers, Hikers,  
and Outdoor Enthusiasts:***

- **Clean and Inspect** your boots, clothes, tires, trucks, trailers, bicycles, ATV's, pets, etc. for hitchhiking seeds, weeds, or other invaders before you travel to a new area.
- **Don't move** plant debris or wood from one site to another or in from out of state.
- **Firewood** should be purchased or gathered where you plan to burn it (preferably within 10 miles but not more than 50 miles). All firewood should be burned before you leave the campsite.

***Landowners and Gardeners:***

- **Plant Natives!** Landscape with plants native to your area. Avoid buying and planting mixtures of seeds, especially ones labeled "wildflowers." Some contain invasive plant species. Be careful when buying plants on the internet or by mail order.
- **Never Dispose** of aquarium animals or water plants into local waters. Some plants and animals sold for water gardens and aquaria can be highly invasive.
- **Never Dispose** of unwanted seeds, plants, or garden clipping in parks or natural areas. Bag plant waste and place in trash receptacles for proper disposal.

### *Pet Owners, Teachers, and Animal Enthusiasts:*

- **Buyer Beware!** Only buy from reputable dealers, whose non-native pets are properly labeled, legally imported, and not harboring foreign pests or diseases.
- **Don't Turn It Loose!** Do not release aquarium fish or animals of any kind into the wild. They may prey on native species or spread disease. If you no longer want your pet or classroom animal, return it to a local pet shop or give it to a shelter, hobbyist, school, nursing home, or veterinarian.
- **Don't Move It!** Never take animals from one habitat into another. By moving a species even from one stretch of a river to another, you may inadvertently introduce ANS, upset the balance of the ecosystem, and spread disease.

## **Identify and Report Suspected ANS**

Early detection is crucial to stopping an invasive species from becoming permanently established. Use this guide to identify and report invasive species. Once aware of the presence of ANS, your local, state, and federal agencies can take action and respond to the threat.

Federal, state, and local agencies have programs in place to prevent the introduction of new invasive aquatic species, control ANS when possible, and contain and manage those invasive species that are well established and widespread. Many of the species found in this guide are found on several agencies "hit lists" and are regulated by both state and federal statutes.



## Federal ANS Laws

The United States has been addressing the problem of invasive, non-native species for a long time. Various federal laws regulate ANS importation, interstate transport, exclusion, control, and eradication. Only a few of these are discussed in this guide.

In 1990, the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) was passed to address ANS in the United States. NANPCA provides a framework to promote and coordinate research, establish national priorities, develop and apply prevention and control strategies, educate and inform citizens, and coordinate public programs. This legislation provides federal funds to states that have ANS management plans to control, eradicate, and prevent the spread of aquatic invasive species.

In February 1999, President Clinton signed Executive Order (EO) 13112, which requires all federal agencies to collaborate in developing a national invasive species management plan that addresses terrestrial and aquatic species. No single federal agency has control over all ANS management and for brevity, only two are represented in this guide.



### *USFWS Injurious Wildlife Species*

The Lacey Act dates back to the early 1900s and is one of the oldest wildlife related laws on the books. Under the Lacey Act, the Secretary of the Interior and the U.S. Fish and Wildlife Service (USFWS) are authorized to regulate the importation and transport of species, including offspring and eggs, determined to be injurious to the

health and welfare of humans, the interests of agriculture, horticulture or forestry, and the welfare and survival of wildlife resources of the U.S. Wild mammals, wild birds, fish, mollusks, crustaceans, amphibians, and reptiles are the only organisms that can be added to the injurious wildlife list.

Several ANS in this pocket guide are listed as injurious species. They may not be **imported** or **transported between** States, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the U.S. by any means without a permit issued by the USFWS.



### ***USDA Noxious Weed List***

The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) has authority under several laws to list and control noxious weeds, many of which are ANS. Most of these laws (Plant Quarantine Act of 1912, Federal Plant Pest Act of 1957, Federal Noxious Weed Act of 1974, Organic Act of 1944, and others) were consolidated and updated by the Plant Protection Act (PPA) of 1990. The PPA defines a noxious weed as: *“any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.”*

## State ANS Act

As with the federal government, no centralized authority coordinates ANS management in Colorado. The Colorado Department of Natural Resources (DNR) manages wildlife, vegetation, recreation, and water resources in Colorado. The agency within DNR that focuses effort on ANS management is Colorado Parks & Wildlife.

The State ANS Act was passed by the General Assembly in May of 2008 and defines ANS as *exotic or non-native aquatic wildlife species or any plant species that have been determined to pose a significant threat to the aquatic resources or water infrastructure of the state*. It makes it illegal to possess, import, export, ship, transport, release, plant, place, or cause an ANS to be released. The Act allocated funding and joint authority for ANS programs to both the former Division of Wildlife (DOW) and State Parks. It provides authority to qualified peace officers and certified authorized agents to inspect, and if necessary, decontaminate or impound watercraft for ANS.



### ***Colorado Division of Wildlife (DOW) Prohibited Aquatic Species***

CPW manages the state's wildlife and protects wildlife habitat. *Colorado Revised Statutes (CRS) Title 33, Article 7, Colorado Wildlife Regulations* gives sole authority to craft regulations regarding aquatic wildlife to the Wildlife Commission, as advised by the Aquatics Section of CPW, and with review and comment by the Fish Health Board. Regulations regarding ANS include:

### **# 012 Possession of Aquatic Wildlife**

This regulation gives DOW authority over all vertebrate, crustacean, and molluscan wildlife and regulates which live aquatic wildlife may be possessed. DOW maintains a list of prohibited species (fish, animals, and pathogens) that are thought to be detrimental to wildlife or wildlife habitat. Importation, transportation, possession, and release of species on a DOW prohibited list can result in particularly heavy fines.

### **#013 Release of Aquatic Wildlife**

This regulation gives DOW authority to control the release (stocking) of aquatic wildlife. Only certain species of fishes can be stocked and only in certain defined areas. Release of all other aquatic wildlife including vertebrates, crustaceans, and mollusks must be accompanied by written permission from the Director.

### **# 014 Aquatic Wildlife Health Management**

No live aquatic animals may be imported into Colorado without an Aquatic Species Importation License. No live fish may be imported, transported, transferred, or stocked in Colorado without a current fish health certificate. Salmonid fishes must be certified free of several regulated pathogens. Non-salmonid fishes are required to be inspected for Viral Hemorrhagic Septicemia virus (VHSV).

In response to finding zebra mussel at Pueblo Reservoir in January 2008, DOW passed an emergency regulation (*Water Restrictions: Use of Boats and Other Floating Devices and Other Uses on Division Controlled Waters. #903, Aquatic Nuisance Species*) that enables DOW

personnel to inspect all vessels for any plant material or aquatic nuisance species, as well as to decontaminate any watercraft or floating device on any DOW managed property. The regulation gives DOW staff the ability to refuse entry to the property, if the vessel owner is not willing to comply with a search or decontamination. It makes it unlawful for any person to launch any floating device before consenting to a search, inspection, and decontamination process or to launch any floating device that contains plant materials or ANS within a DOW controlled property. (See <http://wildlife.state.co.us/Fishing/Pages/MandatoryBoatInspections.aspx>)



### ***State Parks ANS Regulations***

Regulations required by the State ANS Act were passed by the Parks Board on February 20, 2009. The rules require mandatory watercraft inspection and if necessary decontamination of all boats coming in from out of state, leaving known positive water in Colorado, or entering a high risk water where inspections and decontaminations are required by the managing agency. The rules set standards for watercraft inspection, decontamination, impoundment, sampling, monitoring, identification, and reporting. Lastly, they created an ANS species list (plants and animals) which focus only on those ANS that can be transported by watercraft.



### ***Colorado Department of Agriculture (CDA) Noxious Weed List***

Plant ANS are also known as aquatic noxious weeds. Since 1990, the Colorado Department of Agriculture (CDA) has protected the

state's natural resources by enforcing regulations controlling terrestrial and aquatic noxious weeds: non-native ecosystems and harm agriculture. CDA classifies noxious weeds into three separate lists: A, B, and C. Several species in this guide are List A or List B noxious weeds.

- List A plants are designated for elimination on all public and private lands. They must be eradicated wherever detected in order to protect neighboring communities and the state as a whole.
- List B includes plants whose continued spread must be stopped. The Colorado Commissioner of Agriculture works with the state noxious weed advisory committee, local governments, and others to develop and implement noxious weed management plans to contain these species.
- List C plants are widespread in Colorado and the degree to which they are managed is determined solely by local governments.



### ***Colorado ANS Watch List***

The Colorado Aquatic Nuisance Species Management Plan contains a Watch List of organisms known to pose environmental and/or economic risk to Colorado. The management of some of these species is addressed by existing laws and is under the purview of state or federal agencies. The species that are not covered by statute and have no management plan but are still invasive and considered potentially detrimental are included on the Colorado ANS Watch List.

## Symbols

The following symbols will be used throughout this guide to denote the status of each species and the action to take if the species is sighted. Please report your sighting to the appropriate authority.

- Status**
-  Present in Colorado
  -  Not Known to be in Colorado
  -  USFWS Injurious Wildlife Species
  -  DOW Prohibited Aquatic Species
  -  State Parks ANS List
  -  USDA Noxious Weed List
  -  CDA Noxious Weed List
  -  Colorado ANS Watch List

### *Action to Take*

If you find this species, contact the State Invasive Species Coordinator at Colorado Parks & Wildlife, (303) 291-7362 or email [ReportANS@state.co.us](mailto:ReportANS@state.co.us).



If you find this plant, contact the Early Detection and Rapid Response Specialist at the Colorado Department of Agriculture, (303) 239-5767 or email [Weeds@ag.state.co.us](mailto:Weeds@ag.state.co.us)



## New Zealand Mudsnail

### *Potamopyrgus antipodarum*

New Zealand mudsnails (NZMS) are small aquatic snails native to fresh waters of New Zealand. They were first discovered in North America in the late 1980s in the Snake River, Idaho and Madison River, Montana.

**Identification:** NZMS range in size from a grain of sand to 1/8 inch in length and are black or brown in color. The shell has about 5 1/2 spirals. If the shell is held tip up with the opening toward you, the opening is on the right. There is an attached operculum (cover) which can close off the opening.



PHOTO BY CPW INVASIVE SPECIES PROGRAM



**Habitat:** Found in freshwater, brackish, or saline waters with almost any substrate. Populations in saline conditions produce fewer offspring and grow more slowly. Also tolerates a wide range of temperatures, ranging from near freezing to 82°F.

**Pathway of Introduction and Spread:** New Zealand mudsnails are spread into new river systems primarily by humans, although they can be carried on the feet of dogs and wildlife. Anglers, boaters, researchers and others can

carry NZMS to uninfested locations on their boots and gear. They can survive up to 50 days on a damp surface, giving them ample time to be transferred from one body of water to another on fishing gear.

**Impacts:** NZMS compete with native invertebrates, including native mollusks, for space and food resources. NZMS may reduce the availability of native invertebrate prey for fish—particularly mayflies, caddisflies and chironomids. They are not a viable food source themselves—their hard shell allows them to pass through a fish gut unharmed.

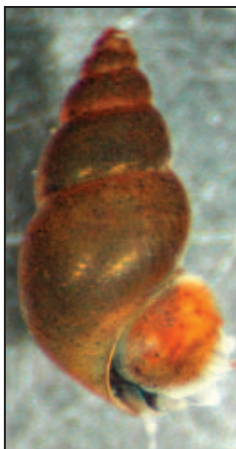


PHOTO BY MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

**Status:**    

**Action:** 

## Zebra Mussels

*Dreissena polymorpha*

## Quagga Mussels

*Dreissena rostriformis bugensis*

Zebra and quagga mussels are freshwater bivalve mollusks—animals with two shells. Zebra mussels are native to the Black and Caspian Seas. Quagga mussels are native to the Dnieper River Drainage in the Ukraine. Both species were introduced into the Great Lakes system in the late 1980s in the ballast water discharged from transoceanic ships.

**Identification:** It is very difficult to tell the two species apart. The shell color of both mussels alternates between light and dark bands, often forming stripes. Both have



PHOTO BY JASON GOEKLER, KANSAS DEPARTMENT OF WILDLIFE AND PARKS



QUAGGA PHOTO BY  
U.S. GEOLOGICAL SURVEY



tiny threads—byssal threads—that help them attach to hard surfaces. They range in size from microscopic to nearly two inches long. The zebra mussel is nearly triangular in shape and the quagga mussel is more rounded.

**Habitat:** Found in freshwater lakes, rivers, reservoirs, and ponds; attaches to hard surfaces such as rocks, docks, cement, wood, and other aquatic plants and animals.



ZEBRA PHOTO BY LAUREN LIVO  
AND STEVE WILCOX

### **Pathway of Introduction and Spread:**

Zebra and quagga mussels likely made their way to Colorado on trailered watercraft. Larval and adult mussels can be transported between waters in bait

buckets, live wells and bilge water or attached to boat hulls, motors, trailers, fishing gear or other equipment. Microscopic larvae can be carried downstream in water currents.

**Impacts:** Zebra and quagga mussels grow and reproduce quickly. They attach to most underwater structures and have significant economic, ecological, and recreation impacts. These mussels clog water supply infrastructure and degrade water quality. As filter feeders, they eat most of the food at the bottom of the food chain, leaving little or nothing for native aquatic species. They also attach to and encrust native organisms, essentially smothering them.

**Status:**



**Action:**



**Water Flea**  
*Daphnia lumholtzii*

**Spiny Water Flea**  
*Bythotrephes longimanus*  
(*cederstroemi*)

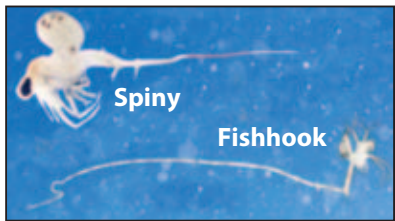


PHOTO BY JEFF GUNDERSON, MINNESOTA SEA GRANT

**Fishhook  
Water Flea**  
*Cercopagis pengoi*

In general terms, water fleas are small aquatic crustaceans that have a jumpy or jerky mode of swimming. *Daphnia lumholtzii* are native to tropical and subtropical regions in Africa, Asia, and Australia. It is suspected that they were brought to North America with African fish imported for the aquarium trade or to stock reservoirs. The other two water fleas are native to Eurasia and both were introduced into the Great lakes from ships' ballast water.

**Identification:** These three species all have sharp tail spines. *Daphnia l.* is the smallest, 0.4 to 0.6 inches long. *Bythotrephes* and *Cercopagis* water fleas range from ¼ to ⅝ inches in length. On a fishing line, all look like bristly gobs of jelly with black spots.



**Habitat:**

Found in warmer freshwater lakes, reservoirs, and rivers.

**Pathway of Introduction and Spread:** Eggs and adults are easily transported in bilge water, bait buckets, live wells, and on fishing lines, downriggers, anchor lines, and fishing nets. It only takes one adult or egg to start an infestation. While female water fleas die out of water, under certain conditions they produce eggs that resist drying and freezing, which can establish a new infestation.

**Impacts:** These invasive water fleas eat small animals (zooplankton), including native *Daphnia*, which are an important food for larval and juvenile native fish. Fish do not feed on these species of water fleas because their sharp spine makes them hard to swallow. They become entangled on fishing lines and can clog the eyelets of fishing rods.

**Status:**



**Action:**



## Chinese Mitten Crab

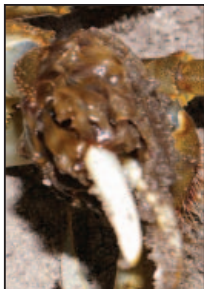
### *Eriocheir sinensis*

The Chinese mitten crab is a burrowing crab native to the coastal rivers and estuaries of the Yellow Sea in Korea and China. Mitten crabs were found by commercial shrimp trawlers in southern San Francisco Bay in 1992. They were probably released deliberately to establish a fishery or accidentally via ship ballast water. In Asia, the mitten crab is a delicacy. Crabs have been imported live illegally to markets in Los Angeles and San Francisco. Currently, the mitten crab has been found on the West Coast, Great Lakes, and Chesapeake Bay.

**Identification:** Adult and large juvenile mitten crabs have dense patches of hair covering white-tipped claws. The claws are equal in size. The mitten crab's shell has four spines on either side and is three to four inches wide. The legs of the adult crab are generally more than twice as long as the width of the shell.



PHOTOS BY CHRISTIAN FISCHER



**Habitat:** Found in both freshwater and salt water. They are walking crabs that can emerge from the water to move upstream of barriers and are capable of moving several hundred miles upstream from salt water. They spend most of their lives in freshwater rivers, migrating to brackish or salt water to reproduce.

**Pathway of Introduction and Spread:** The mitten crab is a delicacy in some areas and live mitten crabs are imported illegally for food or for the pet/aquarium trade. The planktonic larvae of the Chinese mitten crab naturally float on currents to uninfested locations and both larvae and adults can be transported on boats.

**Impacts:** Mitten crabs are carnivorous and aggressive and may compete with native crustaceans and fish for food. They also harm fisheries by eating fish eggs and young. Mitten crabs burrow into banks for protection from predators and desiccation. This burrowing activity may increase erosion and instability of levees and riverbanks. They damage commercial fishing nets and clog pumps, screens, and intakes. On the west coast, mitten crabs have damaged and killed fish at water diversions. Mitten crabs are an intermediate host for the Oriental lung fluke, and mammals, including humans, can become infested by eating raw or poorly cooked mitten crabs.

**Status:** 

**Action:** 

## Rusty Crayfish

### *Orconectes rusticus*

Rusty crayfish are native to the Ohio River Basin. They were first discovered outside of their native range in the 1960s.

**Identification:** Rusty crayfish grow up to five inches long. They have brown bodies and large grayish-green to reddish-brown claws with dark black bands on the tips. There are two rusty patches on either side of the crayfish's body. The claws, when closed, have an oval gap in the middle. The moveable claw is smooth and S-shaped. Males tend to be larger than females.

**Habitat:** Found in freshwater lakes, rivers, and streams. Prefer deep pools and fast currents with cover from predators.



PHOTO BY PHIL MYERS, MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN





PHOTO BY U.S. ENVIRONMENTAL PROTECTION AGENCY

### Pathway of

### Introduction and Spread:

Introduced by anglers who use the crayfish as bait and throw unused bait into the water or illegally stocked as a prey base for a fishery.

**Impacts:** Rusty crayfish eat small fish, insects, and fish eggs. They also eat aquatic vegetation, damaging underwater habitat that

is important for fish spawning, cover, and food. They are aggressive and displace native crayfish.



PHOTO BY PHIL MYERS, MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN

**Status:**



**Action:**



## American Bullfrog

*Lithobates catesbeiana*

Bullfrogs are native to the eastern U.S. from the Atlantic states through Kansas. Bullfrogs were introduced intentionally—as game animals and to control mosquitoes and other pests—and unintentionally, when tadpoles were released along with introduced sport fish. Bullfrogs have also been released when they were no longer wanted as pets, laboratory, or classroom animals.

**Identification:** Bullfrogs are the largest frogs in the U.S., up to eight inches long and weighing up to one pound. They are green to near black, often with darker spots and have a prominent fold of skin from behind eye extending around eardrum. The eardrum is as large as the eye in females and is even larger in males.



PHOTO BY CARL D. HOWE



PHOTO BY GARY M. STOLZ, U.S. FISH AND WILDLIFE SERVICE

**Habitat:** Found in warm lakes, ponds, stock tanks, and sluggish portions of streams and rivers.

**Pathway of Introduction and Spread:** Bullfrogs easily establish and expand their range when released as bait, unwanted pets, laboratory, and classroom animals. Unintentional releases with sport fish stockings and intentional introductions for pest control add to the problem.

**Impacts:** Bullfrogs eat anything that moves and will fit into their mouths including fishes, frogs, birds, bats, snakes, tarantulas, small mammals, and a variety of invertebrates. They out-compete and eat native amphibian species and are a factor in native species population declines.

**Status:** 

**Action:** 

## **Green Frog, Northern Green Frog, Bronze Frog, Banjo Frog**

*Lithobates clamitans*

The green frog's native range includes most of eastern North America east of central Oklahoma. The bronze frog is the more southern subspecies.

**Identification:** Green frogs are three to five inches in length. They can be olive, brown, or green with dim black spots on the back. Their chin, breast, and undersides of legs are sometimes mottled and their legs have dark transverse bands. They are yellowish or white below, and males usually have a bright yellow throat. In males



PHOTOS BY DEREK RAMSEY

the tympanum (eardrum) is much larger than the eye and females tend to have a tympanum the same size as the eye. They can be confused with bullfrogs. Their distinguishing characteristic is a ridge of skin (dorsolateral ridge) that begins just behind the eye of the green frog and extends to where the hip bones protrude; the fold is absent in bullfrogs.



**Habitat:** Found in a variety of shallow, weedy, aquatic habitats around lakes, ponds, and streams. They can also be found in wetlands and flooded fields.

**Pathway of Introduction and Spread:** Most infestations are from intentional or accidental release of pets, laboratory and classroom animals, or from released live bait.

**Impacts:** Green frogs are smaller than American bullfrogs and may not be as problematic to native amphibians when it comes to predation. Competitive interactions and introduction of disease are potential issues.

**Status:** 

**Action:** 

## African Clawed Frog

### *Xenopus laevis*

African clawed frogs are native to the African Rift Valley south of the Sahara in east and southern Africa. They are also found in South Africa and Namibia and Angola in western Africa. This species was used in human pregnancy tests in the 1940s. When more effective means of pregnancy tests were made available, many were released and became invasive all over the world.

**Identification:** African clawed frogs can grow up to five inches in length. They have a wedge-shaped head and flattened body, but have no tongue or external ears. Females are larger than males. Males lack a vocal sac but produce a clicking noise by rapid muscle contractions in their throat. The front toes are not webbed. The hind toes are webbed and the skin on the tips of the three inside back toes is thickened to look and function as claws.

**Habitat:** Prefers warm, stagnant freshwater pools and ponds; they are rarely found in running streams.



PHOTO BY BENEDIKT RAUSCHER

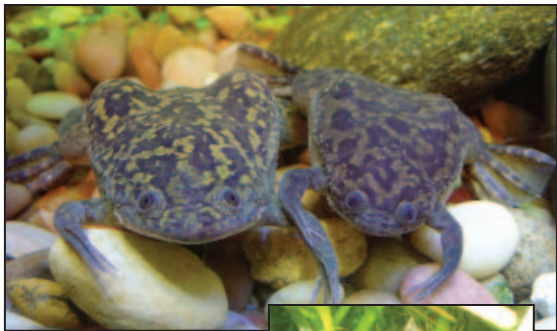


PHOTO BY TIM VICKERS

### Pathway of Introduction and Spread:

Most infestations are from intentional or accidental release of pets and laboratory animals.

**Impacts:** African clawed frogs are voracious

predators and scavengers that eat aquatic insects and larvae, crustaceans, small fish, tadpoles, worms, and freshwater snails. They can disrupt the food chain and have been shown to devastate native frog populations by eating their young. They can travel short distances to other bodies of water, and some have even been documented to survive mild freezes. During drought, this frog burrows in the mud and may lie dormant for up to a year.



PHOTO BY CHRISTOPHER CAGE

**Status:**



**Action:**



## **Bowfin, Grindle, Dogfish, Grinnel, Cypress Trout, Mud Fish**

*Amia calva*

The bowfin is native to most parts of the Mississippi River Basin, along the Gulf Coast and the Florida Peninsula.

**Identification:** Bowfins are 18 to 24 inches long and weigh two to three pounds. They have a large head with no scales and a large mouth containing many sharp teeth. The dorsal fin is long, extending more than half the length of the back, and contains more than 45 rays. The tail is rounded, and the backbone extends part way into it. There is a barbel-like flap by each nostril. The back is mottled olive green shading to lighter green on the belly. The dorsal fin is dark green and the other fins are lighter green. Young fish have a black spot (ocellus) near the base of the upper part of the tail fin that has yellow or orange edges. The spot is found in adult fish, but is less prominent in females.





**Habitat:**

Found in lakes and slow-moving rivers with plentiful vegetation;

tolerate silt and mud and can survive in warm, stagnant water by breathing air through the gas bladder.



**Pathway of Introduction and Spread:** Past bowfin introductions have been attributed mainly to intentional stockings in ponds, lakes, and rivers.

**Impacts:** Young bowfins eat phytoplankton, zooplankton, and insects. The adults mainly feed on fish, including desirable game fish, which may impact recreational fishing, tourism, and the economy.

**Status:****Action:**

PHOTO BY BENEDIKT RAUSCHER

# Bighead Carp

## *Hypophthalmichthys nobilis*

Bighead carp are native to China. They were first introduced in the U.S. in Arkansas in 1972 to control algae and aquatic weeds in aquaculture ponds. Bighead carp escaped from aquaculture farms during flooding in 1994 and spread throughout the Mississippi basin.

**Identification:** Bighead carp have a large head with eyes low on the head that look downward. The bighead has no teeth and its lower jaw protrudes out farther than its upper jaw. They have tiny scales and gray to black blotches on the body, which gives them a speckled appearance. Bighead can reach 80 pounds or more.

**Habitat:** Prefer large rivers, but can also be found in smaller rivers and streams, as well as lakes and ponds. Can survive in a wide range of temperatures, but their preferred temperature is 78°F.

**Pathway of Introduction and Spread:** Once in open waters, bighead carp can spawn and disperse themselves. Juvenile bighead carp are popular as bait and infestations may be caused by dumping unused bait into the water.

**Impacts:** Bighead carp consume the same zooplankton that native filter feeders and juvenile fish eat. Declines in the zooplankton population can also result in dense algae blooms.





PHOTO BY SCOTT YESS, U.S. FISH AND WILDLIFE SERVICE



PHOTO BY MICHIGAN SEA GRANT

# Catla

## *Gibelion catla* (also *Cyprinus catla*, *Catla catla*, *Leuciscus catla*)

Catla are native to India, Pakistan, Bangladesh, Nepal, and Myanmar.

**Identification:** Catla can grow to six feet in length and weigh up to 83 pounds. They have a prominent protruding lower jaw and upturned lower lip that covers its mouth. Scales are large and dark grayish-green. Fins are dark; the pectoral fins are long, extending to pelvic fins.

**Habitat:** Found in warm rivers, lakes, and ponds, 64° to 82°F.

**Pathway of Introduction and Spread:** The fish is a popular food fish in India, and may be intentionally introduced to ponds and other bodies of water to establish a fishery.

**Impacts:** Catla are omnivorous, feeding on aquatic and terrestrial insects, detritus, and phytoplankton. They could compete with native species for food.

**Status:**



**Action:**



PHOTO BY KHALID MAHMOOD

# Gibel, Crucian Carp, Prussian Carp, Silver Prussian Carp

## *Carrassius gibelio*

Gibel are medium-sized members of the carp family and are native to Asia. There was an introduction of these fish to the lakes and ponds around Chicago in the early 1900s but that population died off. There are no recent reports of this species in the U.S.

**Identification:** Body silvery-brown in color; dorsal and anal fins have a serrated, spinelike ray. Juveniles have a black spot on the base of the tail which disappears with age. It has no barbels around the mouth.

**Habitat:** Inhabits a wide variety of still water bodies and lowland rivers, usually associated with submerged vegetation or regular flooding. Tolerates low levels of dissolved oxygen and pollution.

PHOTO BY GEORGE CHERNILEVSKY



**Pathway of Introduction and Spread:** Any introduction would most likely be from deliberate stocking.

This is a wild relative of the common goldfish and could hybridize with that species.

**Impacts:** Not known. Since they are very hardy and eat a wide range of foods, it is likely they would compete with native fish for food and habitat.

**Status:**



**Action:**



## **Giant Barb Carp, Siamese Giant Carp, Giant Barb** *Catlocarpio siamensis* and *Catlocarpio spp.*

Giant barb carp are the largest species of carp in the world. These migratory fish are native to the Mae Klong, Mekong, and Chao Phraya river basins in Thailand and Vietnam. Its numbers have declined seriously in its native range due to over harvesting and habitat loss. It has not been reported in the U.S.

**Identification:** Giant barb carp can reach ten feet in length and weigh more than 600 pounds. It has very large dark silver grey to black scales with lighter grey, dark blue or dark green edges. The fins and tail are dark



PHOTO BY LERSUJWA

grey to black and the dorsal fin is short but high. It has a large mouth with pink lips, no barbels, and light to cream colored cheeks.

**Habitat:** Adults inhabit big pools along the edges of large rivers and prefers deep, weedy, slow-moving, or still waters. Juveniles inhabit floodplains and small tributaries. In SE Asia, it seasonally enters smaller canals, floodplains, and flooded forests, possibly for breeding.

**Pathway of Introduction and Spread:** Giant barb carp are a favored food source in Asia and could be introduced deliberately to establish a fishery.

**Impacts:** Giant barb carp feed on algae, phytoplankton, vegetation, worms, crustaceans, and insects and moves along the bottom, sucking up food. This fish would compete with native fish for food and space and its feeding method would increase sedimentation, lowering water quality.

**Status:**



**Action:**



# Goldfish

## *Carrassius spp.*

Goldfish are small members of the carp family and are native to Asia. They are now found world-wide due to the pet trade.

**Identification:** Selective breeding over many centuries has produced goldfish with many different body shapes, colors, and fin and eye configurations. These fish often revert to olive-bronze coloration and normal fin shapes if released from captivity.

**Habitat:** Found in rivers, lakes, ponds, lagoons, and ditches with cold, slow-flowing water and aquatic vegetation. Goldfish are able to withstand some salinity and can tolerate low levels of dissolved oxygen.

### Pathway of Introduction

**and Spread:** Goldfish are most commonly released to waters as discarded pets, classroom, or laboratory animals. Some goldfish escape outdoor ponds into uninfested waters.

**Impacts:** Goldfish can carry diseases and parasites that are not normally present in wild fish and amphibian populations, leading to die-offs of native species. Goldfish also compete with other species for food. They eat a wide range of foods including plants, small crustaceans, insects and detritus.

**Status:**



**Action:**



PHOTO BY WIKIMEDIA



# Mrigal, Small Scale Mud Carp

## *Cirrhinus cirrhosis* and *Cirrhinus spp.*

Mrigal are native to India, Bangladesh, Cambodia, Laos, Malaysia, Mauritius, Myanmar, Nepal, Pakistan, Sri Lanka, and Vietnam. It is an important food fish and is farmed throughout South Asia.

**Identification:** Mrigal have a sleek body covered in small scales and small reddish colored fins, particularly during breeding season. The mouth has a protruding upper lip and there is single pair of short barbels. The caudal fin is deeply forked.

**Habitat:** Inhabits fast flowing streams and rivers; can tolerate high levels of salinity.

**Pathway of Introduction and Spread:** Mrigal are a favored food source in Asia and could be introduced deliberately to establish a fishery.

**Impacts:** Mrigal are omnivorous and would compete with native fish for food and space.

**Status:**



**Action:**



PHOTO BY LEONARD L. LOVSHIN,  
AUBURN UNIVERSITY, DEPARTMENT OF  
FISHERIES AND ALLIED AQUACULTURES

## Carp species *Cyprinus spp.*

**Common carp**, *Cyprinus carpio carpio*, also known as **German Carp, European Carp, Mirror Carp, Leather Carp, Koi** are native to Eurasia, in the Caspian Black and Aral Sea basins. They may have been introduced into North America as a game fish as early as 1830 and are not a prohibited species in Colorado. But other carp species in the genus *Cyprinus* are. These include the following: *Cyprinus acutidorsalis*, *Cyprinus barbatus*, *Cyprinus centralus*, *Cyprinus chilia*, *Cyprinus cocsa*, *Cyprinus dai*, *Cyprinus daliensis*, *Cyprinus exophthalmus*, *Cyprinus fuxianensis*, *Cyprinus hyperdorsalis*, *Cyprinus ilishaestomus*, *Cyprinus intha*, *Cyprinus longipectoralis*, *Cyprinus longzhouensis*, *Cyprinus mahuenensis*, *Cyprinus megalophthalmus*, *Cyprinus micristius*, *Cyprinus multitaeniata*, *Cyprinus pellegrini*, *Cyprinus qionghaiensis*, *Cyprinus rubrofuscus*, *Cyprinus yilongensis*, *Cyprinus yunnanensis*



PHOTO BY DAVE GORDANO



**Identification:** Carp are usually 12 to 25 inches in length and weigh eight to 10 pounds, but can be larger. They have two pairs of barbels on each side of the upper jaw. Color varies by species. The dorsal fin and the anal fin both have a heavy toothed spine.

**Habitat:** Found in warm, muddy, eutrophic waters.

**Pathway of Introduction and Spread:** Anglers using juvenile carp as bait fish can introduce the species to new bodies of water. They can expand their range by moving to other connected bodies of water. While common carp are not prohibited, it is not recommended to move any fish to uninfested waters.

**Impacts:** Carp are bottom feeders that degrade shallow lakes by causing excessive turbidity, destroy spawning beds and cause declines in waterfowl and important native fish species. Carp prey on the eggs of other fishes and can dominate a water body in a short period of time.

**Status:**



**Action:**



*Note: The common carp is not prohibited*

## Silver Carp

### *Hypophthalmichthys molitrix*

Silver carp are native to China and were imported into the U.S. in the 1970s as a method for removing algae from catfish farms. Flooding in the 1990s overflowed farming ponds and sent the fish into the Mississippi River.

**Identification:** Silver carp can weigh up to 60 pounds. They have eyes set below the mouth and large upturned mouths without barbels. When feeding, they hold their mouths wide open.

**Habitat:** Found in still or slow-flowing water, and in impoundments or the backwaters of large rivers.

**Pathway of Introduction and Spread:** The juveniles are sometimes used as baitfish, so they could be spread through use or release of live bait.



PHOTO BY DAN O'KEEFE, MICHIGAN SEA GRANT



PHOTO BY SCOTT YESS, U.S. FOREST AND WILDLIFE SERVICE

**Impacts:** Silver carp eat plankton and detritus and compete for food with native organisms including mussels, larval fishes, and some adult fish. Silver carp can jump up to 10 feet out of the water when disturbed by sounds of watercraft. They often jump into boats and can injure boaters, personal watercraft operators, and water skiers.

**Status:**   

**Action:** 

# Rohu

## *Labeo rohita* and *Labeo spp.*

Rohu are native to Pakistan, India, Bangladesh, Myanmar, and Nepal.

**Identification:** Rohu have dark scales on the upper body but the lower body and belly are golden brown. They have a dark brown dorsal fin and tail. Pelvic, pectoral, and anal fins have a red tint. Single pair of barbel (maxillary) present.

**Habitat:** Found in weedy and slow flowing or standing waters of lakes, ponds, pools, and rivers.

**Pathway of Introduction and Spread:** Rohu are a favored food source in Asia and could be introduced deliberately to establish a fishery.

**Impacts:** Rohu can compete with native species for food and cause excess turbidity.

**Status:**



**Action:**



PHOTO BY KHALID MAHMOOD

# Mahseers

## *Tor spp.*

Mahseer are native to India, Pakistan, Malaysia, and Indonesia.

**Identification:** Mahseer have an elongated body with a pointed snout and can weigh more than 100 pounds. The forehead is flat and the jaws are equally sized. There are two pairs of barbels. Body color varies per species.

**Habitat:** Found in fast moving rivers and streams.

**Pathway of Introduction and Spread:** Mahseer are a prized sport fish in Asia and could be introduced deliberately to establish a fishery.

**Impacts:** Mahseers are omnivorous, eating not only algae, crustaceans, insects, frogs, and other fish, but also fruit that falls from trees overhead. They may compete with native species for food and cause excess turbidity.

**Status:**



**Action:**



PHOTO BY KHALID MAHMOOD

**Black Carp, Snail Carp,  
Black Amur, Chinese Roach,  
Black Chinese Roach**  
*Mylopharyngodon piceus*  
and all *Mylopharyngodon spp.*

The black carp is native to most Pacific drainages in eastern Asia. Black carp were purposely imported into the U.S. in the early 1970s for use as a food fish and also to control snails that caused parasitic infections in fish held captive on fish farms.

**Identification:** The black carp is a blackish-brown fish with blackish-grey fins and an elongated and laterally compressed body. The scales are very large and have black tips. They can typically grow to more than three feet in length and weigh more than 30 pounds. The fish can reach five feet in length and weigh up to 150 pounds. They have molar-like pharyngeal teeth.



PHOTO BY ROB COSGRIFF, ILLINOIS NATURAL HISTORY SURVEY, GREAT RIVERS FIELD STATION



**Habitat:** Found in rivers, streams, and lakes up to 30 feet deep.

**Pathway of Introduction and Spread:** Most infestations result from escapes and releases from aquaria and aquaculture farms.

**Impacts:** The black carp is a bottom-dwelling molluscivore—they eat mollusks such as clams, snails, and mussels. Black carp have the potential to devastate native mollusk populations. They feed on fingernail clams, a primary food source of migrating waterfowl and fish. They also compete with native turtles and mammal such as raccoons, muskrats, and otters for food. Where snails play an important role by grazing on algae, the fish could reduce the snail population to the point where algae mats could develop. Black carp are host to parasites, flukes, and bacterial and viral diseases and could possibly transfer these to other fish species.

**Status:**



**Action:**



## **Grass Carp, Hybrid Grass Carp** *Ctenopharyngodon idella*, *Ctenopharyngodon idella* *x Aristichthys nobilis*

The grass carp, or white amur, is native to southeastern Russia and northwestern China and was brought to Arkansas in the 1960s to control aquatic plants in reservoirs and aquaculture farms. Hybrid grass carp, which are a cross with bighead carp, are thought to be sterile. The hybrid was never as efficient at weed control as the grass carp. Once ways of sterilizing grass carp were developed in the 1980s, production of hybrid grass carp in North America ceased. Grass carp are widely stocked in Colorado. However, all grass carp stocked on the West Slope or in the Rio Grande drainage must be certified triploid (sterile).



PHOTO BY ERIC ENGBRETSON, U.S. FOREST AND WILDLIFE SERVICE

**Identification:** Grass carp are torpedo shaped with moderately large scales. The head has no scales. They are silver to olive in color. The adults can weigh up to 70 pounds.

**Habitat:** Found in quiet waters, such as lakes, ponds, pools, and backwaters of large rivers. Tolerant of low levels of salinity; may occasionally enter brackish-water.

**Pathway of Introduction and Spread:** Infestations result from legal and illegal interstate transport and release by individuals and private groups for weed control, escapes from farm ponds and aquaculture facilities; and natural dispersal from introduction sites.

**Impacts:** Until they are about two inches long, grass carp feed on microscopic zooplankton. Once they reach a length of about four inches, they feed almost exclusively on aquatic plants. Grass carp prefer soft, low fiber aquatic weeds and various underwater plants. If the more desired species of plants are not available, they will feed on plants above the water surface; and have been observed feeding on overhanging brush and tree branches. Grass carp may harm water quality by increasing phosphorus levels.

**Status:**



**Action:**



## Walking Catfish

### *Clarias batrachus*

The walking catfish is native to Malaysia, Thailand, eastern India, Sri Lanka, Bangladesh, Burma, Indonesia, Singapore, and Borneo. In the early 1960s, walking catfish were imported to Florida from Thailand for the aquarium trade.

**Identification:** Walking catfish have no scales and may appear dark brown, gray, or olive with white specks. Fins are gray-green and there may be red borders on the median fins and some yellow on the dorsal fin. The dorsal and anal fins are long and end near the caudal fin. The pectoral fins are rigid. The head is flat and wide and the body tapers to the tail. The eyes are very small and the mouth is broad with fleshy lips and numerous small



PHOTO BY IAN BAIRD, U.S. GEOLOGICAL SURVEY



pointed teeth in large bands on both the upper and lower jaw. They have four pairs of barbels.

**Habitat:** Commonly found in freshwater and brackish water. They can exist in cloudy, low-oxygen waters.

**Pathway of Introduction and Spread:** Walking catfish can breathe atmospheric oxygen and have the ability to “walk” on land for long distances, especially during or after rainfall.

**Impacts:** Walking catfish move from site to site and prey on insect larvae, fish eggs, fish, and occasionally plant material and can decimate native and sport fish populations.

**Status:**



**Action:**



PHOTO BY MISTVAN

## Asian Swamp Eel, Rice Eel, Rice-paddy Eel, Belut *Monopterus albus*

Asian swamp eels are native to Asia, from northern India and Burma to China. Immigrants who wanted to propagate the animal as a food fish reportedly brought the eel to Hawaii in the early 1900s. Swamp eels were introduced to mainland North America in the 1990s, possibly through aquarium release, stocking as a food source, or escaped from fish markets.

**Identification:** Swamp eels have a scale-less, elongated body with a tapering tail and blunt snout. They are brown or greenish above and the belly is lighter in color—often white, orange, or light brown. Their teeth look like bristles and they have one V-shaped gill located beneath the head. They can grow to three feet in length and weigh up to one pound.



PHOTO BY WIKIMEDIA



PHOTOS BY U.S. GEOLOGICAL SURVEY



**Habitat:** Found in a wide variety of freshwater habitats: shallow wetlands, stagnant waters, marshes, streams, rivers, ditches, canals, lakes, reservoirs, and ponds.

**Pathway of Introduction and Spread:** Asian swamp eels may be caught and transported as bait, food, or aquarium pets.

**Impacts:** Asian swamp eels eat a broad range of prey, including fish, shrimp, crayfish, frogs, turtle eggs, and aquatic invertebrates and may out-compete and displace native aquatic species. They hide by day by burrowing into the bottom mud and come out to feed at night.

**Status:**  

**Action:** 

## Gars

### *Family Lepisosteidae*

Gars are native to the Mississippi River basin.

**Identification:** All gars have a torpedo-shaped body with the dorsal and anal fins located far back towards the tail. They are covered by thick diamond-shaped interlocking scales (ganoid scales) that create a very hard protective covering. The swim bladder acts like a primitive lung, allowing gar to breathe atmospheric air and survive in low oxygen conditions. Alligator gar have two rows of “canine-like” teeth on the upper jaw while other gars usually have only one row.





**Habitat:** Found in large, slow moving rivers, reservoirs, and oxbow lakes.

**Pathway of Introduction and Spread:** This species could spread through intentional release.

**Impacts:** Gar are aggressive predators of other fish. Because they eat walleyes and other sport fish, some anglers consider gar an undesirable species. The roe of gar are poisonous to many animals, including humans.

**Status:**



**Action:**



PHOTO BY TINO STRAUSS

## Goby

### *Family Gobiidae*

Goby belong to a family of fish, Gobiidae, with more than 2,000 species in more than 200 genera. Most gobies are adapted to shallow marine habitats or brackish water and estuarine habitats. A small number of gobies (numbering in the hundreds) are also fully adapted to freshwater environments. One such species, the round goby (*Neogobius melanostomus*), was introduced into the Great Lakes in 1990, probably via contaminated ballast water of transoceanic ships.

**Identification:** Most gobies are relatively small, typically less than four inches in length. They have fused pelvic fins, which form a suction-cup structure on the chest of the fish. The round goby is four to 10 inches long, and is grey with blotches of black and brown. The dorsal fin



PHOTO BY CENTER FOR GREAT LAKES AND AQUATIC SCIENCES

may be tinged with green; the front dorsal fin has a distinctive large black spot.

**Habitat:** Found in freshwater lakes, reservoirs, and ponds.

**Pathway of Introduction and Spread:** Round goby may extend their range from the Great Lakes and Mississippi River basin naturally, but could be transported overland by anglers using them as bait.

**Impacts:** Goby are bottom-dwelling fish that perch on rocks and other substrates. They are aggressive fish and voracious feeders and can forage in total darkness. They vigorously defend spawning sites in rocky or gravel habitats, pushing out native species. Goby can also survive in degraded water conditions, and spawn more often and over a longer period than native fish thereby restricting access of other less aggressive fish to prime spawning areas.

**Status:**  

**Action:** 

*Note: Round Goby, (Neogobius melanostomus) shown*

## White Perch, Narrow-mouthed Bass, Silver Perch, Sea Perch

### *Marone americana*

White perch are native to the Atlantic coast region of North America and first invaded the Great Lakes through the Erie and Welland canals in 1950. Since then, they have been stocked intentionally in other areas for sport fishing or were accidentally introduced as contaminants in other fish stockings.

**Identification:** White perch are usually less than 10 inches long and closely resemble white bass. They have a slightly projecting lower jaw and small teeth and are generally silvery with no stripes. The spiny and soft dorsal



PHOTO BY JEFF GUNDERSON, MINNESOTA SEA GRANT

fins are connected. They have a mildly forked tail with three hard anal fin spines, one short and two long.

**Habitat:** Found in lakes, reservoirs, and rivers.

**Pathway of Introduction and Spread:**

Illegal stocking has been source of spread to inland waters.



ILLUSTRATION BY DUANE RAVER, U.S. FISH AND WILDLIFE SERVICE

**Impacts:** In

spring white perch eat mainly fish eggs, especially those of walleye and white bass, causing declines in those species. White perch also feed heavily on baitfish and out-compete native and sport fishes for food and space. They hybridize with white bass, diluting the gene pool of the species. Although an excellent table fish, lack of natural enemies often result in white perch becoming overpopulated and stunted. Thus they are often useless to anglers.

**Status:**



**Action:**



## Piranha

### *Serrasalmus spp.*, *Pygocentrus spp.*

Piranhas are native to South America and were introduced into North America via the aquarium trade.

**Identification:** The genus *Pygocentrus* contains true piranhas or caribes. This genus includes *P. nattereri*, the red-bellied piranha, which grows to about 12 inches. The genus *Serrasalmus* is a large complex of as many as 12 to 14 closely related species. The most common “piranha” in the class is *S. rhombeus*, which grows up to 18 inches. This species varies and can be known as “white piranha” or “black piranha.” Generally speaking these fish have laterally compressed bodies, and short powerful jaws with triangular interlocking teeth.

**Habitat:** Found in rivers, streams, and lakes.



PHOTO BY GREGORY MOINE



PHOTO BY WIKIMEDIA

**Pathway of Introduction and Spread:** Most piranhas are introduced into uninfested waters as unwanted pets.

**Impacts:** Piranhas are carnivorous and will bite anything that moves. Their teeth allow them to bite pieces out of larger prey, as opposed to having to swallow their prey whole. Piranhas often feed in schools and exhibit feeding-frenzy behavior. They can decimate populations of native fish and are a threat to human safety.

**Status:**



**Action:**



## **Rudd, Redeye, Pearl Roach**

### *Scardinius erythrophthalmus*

Rudd is native to the Caspian and Aral Seas of Western Europe and was introduced to the U.S. in the early 1900s, possibly as a food species. In the early 1980s, rudd were cultured and sold as bait and have since spread to waters throughout the country.

**Identification:** Adult rudd can reach over 15 inches in length and are golden-olive on the back fading to silvery-white on the belly. Many of the fins are bright red. The rudd's eye color ranges from pink to gold.



PHOTO BY ROTFEDER





PHOTO BY GEORGE CHERNILEVSKY

**Habitat:** Found in freshwater lakes, rivers, marshland, and ponds with little current and large beds of aquatic plants. They can tolerate a wide range of temperatures and water conditions, including eutrophic or polluted waters.

**Pathway of Introduction and Spread:** Rudd may be marketed as a bait minnow and released into uninfested waters by anglers.

**Impacts:** Young rudd eat zooplankton, aquatic insects, and occasionally other small fish. Mature rudd eat mostly aquatic vegetation and terrestrial insects, consume up to 40% of their body weight each day, and may impact native plant populations.

**Status:**  

**Action:** 

## Eurasian Ruffe

### *Gymnocephalus cernuus*

Eurasian ruffe are native to Eurasia. They were introduced into Lake Superior in the mid 1980s from the ballast water of an ocean-going vessel.

PHOTO BY DOUG JENSEN,  
MINNESOTA SEA GRANT



**Identification:** Eurasian ruffe are small fish, four to six inches in length, is olive-brown to golden-brown on its back with yellowish white undersides. Its dorsal fins

are fused, with the front 12 to 19 dorsal spines followed by 11 to 16 soft dorsal rays. The caudal fin has 16 to 17 rays.

**Habitat:** Found in turbid lakes with soft bottoms and little or no vegetation or rivers with slow moving waters.

**Pathway of Introduction and Spread:** Ruffe can be spread to uninfested locations in the live well or bilge of trailered boats or may be used as bait and spread by anglers dumping unused bait into the water.

**Impacts:** Ruffe mature quickly and have a high reproductive capacity. The average female can produce 130,000 to 200,000 eggs per season. Ruffe eat a variety of foods and have a very sensitive lateral line system and eyes adapted to foraging under poor light conditions. They out-compete native and sport fish for food and space and also eat other fish species eggs.

**Status:**



**Action:**



# Snakeheads and Murrels

*Channa sp., Parachanna spp.,  
Ophiocephalus spp.*

Snakehead fish are native to Asia and Africa but are imported into the U.S. as aquarium and food fish.

**Identification:** Snakeheads have a single dorsal fin that runs the length of the fish. The anal fins are elongated; head is somewhat flattened; mouth is large with sharp teeth. Snakeheads are obligate air breathers, and can live in oxygen-depleted waters by gulping air at the surface.

**Habitat:** Prefers stagnant shallow ponds, swamps and slow streams with mud or vegetated substrate, with temperatures ranging from 0 to >86°F.

**Pathway of Introduction and Spread:** This fish may be intentionally released as a food fish. Snakeheads can live for days out of water if kept moist and potentially wriggle to other water bodies, or be spread by flood.

**Impacts:** Snakeheads compete with native species for food and habitat. Juveniles eat zooplankton, insect larvae, small crustaceans, and the fry of other fish. Adults feed mostly on other fishes, but may eat crustaceans, frogs, small reptiles, and sometimes small birds and mammals.

**Status:**



**Action:**



PHOTO BY U.S. GEOLOGICAL SURVEY

**Note:**  
Northern  
snakehead  
shown

## Sticklebacks

*Apeltes spp.*, *Aulorhynchus spp.*,  
*Culaea spp.*, *Gasterosteus spp.*,  
*Pungitius spp.*, *Spinachia spp.*

Sticklebacks are part of a large group of fish that includes sea horses and pipefishes. Varieties of sticklebacks occur throughout North America, Europe and Asia in both fresh and salt waters. Brook sticklebacks are native to eastern Colorado but invasive on the West Slope and in the Rio Grande Basin.

**Identification:** Sticklebacks are small fish, usually less than three inches long, that have sharp, claw-like hooks protruding from the front portion of their dorsal (back) fins.



PHOTO BY JOHN WOODLING

PHOTO BY KONRAD SCHMIDT



PHOTO BY PIET SPAANS

**Habitat:** Found in cool, clear, slow flowing small streams and ponds with large amounts of filamentous algae and other aquatic plants.

**Pathway of Introduction and Spread:** Sticklebacks are used as bait and spread by anglers dumping unused bait into the water.

**Impacts:** Sticklebacks eat aquatic insects and the eggs and larvae of other fish. They threaten populations of small native fishes, many of which are listed as threatened and endangered.

**Status:**  

**Action:** 

*Note: Ninespine Stickleback (Pungitius pungitius) shown above; Brook Stickleback (Culaea inconstans) shown on facing page*

## Tilapia

*Tilapia spp.*, *Oreochromis spp.*,  
*Sarotherodon spp.*

*Tilapia spp.*, *Oreochromis spp.*, *Sarotherodon spp.*, include roughly 70 species of tilapia native to Africa and the Middle East that have been introduced to other parts of the world. In some cases, the introductions have been accidental; tilapia fish have managed to escape from fish farms or ornamental fish breeders. In other cases, the introduction has been deliberate, e.g. to combat mosquitoes or aquatic weeds. Tilapia has also been introduced as food fish to lakes and other bodies of water.



PHOTO BY MICHAEL RUPERT HAYES

**Identification:** Tilapia species have a wide range of skin colors, black to dark blue to brilliant golden red. They have deep, compressed bodies, a continuous dorsal fin and a short tail (caudal) fin.

**Habitat:** Found in freshwater lakes, wetlands, marine habitats, water courses, estuaries, and marine environments. They water temperatures in the 77 to 86°F range. Some species can tolerate cold temperatures down to about 47°F. Sensitivity to salinity varies greatly between species.

**Pathway of Introduction and Spread:** Tilapia introductions are either deliberate releases or escapes from aquariums or aquaculture farms.

**Impacts:** Tilapia can compete with other species for food and nest sites and can disrupt the ecological balance. Tilapias dig and cause turbidity in clear waters, reducing the amount of light available to aquatic plants.

**Status:**



**Action:**



## **Trahira, Wolf Fish, Tiger Tetra, Wolf Tetra** *Hoplias malabaricus*

Trahira are native to South America, from Costa Rica to Argentina. They were introduced to Florida in the 1970s as either intentional illegal releases or escapes from a fish farm. Cold weather eliminated the species in 1977.

**Identification:** Trahira grow to about 20 inches and three to four pounds. They have a strong jaw with irregularly spaced sharp teeth. They have an elongated, cylindrical body with short anal fin and large scales. They have no adipose fin. The young have a reddish-brown back and yellowish belly, red bands across the head, and green band along the sides. Adults are mottled dull green and brown.

**Habitat:** Inhabits a wide range of freshwater environments from swamps and creeks with little current to free-flowing clear streams. They are able to breathe air, allowing them



PHOTO BY CLAUDIO D. TIMM



to survive in pools and ditches where other fish cannot. They can tolerate saline and brackish water.

**Pathway of Introduction and Spread:** Trahira are often purchased illegally as part of the aquarium trade. They easily escape or can be released when they grow too large for the aquarium. Trahira breathe air and can live for a long time out of the water. This allows them to travel over land through wet vegetation or mud or during rainstorms to infest other waters.

**Impacts:** Trahira are voracious predators that can easily destroy a native or sport fishery. Adults feed on fish and in their native habitat, even eat piranhas. Juveniles feed on crustacean and insect larvae shrimps and other small invertebrates. They are able to breathe air, allowing them to survive in pools and ditches where other fish cannot. Live fish are difficult to handle and potentially dangerous because of their sharp teeth, strong jaws, and slippery bodies.

**Status:**



**Action:**



## Rock Snot, Didymo Algae

### *Didymosphenia geminata*

Didymo alga is a freshwater diatom—a single-celled microscopic alga. It is native to the far northern latitudes of North America, Europe, and Asia. Its range has expanded and it now can be found in rivers in the western and eastern U.S.

**Identification:** Didymo algae form stalks to attach to rocks and plants. The algae eventually die and decompose, but the stalks persist and form masses up to six inches thick that trail for lengths of up to three feet in the current. The clumps, often mistaken for raw sewage, are yellow-brown to white in color and have a



PHOTOS BY BIOSECURITY NEW ZEALAND

texture that is similar to wet wool, but is not slimy.

**Habitat:** Found in freshwater streams and rivers with moderate to high currents, and outlets of lakes and reservoirs.

**Pathway of Introduction and Spread:** Only one cell is needed to begin a new infestation. Didymo algae can survive for several weeks if kept moist. Anglers, boaters, and other recreationists can unknowingly spread microscopic algae which cling to fishing gear, waders, boots, and boats. Felt soled waders are often to blame, since fishermen use them to gain a grip on slippery, rocky bottomed areas.

**Impacts:** Didymo forms dense mats that can be over six inches thick—smothering streambeds, aquatic insects, and plants. Didymo changes the bottom appearance, structure, and food web of a stream and reduces fish habitat and food. It can clog and foul water intakes, hamper water supply systems, and decrease sport fishing opportunities. Aesthetically, the brownish-white flowing masses of stalk structures are unpleasant to see and interfere with recreation.

**Status:**  

**Action:** 



PHOTO BY MARK HODDLE

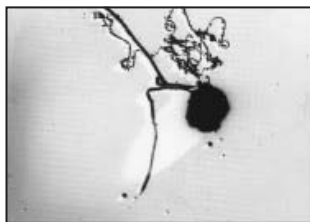
## Golden Algae

### *Chrysochromulina parva* Lackey

Golden algae are toxic, flagellated one-celled alga that is normally found suspended in the water column in brackish water. Golden algae are widely distributed and are found on every continent except Antarctica.

This species was first identified in North America in 1985. It is not known whether the species is indigenous and wasn't previously reported or whether it is exotic to this continent. It has since been reported in 15 U.S. states.

**Identification:** Golden algae are microscopic oval-shaped single-celled organisms. Each alga cell has two equal "tails" called flagella and a short, flexible peg-like organelle called a haptonema. The flagella are used for moving and the haptonema is used to attach to a surface for feeding. Each alga has two saddle shaped chloroplasts that are



PHOTOS BY HEDY KLING

yellow-green to olive in color. When the population of golden algae increases during a bloom cycle, the water may begin to turn yellowish, yellow-copper, or a copper-brown tea color and there can be foaming on the water surface.

**Habitat:** Found in estuarine or marine waters, and inland waters with a relatively high mineral and salt content.

**Pathway of Introduction and Spread:** Golden algae can form dormant cysts when stressed or conditions become unfavorable for the algae. Only one cell is needed to begin a new infestation. Anglers, boaters, and other recreationists can unknowingly spread golden algae in water compartments on boats, on plant fragments or bait, or on fishing gear, waders, and boots.

**Impacts:** When golden alga is stressed due to nitrogen and phosphorus depletion in the environment, it produces a toxin to kill other microscopic organisms and reduce competition. However, the toxin also affects gill-breathing organisms such as fish, bivalves, crayfish, gilled amphibians, and some species of plankton. The toxin damages the gills, which lose their ability to exchange water and absorb oxygen, resulting in death of the organism by asphyxiation. Millions of fish have been killed in the U.S. from golden algae blooms.

**Status:** 

**Action:** 

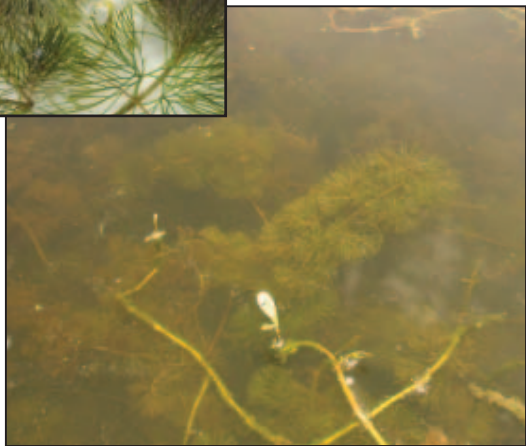
## Fanwort

### *Cabomba carolinana*

Fanwort is a rooted submerged plant that is native to South America and the southeastern U.S., but is considered to be a non-native invasive plant anywhere in the country outside of its native range. Fanwort is commonly used as an aquarium plant because of its delicate appearance, and the aquarium trade has led to infestations worldwide.

**Identification:** Rooted fanwort stems may grow up to thirty feet in length. Leaves are one to two inches across and are arranged in opposite pairs on the stem.

The submerged leaves are finely divided into thin, flat segments that look like fans.



PHOTOS BY GRAVES LOVELL, ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

The floating leaves are smaller and oval and are sometimes split at the tip. Flowers are solitary and vary in color from white to pink to purple, with three sepals and three petals, and are typically about a ½ inch wide.

**Habitat:** Generally grows in three to ten feet of water and prefers slow moving streams, small rivers, lakes, ponds, and ditches.



PHOTO BY TROY EVANS, GREAT SMOKY MOUNTAINS NATIONAL PARK

**Pathway of Introduction and Spread:** Fanwort can reproduce from seeds or small plant fragments. In late summer fanwort stems become brittle, and plants tend to break apart, creating opportunities for spread. Plant fragments carried by boaters, anglers, and other water recreationists, as well as plants emptied from aquariums, can establish colonies in uninfested waters.

**Impacts:** Fanwort grows rapidly, displacing native species and reducing biodiversity. Dense mats of fanwort block sunlight and when they decay, reduced oxygen levels can kill fish and other aquatic organisms. The mats impede swimming, fishing, boating, and other recreational uses and diminish the aesthetic and scenic value of the waterway.

**Status:**  

**Action:** 

## **Brazilian Elodea, Brazilian Egeria, Brazilian Waterweed, South American Waterweed**

*Egeria densa*

Brazilian elodea's native range includes some regions of Brazil to coastal areas of Argentina and Uruguay. It was initially introduced by the aquarium and water garden industry. It was sold for its oxygenation capabilities, and for its attractive flowers. It currently is the top-selling aquatic plant for use in aquaria and has been sold under several names including elodea, "oxygenating plant", and anacharis.

**Identification:** Brazilian elodea is a submerged perennial that can reach lengths of six feet. This plant can live rooted or free floating at depths of up to 20 feet. It has bright green leaves in whorls of four around each node on the stem. Each leaf is up to 1¼ inch long with a linear oblong shape and the margins of the leaf are very finely



PHOTO BY WILLIAM T. HALLER, UNIVERSITY OF FLORIDA



toothed, visible only with a hand lens. The flowers of Brazilian elodea have three white petals and three green sepals. The flowers emerge above the water on long stalks. Brazilian elodea is easily confused with another exotic weed, hydrilla (*Hydrilla verticillata*). Hydrilla will have rough teeth on the underside of the leaves where Brazilian elodea will not.

**Habitat:** Found in slow moving, shallow waters in lakes, ponds, and sluggish rivers and streams.

### Pathway of Introduction and

**Spread:** Fragmented pieces of Brazilian elodea that have double nodes can produce a new plant. It is still extensively sold in the aquarium industry. If people dispose of these plants into open water, it can create a new infestation. Boaters, anglers and other water recreationists can transport fragments from one body of water to another.

**Impacts:** Brazilian elodea creates dense mats that crowd out native plants. Mats can impede boating, fishing, swimming, and other aquatic recreation activities. The mats are unsightly, restrict water movement, trap sediment, impair water quality and degrade fish habitat. The fragmented pieces can clog water intake pipes and other water-delivery infrastructure.

**Status:**



**Action:**



PHOTO BY RICHARD OLD, WWW.XIDSERVICES.COM

## Hydrilla, Water Thyme, Water Weed, Florida Elodea

### *Hydrilla verticillata*

Hydrilla is native to Africa, Australia, and parts of Asia. It was introduced to Florida in 1960 via the aquarium trade and has since spread to other locations in the U.S.

**Identification:** Hydrilla is a submerged, perennial, rooted aquatic plant; stems are slender, branched, and up to 25 feet long. Leaves are pointed and have small, saw-toothed edges and small, red conical bumps along the midrib. Leaves grow in whorls of four to eight around the stem. Tiny white flowers grow on long stalks during summer and fall.



PHOTO BY DAVID J. MOORHEAD, UNIVERSITY OF GEORGIA

**Habitat:** Found in freshwater rivers, lakes, ponds, streams, and wet ditches. Can grow and establish in low light—just one percent of full sunlight.

**Pathway of Introduction and Spread:** Hydrilla grows rapidly from plant fragments, tubers, and turions. It can be dumped from aquariums or unintentionally transported to uninfested waters attached to boats, trailers, or equipment.

**Impacts:** Hydrilla can grow up to four inches a day in clear water, and can establish itself early in the year in low light and spread rapidly. Hydrilla produces thick mats and out-competes, shades out, or simply eliminates ecologically important native, submerged plants. It slows water flow and clogs irrigation and flood-control canals and greatly interferes with boating, prevents swimming and fishing, and alters water chemistry and oxygen levels. Hydrilla infestations can disrupt fish spawning and reduce the size and weight of sport fish.



PHOTO BY CHARLIE EVANS, RIVER TO RIVER CWMA

**Status:**



**Action:**



## Miramar Weed, East Indian Hygrophila, Indian Swampweed *Hygrophila polysperma*

Miramar weed is native to India, Malaysia, and Bhutan and was introduced to North America by the aquarium trade.

**Identification:** Miramar weed is mostly submerged, with a few inches sometimes emerging above the water. The emergent stems are square; submerged stems are round and can grow over six feet long. Elliptical leaves are approximately one half inch in diameter and grow from opposite sides of the stem. The leaves are covered



PHOTOS BY UNITED STATES DEPARTMENT OF AGRICULTURE APHIS PPQ ARCHIVE

in fine white hairs and taper to a sharp point. In autumn, bluish-whitish flowers with two lips form where leaves attach to the stem. The plant produces small fruit pods that are about  $\frac{1}{4}$  inch long and contain 20 to 30 seeds.



**Habitat:** Found in streams and in slowly moving waters; can tolerate low light conditions and a wide pH range.

**Pathway of Introduction and Spread:** Miramar weed fragments very easily, and fragments can hitch rides on boats, gear, or wildlife or drift to uninfested locations. The importance of seeds in the plant's reproduction is not certain.

**Impacts:** Miramar weed grows and spreads rapidly. It forms thick mats that restrict light, choke out native plants, and displace wildlife, reducing biodiversity. When the large stands die, their decomposition can create low oxygen conditions in the water which may result in fish kills. The mats hamper fishing, boating, swimming, and other recreational activities. Dense stands trap sediments, decrease water quality and flow, and provide a breeding ground for mosquitoes.

**Status:** 

**Action:** 

**African Elodea, Oxygen-weed,  
South African Oxygen-weed,  
South African Waterweed,  
Curly Water Thyme,  
Curly Waterweed**  
*Lagarosiphon major*

African elodea is native to southern Africa and is a noxious weed in New Zealand. It has not been found in North America.

**Identification:** African elodea is a perennial, submerged, aquatic plant. It has long stems, up to 20 feet long, which are rooted on the bottom. Leaf color is usually green with a green midrib and leaves often curl downward. Leaves grow from the stem in a spiral pattern and crowd closer together towards the stem tip. The leaves are about one inch long,  $\frac{1}{16}$  to  $\frac{1}{8}$  inch wide, and leaf edges are minutely



PHOTO BY ROHAN WELLS, NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH

toothed. Male and female flowers appear on different plants and are small and have three turned-back petals. Tiny pink to white female flowers grow to the surface of the water on long, thin tubes; male flowers are free-floating.

**Habitat:** Occurs in freshwater lakes and ponds or in flowing streams or rivers. Prefers cool water, is winter hardy, and can grow in high elevation lakes and reservoirs.



PHOTO BY ROBERT VIDEKI

**Pathway of Introduction and Spread:** Only female plants have been found outside its native range, so reproduction in these populations is by plant fragmentation only. African elodea spreads by plant fragments, and the brittle stems break easily to facilitate spread. Water movement, boats, and other equipment can move plant fragments.

**Impacts:** African elodea forms dense stands, blocking sunlight and altering water quality by raising pH, decreasing oxygen, and increasing temperature. Dense stands decrease habitat for fish and other wildlife and stagnant water created by the mats provides good breeding grounds for mosquitoes. African elodea interferes with recreational activities such as swimming, boating, fishing, and water skiing and will clog irrigation ditches and intake pipes.

**Status:**



**Action:**



## Ambulia, Asian Marshweed, Limnophila

### *Limnophila sessiliflora*

Ambulia is native to India and Southeast Asia and was first brought to the U.S. as an aquarium plant.

**Identification:** Most of the ambulia plant is submerged, but a few inches of the stem and leaves can be emergent. Submerged leaves are up to one inch long, feathery, and in whorls about the stem, while emergent leaves are generally lance-shaped with irregular margins. Stems are up to 12 feet long. Single blue to lavender flowers occasionally occur on the emergent portion of the stem.

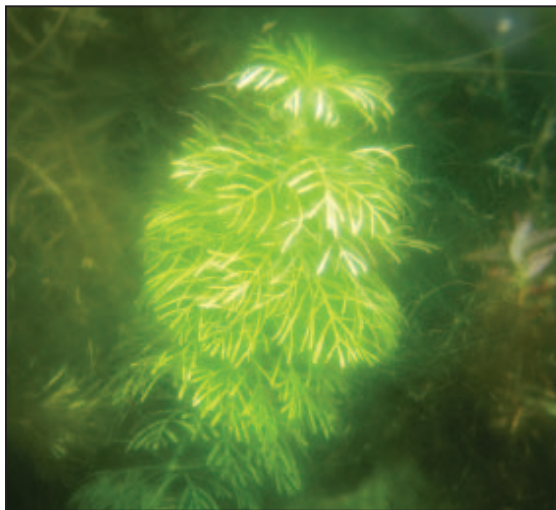


PHOTO BY S. TANAKA



**Habitat:** Grows in a variety of aquatic habitats, including streams, ponds, rivers, lakes, and damp soils.

**Pathway of Introduction and Spread:** *Ambulia* reproduces from plant fragments and by seed. Each flower may set 200 to 300 seeds with a germination rate as high as 96 percent. *Ambulia* continues to be sold through aquarium supply dealers and over the Internet, even though the plant is on the Federal Noxious Weed List. Once in a waterway, it is spread by water currents, animals, boats, gear, or wildlife.

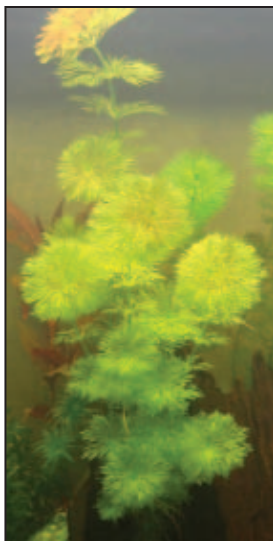


PHOTO BY KAJUKO

**Impacts:** *Ambulia* grows quickly, forming mats that shade out other submerged plant species. It clogs irrigation and flood-control canals, and pumping and power stations.

**Status:**   

**Action:** 

## Parrotfeather

### *Myriophyllum aquaticum*

Parrotfeather is a native of the Amazon River in South America, but is now found worldwide. It was introduced in the 1800s into the U.S., probably as an ornamental for outdoor pond gardens.

**Identification:** Parrotfeather is easily mistaken for Eurasian watermilfoil, a close relative. Parrotfeather has both submerged and emergent leaves arranged in whorls of four to six. Submerged leaves are bright blue-green, oblong, deeply cut, and feathery looking. The emergent leaves are darker green, stiffer, and less feathery than the submerged leaves. The emergent stems and leaves can grow up to a foot above the water surface and look almost like small fir trees. The plant may produce tiny white flowers approximately  $\frac{1}{16}$  inch long.



PHOTOS BY ALISON FOX, UNIVERSITY OF FLORIDA



**Habitat:** Prefers slow moving or still freshwater lakes, ponds, streams, and canals. Roots in shallow water and occurs as floating plants in deep, nutrient-enriched lakes. Plants can survive in wet soil and are adapted to moderate water level fluctuations.

**Pathway of Introduction and Spread:** Parrotfeather spreads exclusively by plant fragments. New infestations can be started by people dumping aquaria into waterways. Once established in a water body, fragments can be carried to uninfested locations on boats, gear, equipment, and animals.

**Impacts:** Parrotfeather forms dense mats that alter the physical and chemical characteristics of lakes and streams by choking and shading out other native aquatic plants that serve as the basis of the aquatic food web. Decaying plants decrease oxygen levels in the water and slow water flow, creating habitat for mosquito larvae. Dense mats restrict water recreation opportunities and foul shorelines. It covers the water's surface, reducing habitat for migrating waterfowl.

**Status:**   

**Action:** 

## Eurasian Watermilfoil

### *Myriophyllum spicatum*

Eurasian watermilfoil is native to Europe, Asia, and northern Africa. It was once commonly sold as an aquarium plant and was introduced to the eastern U.S. at least as long ago as the 1940s, but it may have arrived as early as the late 1800s.

**Identification:** Eurasian watermilfoil is a submerged, rooted perennial with long, branching stems and soft feathery leaves attached in whorls of four. Each leaf has 11 to 21 pairs of leaflets which are closely spaced and about ½ inch long. Eurasian watermilfoil produces small yellow, four-parted flowers on a spike that projects two to four inches above the water surface.

**Habitat:** Tolerates a wide range of water conditions and depths; prefers nutrient-rich substrate.



PHOTO BY CPW INVASIVE SPECIES PROGRAM

PHOTO BY MICHIGAN SEA GRANT



PHOTO BY CPW INVASIVE SPECIES PROGRAM

### Pathway of Introduction and Spread:

Eurasian watermilfoil reproduces by seeds, fragmentation, and winter buds. Fragmentation and winter buds are believed to be more important in spreading the plant. Any plant fragment can start a new infestation. Winter buds are tight leaf clusters that break off and fall to the bottom, where they overwinter. In the spring, the buds grow and form new plants.

Winter buds are tight leaf clusters that break off and fall to the bottom, where they overwinter. In the spring, the buds grow and form new plants.

**Impacts:** Eurasian watermilfoil forms dense mats that restrict swimming, fishing, and boating, and clog water intakes. The mats alter water chemistry by choking and shading out other native aquatic plants. The decaying plants decrease oxygen levels in the water and foul lakeside beaches. This disrupts the food chain and destroys habitat and food needed by fish and birds. Eurasian watermilfoil slows the flow of water in irrigation ditches and canals and creates standing water that is ideal mosquito habitat.

**Status:**



**Action:**



## Duck Lettuce, Water Plantain *Ottelia alismoides*

Duck lettuce is native to southeastern Asia and Australia.

**Identification:** Duck lettuce is entirely submerged except for the flower, which is held above the surface by a long stalk. The flowers have three white petals and a yellow center. Oval-shaped leaves are large and light green.

**Habitat:** Found in slower waters of rivers, lakes, and ponds; requires constant water levels; its vegetation does not tolerate drying out.



PHOTOS BY JESS VAN DYKE



**Pathway of Introduction and Spread:** Duck lettuce reproduces solely by seeds and is slow to spread. It could be planted deliberately for ornamental use, and seeds could be spread by wind, water, animals, or people.

**Impacts:** Duck lettuce can form floating masses that impact aquatic life and water-based recreation.

**Status:**



**Action:**



## Curly-leaf Pondweed

### *Potamogeton crispus*

Curly-leaf pondweed is native to Eurasia, Africa, and Australia. It was accidentally introduced to U.S. waters in the mid-1880s by hobbyists who used it as an aquarium plant.

**Identification:** Curly-leaf pondweed is a submerged, rooted, perennial. The leaves are oval and wavy and appear reddish-green in the water. The leaves are about two to three inches long, with small “teeth” visible on the edges. The leaves are arranged alternately around the stem, and become denser toward the end of branches. The stem of the plant is flat, reddish-brown, and grows from one to three feet long.



PHOTOS BY CHRIS EVANS, RIVER TO RIVER CWMA



**Habitat:** Found in lakes, ponds, ditches, marshes, and canals; can tolerate a wide range of conditions from fresh to slightly brackish waters; most often found in shallow, quiet brackish waters with muddy bottoms; tolerates low light and low water temperatures.



**Pathway of Introduction and Spread:**

Curly-leaf pondweed spreads through winter buds called turions, which float through the water. New plants form under the ice in winter, and curly-leaf pondweed is one of the first aquatic plants to emerge in the spring. Curly-leaf pondweed is also spread by plant fragments attached to boats and equipment.

**Impacts:** Curly-leaf pondweed grows in early spring, shading and choking out native aquatic plants before their growing season begins. Mats also interfere with water-based recreation. It dies back in midsummer, causing algae blooms and a concentration of stinky, dead plants along the shore.

**Status:**  

**Action:** 

## Flowering Rush

### *Butomus umbellatus*

Flowering rush is an emergent aquatic plant that resembles a true rush. It is native to Eurasia and was introduced first to North America as an ornamental garden plant.

**Identification:** Flowering rush can grow up to five feet tall. Leaves are up to 40 inches long, thin, and triangular in cross-section. The leaf tips may be spirally twisted. The leaves are held erect above water but are limp when the plant is submerged in water. On emergent plants, the flowers grow on tall, cylindrical stalks in umbrella shaped clusters. Each individual flower has three whitish pink petals. The three sepals under the petals are also pink and look like small petals. The pistils of the flowers ripen into a dark brown fruit about ½ inches in length.



PHOTOS BY LESLIE J. MEHRHOFF, UNIVERSITY OF CONNECTICUT



**Habitat:** Prefers shallow or slow moving water where it grows as an emergent plant along shorelines. It can also grow submerged in water up to 10 feet deep.

**Pathway of Introduction and Spread:** The root system of flowering rush is a thick creeping rhizome. Little bulb-like plant sprouts called bulblets form at the base of flower stalks and at the roots. Each bulblet can break off and form a new plant. Flowering rush also produce seeds. Both seeds and bulblets can be spread by water currents, wildlife, anglers and boaters, and natural water and ice movements. Flowering rush is also introduced to new areas by people who plant it in gardens.

**Impacts:** Flowering rush forms dense stands which crowd out native plants, degrade habitat for native fish and wildlife, reduce habitat for migrating waterfowl, and interfere with recreational lake use.

**Status:**   

**Action:** 

## Purple Loosestrife

### *Lythrum salicaria*

Purple loosestrife is a Eurasian perennial which was first introduced to the U.S. as an ornamental plant and was also introduced into waterways in discarded soil used as ballast on ships. It has been promoted by horticulturists for its beauty and by beekeepers as a nectar plant.

**Identification:** Purple loosestrife can grow to be ten feet high, but most often are two to six feet tall. It has long spikes of bright purple-pink flowers at the top of the plant. Individual flowers have five or six pink-purple petals. The stems are square. The leaves are usually opposite (two at each joint) and are long and narrow with pointed tips and smooth edges.



PHOTO BY STEVE DEWEY, UTAH STATE UNIVERSITY

**Habitat:** Found in moist wetland sites and on the shallow margins of lakes, reservoirs, ponds, streams, creeks, and rivers.

**Pathway of Introduction and Spread:** Loosestrife has the ability to produce millions of seeds which spread easily by wind or water from existing infestations. Loosestrife can also be transported on animals, watercraft and gear.

**Impacts:** Purple loosestrife stands grow to thousands of acres in size. Loosestrife clogs irrigation ditches and crowds out native plants, reducing food, shelter, and nesting sites for wildlife, birds, turtles, butterflies, and frogs. Efforts to control purple loosestrife costs the U.S. economy an estimated \$45 million each year.



PHOTO BY ERIC COOMBS, OREGON DEPARTMENT OF AGRICULTURE

**Status:** 

**Action:**  COLORADO  
DEPARTMENT OF  
AGRICULTURE

## Heartshape False Pickerelweed, Monochoria, Pickerelweed *Monochoria vaginalis*

Heartshape false pickerelweed is native to Asia and is commonly found in rice fields. By the 1970s, it had become commonly seen among the rice fields of California.

**Identification:** The stem of the heartshape false pickerelweed is slightly erect and fleshy. The leaves are heart-shaped, shiny, and with rounded bases. The flower head is clustered and composed of up to 25 flowers. The flowers are lilac or violet-blue. The roots are submerged under water or rooted in the mud and the rest of the plant parts are above the water surface.

**Habitat:** Found in irrigated fields, ditches, ponds, and swamps from near sea level to 5,000 feet.



PHOTOS BY HAI LE



**Pathway of Introduction and Spread:** Pickerelweed may spread from irrigated fields to waterways. The plant reproduces by seeds and through daughter plants that form on rhizomes. Plants that break off can be dispersed by wind and water currents or on trailered watercraft or gear.

**Impacts:** In areas where rice is grown, heartshape false pickerelweed can reduce rice yield as high as 82 percent. This plant is in the water hyacinth family and can form mats when growing on water. These mats can impede water-based recreation, restrict sunlight to underwater native plants, and deplete oxygen from the water. Plants can cover the water's surface, reducing habitat for migrating waterfowl.

**Status:** 

**Action:**  COLORADO  
DEPARTMENT OF  
AGRICULTURE

## Exotic Bur-reed, Branched Bur-reed, Simplestem Bur-reed

### *Sparganium erectum* Linneaus

Exotic bur-reed is native to Eurasia and Northern Africa. In 1999, it was distributed to as many as 35 states, from Alaska to Georgia, after Home Depot received it in a shipment of exotic plants from Holland and sold them as pond plants.



PHOTO BY GRAEBN HARA



PHOTO BY KRISTIAN PETERS



**Identification:**

Exotic bur-reed is a six foot long green reed with a small yellow flower that contains a bur-like fruit. The leaves are narrow, smooth,



PHOTO BY ENRICO BLASUITTO

and keeled and triangular in cross-section. The flowers are produced on a branching spike. The flowers at the tip of the spike are male whereas those further down are female. The female flowers take on a bur-like appearance before breaking up into distinct fruits. The fruits are small, dry, and spongy and contain one or two seeds.

**Habitat:** Prefers muddy or shallow waters or rich, wet soil. Typically grows in a narrow band at the margins of lakes, rivers, streams, ditches, and canals.

**Pathway of Introduction and Spread:** Bur-reed was accidentally introduced as an ornamental. It reproduces both by seed and vegetatively from the rhizomes. The fruits can float for a number of months. They germinate under water, but seedling survival is poor.

**Impacts:** This reed can displace wildlife habitat, choke waterways and interfere with recreation in shallow waters.

**Status:****Action:**

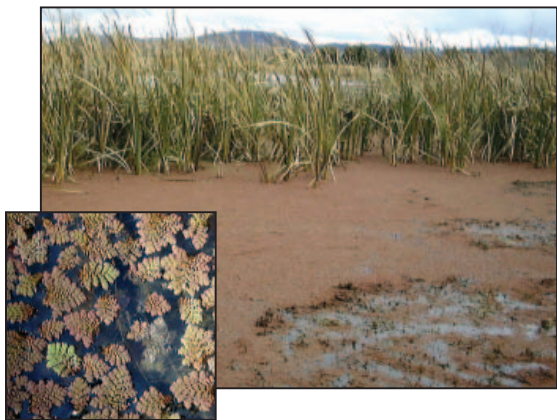
# Mosquitofern, Water Velvet, Feathered Mosquitofern

## *Azolla pinnata*

Mosquitofern is native to Africa, Madagascar, India, Southeast Asia, China, Japan, Malaya, the Philippines, the New Guinea mainland, and Australia. It was introduced inadvertently to the U.S. in shipments of ornamental pond or aquarium plants.

**Identification:** Mosquito fern is a small, free-floating triangular-shaped fern, less than half an inch across. The plant's midsection has feathery side branches with leaves that overlap. Newer leaves are gray green, but turn rusty-red, especially in winter. Small roots dangle beneath each leaf.

**Habitat:** Found in freshwater ponds, lakes, water courses, and wetlands. It has the ability to survive on moist soil in



PHOTOS BY DAVID NICHOLLS



and around rivers, ditches, and ponds and can survive low water levels and periods of drought.

### **Pathway of Introduction**

**and Spread:** Plants reproduce vegetatively by plant fragments and sexually by dispersing spores. Plant fragments carried by boaters, anglers, and other water recreationists, as well as plants emptied from aquariums, can establish colonies in uninfested waters.

**Impacts:** Mosquitofern lives in symbiosis with blue-green algae (cyanobacteria) which fixes atmospheric nitrogen. This nutrient allows the plants to grow quickly, doubling in numbers every two to three days. Mosquitofern forms dense surface mats, choking out other species, blocking light available to aquatic plants, and degrading water quality by reducing oxygen levels for aquatic life. The mats interfere with boating, fishing, and recreational activities. The plant has no known direct food value to wildlife. It covers the water's surface, reducing habitat for migrating waterfowl.

**Status:**



**Action:**



## Water Hyacinth

### *Eichhornia crassipes*

Water hyacinth is an ornamental floating plant that was brought from Central and South America to the Cotton States Exposition in New Orleans in 1884. Visitors took these plants home and added them to private backyard ponds. This attractive plant is now considered one of the world's worst aquatic weeds.

**Identification:** Water hyacinth is a floating plant with thick, glossy, round leaves and very showy lavender flowers. Each flower has six bluish-purple petals joined at the base to form a short tube. One petal has a yellow spot.

**Habitat:** Found in freshwater lakes, rivers, ponds, and ditches.



PHOTO BY CHRIS EVANS, RIVER TO RIVER CWMA

### Pathway of Introduction and Spread:

Water hyacinth reproduces by seeds and through hundreds of daughter plants that form on rhizomes. Daughter plants that break off can be dispersed by wind and water currents or on trailered watercraft or gear. A single plant can also produce as many as 5,000 seeds which can be transported by water, wildlife, boats, and equipment to uninfested locations. Water hyacinth is sold by aquarium and pond supply dealers as ornamental vegetation for private ponds. Its presence as an ornamental makes escape and growth in the wild common.



PHOTO BY WENDY VANDYK EVANS

**Impacts:** Water hyacinth clogs irrigation ditches and waterways, making boating, fishing, swimming, and almost all other water activities impossible. These plants cover the water's surface in a mat-like sheet and restrict sunlight that underwater native plants need for growth. Eventually, this underwater vegetation dies and decays and depletes oxygen from the water, killing fish and other aquatic life. Water hyacinth provides prime habitat for disease-harboring animals such as mosquitoes and parasitic flatworms. It reduces habitat for migrating waterfowl.

**Status:**



**Action:**



## Creeping Water Primrose, Floating Water-primrose, Floating Primrose Willow

### *Ludwigia peploides*

Creeping water primrose is native to regions in South, Central, and North America, including parts of the southeastern U.S.

**Identification:** Creeping water primrose has rooted purple-tinged stems but most of the stem floats on the surface of the water. The lance-shaped leaves have long petioles (stalks) and are attached alternately to the stem. The flowers are about an inch wide with five yellow petals and five narrow sepals that point downward.



PHOTOS BY GRAVES LOVELL, ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES



**Habitat:** Found in ditches, riverbanks, ponds, slow moving streams, and along margins of lakes and reservoirs.

### **Pathway of Introduction**

**and Spread:** Creeping water primrose produces seeds but reproduces mainly through plant fragmentation. When a piece of stem breaks off, it develops roots and will grow into a new plant. Fragments can be transported on boats, clothing, or recreation equipment to start new infestations.

**Impacts:** Creeping water primrose forms dense, floating mats that block waterways, interfering with boating, swimming, and fishing. It fouls intakes to industrial and municipal water supplies and irrigation. The mats choke out native submerged aquatic plants and wetland grasses and reduce forage for wildlife and livestock. Dense stands trap sediments, decrease water quality and flow, decrease pH and dissolved oxygen content, and provide a breeding ground for mosquitoes.

**Status:**  

**Action:** 

## Yellow Floating Heart

### *Nymphoides peltata*

Yellow floating heart is a native of Eurasia and the Mediterranean area as well as Japan, China, and India and was introduced to the U.S. as an ornamental water plant.

**Identification:** Yellow floating heart is a perennial, water lily-like plant that carpets the water surface with long-stalked, heart-shaped leaves. There are two to five bright yellow flowers on each flower stalk. Flowers are about an inch in diameter, and have five petals with a distinctive fringe along the edges.

**Habitat:** Prefers slow moving rivers, lakes, reservoirs, and ponds.



PHOTOS BY ROB ANDRESS, ALABAMA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES





### **Pathway of Introduction and Spread:**

Yellow floating heart reproduces by water-dispersed seeds and by plant fragments.

Broken off leaves with part of a stem and stolons will form new plants.

**Impacts:** Yellow floating heart grows in dense patches, excluding native species and creating stagnant areas with low oxygen levels. These mats make it difficult to fish, water ski, swim, or paddle a canoe. Plants stop the flow of water and cover the water surface, reducing the habitat for migrating waterfowl.

**Status:**



**Action:**



# Giant Salvinia, Karibaweed

## *Salvinia molesta*

(also *Salvinia auriculata*,  
*Salvinia biloba*, *Salvinia herzogii*)

Giant salvinia is a small free-floating fern that is native to southeastern Brazil. It has been cultivated in the U.S. as an ornamental plant and distributed by the aquarium and landscaping trades. It is considered one of the world's worst aquatic weeds.

**Identification:** Giant salvinia is an aquatic fern with floating, oblong leaves  $\frac{1}{2}$  to  $1\frac{1}{2}$  inches long with a distinct midrib. Salvinnias have stiff leaf hairs on the upper surface of the leaves. The leaf hairs have a single stalk that divides into four segments that reconnect at the top, giving the hair an egg-beater appearance. The leaves of young plants lie flat on the water's surface, but the leaves of mature plants fold along



PHOTO BY SCOTT ROBINSON, GEORGIA  
DEPARTMENT OF NATURAL RESOURCES

PHOTO BY KENNETH CALCOTE, MISSISSIPPI DEPARTMENT  
OF AGRICULTURE AND COMMERCE



PHOTO BY VICTOR RAMEY,  
UNIVERSITY OF FLORIDA

the midrib and grow upright. Mature plants aggregate and press into tight chains, stacking into layers of plants. Rootlike structures conceal stalks that can have egg-shaped spore cases attached.

**Habitat:** Quiet water of lakes, ponds, ditches, slow flowing streams and rivers, backwater swamps, marshes, and wet fields.

**Pathway of Introduction and Spread:** This weed overwinters and reproduces vegetatively. Fragments may spread when parts of the plant adhere to fishing equipment, boats, trailers, vehicles, or animals.

**Impacts:** Giant salvinia grows rapidly and can double the size of its mats in 7 to 10 days. As the mats continue to grow, they form thick layers of vegetation, replacing native plants and completely covering the water's surface. This reduces habitat for migrating waterfowl and prevents oxygen and light from entering the water. When pieces of the plant break off and drop to the bottom, they decompose and further reduce the water's dissolved oxygen, killing fish and other aquatic life. Giant salvinia impairs all forms of water-based recreation, clogs irrigation canals and water delivery pipes, and fouls hydroelectric plants.

**Status:**



**Action:**



## European Water Chestnut

### *Trapa natans*

Water chestnut is native to Europe, Asia, and Africa and was first observed in North America near Concord, Massachusetts in 1859. The origin of the introduction is unknown.

**Identification:** Water chestnut has submerged stems that can reach 12 to 15 feet in length. Very fine roots anchor the plant into the mud. Each stem holds a rosette of floating, triangle-shaped, saw-toothed leaves. Flowers are small with four white petals. The fruit is a large nut that has four sharp spines.



PHOTO BY JOHN M. RANDALL, THE NATURE CONSERVANCY



PHOTO BY ALFRED COFRANCESCO,  
U.S. ARMY CORPS OF ENGINEERS

**Habitat:** Any freshwater setting, although it prefers nutrient-rich lakes and rivers.

### Pathway of Introduction and Spread:

Water chestnut spreads when the rosette and fruits detach from the stem and float to another area or when fruits stick to objects, birds, and other animals and are carried to uninfested locations.



PHOTO BY LESLIE J. MEHRHOFF,  
UNIVERSITY OF CONNECTICUT

**Impacts:** Water chestnut can form dense floating mats, severely limiting light to submerged native plants. This plant can also reduce oxygen levels, which may increase fish kills. It competes with native vegetation and is of little value to waterfowl. Water chestnut infestations limit boating, fishing, swimming, and other recreational activities. The sharp fruits, if stepped on, can cause painful wounds.

**Status:**  

**Action:** 

## Swollen Bladderwort, Floating Bladderwort

### *Utricularia inflata*

Swollen bladderwort is a free floating, carnivorous aquatic plant that is native to the southeastern U.S. and was likely introduced to the western U.S. as an ornamental plant.

**Identification:** Swollen bladderwort is a floating plant with small, round, bladders interspersed throughout green foliage. There are not true leaves, but stems branch into lacy leaf-like segments. When in flower, the plant forms a very distinctive wheel-like floating platform that supports a yellow snapdragon-like flower. These flowers



PHOTOS BY STURGIS MCKEEVER, GEORGIA SOUTHERN UNIVERSITY

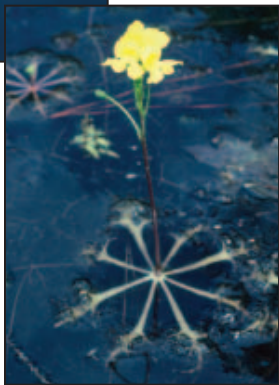


extend about six inches above the water surface.

**Habitat:** Ponds, lakes, and slow-moving streams and rivers.

**Pathway of Introduction and Spread:**

Swollen bladderwort is a prized water garden plant or aquarium plant and is also popular with people who cultivate carnivorous plants. It reproduces from small fragments and from seed and can easily spread if it escapes cultivation.



**Impacts:** Swollen bladderwort forms dense mats which may interfere with water-based recreation. It obtains its nutrients from the water and from tiny creatures that it captures in its seed-like bladders. Consequently, it may upset native food webs.

**Status:**  

**Action:** 

# Giant Reed, Elephant Grass, Wild Cane, Cana Brava, Carrizo

## *Arundo donax*

Giant reed is native to India and was introduced into the U.S. at Los Angeles, California in the early 1800s for ornamental purposes.



PHOTO BY JAMES H. MILLER, USDA FOREST SERVICE

**Identification:** Giant reed is a tall, perennial grass that can grow to over 20 feet in height. The stem resembles a corn stalk and has long, flat leaves that are one to two inches wide and a foot long. Dense, plume-like flowers appear in two-foot long clusters during August and September.

**Habitat:** Grows in moist places such as ditches, streams, and riverbanks. It tolerates a wide variety of conditions, including high salinity, and can flourish in many soil types.





PHOTO BY CHRIS EVANS,  
RIVER TO RIVER CWMA

**Pathway of Introduction and Spread:** During flood flows, giant reed can float miles downstream where root and stem fragments may take root and initiate new infestations. Due to its rapid growth rate and vegetative reproduction, it is able to establish stands in uninfested areas quickly.

**Impacts:** Giant reed chokes river and stream channels, crowds out native plants, interferes with flood control and water delivery systems, and reduces habitat for wildlife. The long, fibrous, interconnecting root mats of giant reed trap debris behind bridges, culverts, and other structures and can cause damage and flooding. It ignites easily and increases the potential of intense fires.

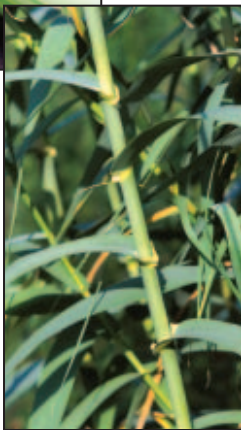


PHOTO BY JAMES H. MILLER, USDA FOREST SERVICE

**Status:**   

**Action:** 

## Hairy Willow-Herb, Codlins and Cream *Epilobium hirsutum*

Hairy willow-herb is native to Eurasia. It was first found in the northeastern U.S. in 1829. It may have been brought to North America in ship ballast or purposefully cultivated as an ornamental.

**Identification:** Hairy willow-herb is a semi-aquatic, plant that ranges in height from three feet to six feet tall. The stems and leaves are covered with fine soft hairs. Leaves are opposite, lance-shaped with toothed edges, and attach directly on the stem. Showy rose-purple flowers extend from leaf axils near the top of the plant and are approximately  $\frac{3}{4}$  inch across. Each flower has four sepals, four notched petals, and eight stamens. Flowering occurs in July and August.



PHOTOS BY RICHARD OLD, WWW.XIDSERVICES.COM



**Habitat:** Found in a wide range of moist soils, including wetlands, ditch and stream banks, low fields, pastures, and meadows up to 8,100 feet. It is intolerant of shade.

**Pathway of Introduction and Spread:** Hairy willow-herb reproduces by wind dispersed seeds as well as vegetatively by thick rhizomes (underground stems).

**Impacts:** Hairy willow-herb forms monotypic stands in natural wetland areas, and its aggressive and dense growth can crowd out native or beneficial species and slow the flow of water.



## Yellow Flag Iris

### *Iris pseudacorus*

Yellow flag iris is native to Europe, the British Isles, North Africa, and the Mediterranean region. It entered the U.S. from Canada as an ornamental plant in the early 1900s.

**Identification:** Yellow flag iris is the only yellow iris in the U.S. It is four to six feet tall and has long, dark green, flattened, sword-like leaves. The yellow flower is three to four inches across. The three yellow sepals curve backward and are often streaked with brown to purple lines.

**Habitat:** Found in wetlands or along the edge of ponds, lakes, or slow moving streams or rivers. It is usually found in very shallow water or mud and will tolerate drying, some salinity, and high soil acidity.

**Pathway of Introduction and Spread:** Yellow flag iris spreads by seeds and by rhizomes that can connect several



PHOTO BY TODD PEIFFER KLAMATH COUNTY WEED CONTROL

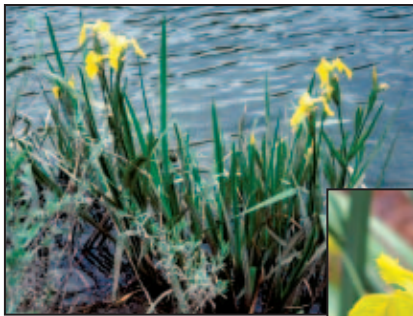


PHOTO BY JOHN M. RANDALL,  
THE NATURE CONSERVANCY



PHOTO BY NANCY LOEWENSTEIN, UNIVERSITY OF AUBURN

hundred flowering plants. If a small rhizome fragment breaks off, it can drift with the water to another location to form a new plant. This plant is still sold by the nursery trade and is popular with aquatic gardeners, who actively exchange rhizomes with other gardeners, and continues to escape into wild habitats.

**Impacts:** Yellow flag iris rhizomes form dense stands, forcing out native wetland species, including the common cattail, sedges, and rushes. Many over-wintering waterfowl species are dependent on sedge and rush seeds as a high-energy food source. Yellow flag iris is not a good source of food for wildlife and will sicken livestock if ingested. The rhizome masses trap sediment, which reduces water flow, affecting fish and other aquatic life.

**Status:**  

**Action:** 

## Invasive Knotweeds

### *Polygonum spp.*

**Himalayan Knotweed** (*Polygonum polystachyum*); **Bohemian Knotweed** (*Polygonum x bohemicum*); **Japanese Knotweed** (sometimes called *Fallopia japonica* by landscape trades) (*Polygonum cuspidatum*); and **Giant Knotweed, Elephant Ear Bamboo** (*Polygonum sachalinense*) were introduced from Asia as ornamentals and for erosion control.

**Identification:** Knotweed stems are stout, cane-like, and reddish-brown. The plants die back at the end of the growing season but their old reddish-brown canes often persist. The stem nodes are swollen and surrounded by thin papery sheaths. Leaves are heart-shaped on all but the Himalayan knotweed which has lance-shaped leaves. Giant knotweed leaves can be more than 12 inches long, which is why the species is often called elephant ear bamboo. The flowers of all species are small, creamy white to greenish-white, and grow



PHOTO BY BARBARA TOKARSKA-GUZIK

PHOTO BY VELOCICAPTOR



PHOTO BY MARY ELLEN HARTE

in showy plume-like, branched clusters. The fruit is three-sided, black, and shiny.

**Habitat:** All species are commonly found along roadsides and on stream banks but also may be present in yards, vacant lots, edges of fields, parks, and many other places.

**Pathway of Introduction and Spread:** Knotweeds spread primarily by sprouting clones from rhizomes that can be 30 feet or longer. Small fragments of rhizomes that break loose can float downstream and start new infestations. These fragments can also be transported in soil and on boats, clothing, and gear.

**Impacts:** Knotweed clones can completely clog small waterways and displace streamside vegetation, increasing bank erosion and lowering the quality of riparian habitat for fish and wildlife. Rapid spring growth and deep, extensive roots enable knotweed to out-compete most other plants, even small trees and shrubs.

**Status:** 

**Action:** 

## Epizootic Epitheliotropic Disease Virus (EEDV)

Epizootic epitheliotropic disease (EEDV) is a relatively new and extremely devastating disease that causes high mortalities of young hatchery-reared lake trout. In the late 1980s, outbreaks occurred in federal and state hatcheries in the northern Great Lakes region of the U.S.



PHOTO BY U.S. FOREST AND WILDLIFE SERVICE



Lake trout and splake appear to be the only species that display symptoms from this viral disease. The origin of EEDV is unknown. Transmission of the virus occurs from fish to fish via the water. It is not known whether parents can transmit it to their offspring or if parasites may carry the virus to fish. Fish infected with EEDV display few signs. In the early stages of the disease, fish tend to ride high in the water, flash, and become hyperexcitable. Hemorrhaging sometimes occurs at the bases of the fins and in the eyes. In later stages, there is a loss of equilibrium, rapid eye movements and fungal infections.

Epizootic Epitheliotropic virus has recently been found in free-ranging rainbow, brown, and brook trout, lake trout and grayling in Wyoming and California in an asymptomatic carrier state. The presence of the virus can only be detected by DNA probe (PCR). More research will be required to determine what role EEDV may or may not play in nature.

**Status:**



**Action:**



## **Viral Hemorrhagic Septicemia Virus (VHSV)**

Viral hemorrhagic septicemia virus is an extremely serious pathogen of fresh and saltwater fish worldwide. The virus may have been introduced by ballast water or by anadromous fish migrating through the locks into the Great Lakes. Once in the Great Lakes, mutations occurred in the virus making it much more pathogenic. Now VHSV can infect at least 50 species of fish including

## VHSV (continued)



PHOTOS BY VERMONT FISH AND WILDLIFE

smallmouth bass, northern pike, bluegill, white bass, and walleye. The disease transmits easily between fish of all ages. Mortality is highest at low water temperatures between 37 and 54° Fahrenheit. Some fish will show no external signs while others show signs that include bulging eyes, bloated abdomens, inactive or hyperactive behavior, and hemorrhaging in the eyes, skin, gills, and at the base of the fins. Fish transfers and natural fish movements may also aid the spread of VHSV.

**Status:**



**Action:**



## **Proliferative Kidney Disease (PKD)** *Tetracapsula bryosalmo*

Proliferative kidney disease (PKD) is a condition of trout and salmon that was first seen in North America following an outbreak of the disease in late 1981 at the Hagerman State Fish Hatchery in Idaho. The disease had already been a major problem in rainbow trout hatcheries and farms in Europe and the British Isles. PKD is a debilitating condition for affected fish, leading to severe inflammation of the kidneys and spleen. Affected fish appear dark, have pale gills, protruding eyes and a distended abdomen. The parasite that causes deadly PKD in fish cycles between trout and freshwater bryozoa, which are colony-forming animals that feed on microscopic algae. Some species of the bryozoa resemble plants and can fragment to form new colonies that could spread the disease.

**Status:**



**Action:**



## **Whirling Disease (WD)** *Myxobolus cerebralis*

Whirling disease was introduced to the U.S. from Europe in the 1950s and has spread throughout the country. Whirling disease attacks juvenile trout and salmon, but does not infect warm water species. Rainbow trout and cutthroat trout appear to be more susceptible than other trout species. WD is caused by a microscopic parasite that produces a spore. The parasite has a two-host

## WD (continued)



PHOTO BY ERIC FETHERMAN

lifecycle that involves trout and an alternate host, a common bottom-dwelling tubifex worm. When an infected trout dies, large numbers of hard spores are released. These hard spores are hardy, resist freezing and drought and can remain viable for decades. After release

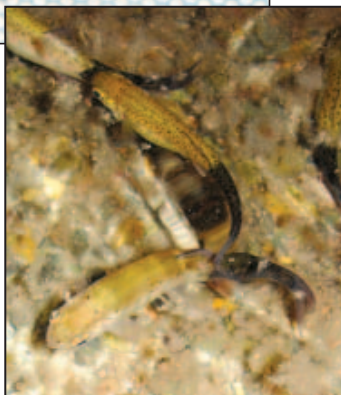


PHOTO BY STEPHEN ATKINSON

from the host fish, they can be ingested by the tubifex worm. The worms are then parasitized by the organism, the end result of this phase being a delicate, water-borne spore. When released from the worm, these water-borne spores can infect susceptible fish by attaching to their bodies, or when fish eat infected worms. Young fish are at greatest risk. The parasite attacks their soft cartilage,

causing nerve damage, skeletal deformities and in some cases death. Once a fish reaches three to four inches in length, cartilage forms into bone and the fish is much less susceptible to effects from whirling disease. However, they remain carriers of the parasite. Once established in a stream, the parasite cannot be eradicated, nor can its worm host, without significantly damaging the ecosystem.

**Status:**



**Action:**



## **Bacterial Kidney Disease (BKD)** *Renibacterium salmoninarum*

Bacterial Kidney Disease is a disease of trout and salmon caused by the bacterium *Renibacterium salmoninarum*, a small, non-motile, Gram positive rod shaped bacterium that usually occurs in pairs. The disease affects the entire body but gets its name from off-white bacterial lesions in the kidney. As the disease progresses, the body cavity may become filled with fluid, the eyes will protrude; the skin will darken and may hemorrhage at the base of the fins. The gills may appear pale and anemic. Outbreaks can occur throughout the year, but generally accompany rising water temperatures in the spring.



PHOTO BY AMERICAN FISHERIES SOCIETY

**Status:**



**Action:**



# Index

## Species Common Names

### *Animals:*

- African Clawed Frog—26, 27
- American Bullfrog—22, 23
- Banjo Frog—24
- Bronze Frog—24
- Chinese Mitten Crab—18, 19
- Fishhook Water Flea—16, 17
- Green Frog—24, 25
- New Zealand Mudsail—12, 13
- Northern Green Frog—24
- Quagga Mussel—14, 15
- Rusty Crayfish—20, 21
- Water Flea—16, 17
- Zebra Mussel—8, 14, 15

### *Fish:*

- Asian Swamp Eel—50, 51
- Belut—50
- Bighead Carp—30, 46
- Black Amur—44
- Black Carp—44, 45
- Black Chinese Roach—44

Brook Stickleback—64, 65  
Bowfin—28, 29  
Catla—32  
Chinese Roach—44  
Common Carp—38, 39  
Crucian Carp—33  
Cypress Trout—28  
Dogfish—28  
Eurasian Ruffe—62  
European Carp—38  
Gar—52, 53  
German Carp—38  
Giant Barb—34  
Giant Barb Carp—34, 35  
Gibel—33  
Goby—54, 55  
Goldfish—33, 36  
Grass Carp—46, 47  
Grindle—28  
Grinnel—28  
Hybrid Grass Carp—46  
Koi—38  
Leather Carp—38  
Mahseer—43  
Mirror Carp—38  
Mrigal—37  
Mud Fish—28  
Murrel—63  
Narrow-mouthed Bass—56  
Ninespine Stickleback—64, 65

Pearl Roach—60  
Piranha—58, 59, 69  
Prussian Carp—33  
Redeye—60  
Rice Eel—50  
Rice-paddy Eel—50  
Rohu—42  
Rudd—60, 61  
Sea Perch—56  
Siamese Giant Carp—34  
Silver Carp—40, 41  
Silver Perch—56  
Silver Prussian Carp—33  
Small Scale Mud Carp—37  
Snail Carp—44  
Snakehead—63  
Stickleback—64, 65  
Tiger Tetra—68  
Tilapia—66, 67  
Trahira—68, 69  
Walking Catfish—48, 49  
White Perch—56, 57  
Wolf Fish—68  
Wolf Tetra—68

***Plants:***

African Elodea—82, 83  
Ambulia—84, 85  
Asian Marshweed—84



Branched Bur-reed—100  
Brazilian Egeria—76  
Brazilian Elodea—76, 77  
Brazilian Waterweed—76  
Bohemian Knotweed—122  
Cana Brava—116  
Carrizo—116  
Codlins and Cream—118  
Creeping Water Primrose—106, 107  
Curly Water Thyme—82  
Curly Waterweed—82  
Curly-leaf Pondweed—92, 93  
Didymo Algae—70, 71  
Duck Lettuce—90, 91  
East Indian Hygrophila—80  
Elephant Ear Bamboo—122  
Elephant Grass—116  
Eurasian Watermilfoil—86, 88, 89  
European Water Chestnut—112  
Exotic Bur-reed—100, 101  
Fanwort—74, 75  
Feathered Mosquitofern—102  
Floating Bladderwort—114  
Floating Primrose Willow—106  
Floating Water-primrose—106  
Florida Elodea—78  
Flowering Rush—94, 95  
Giant Knotweed—122  
Giant Reed—116, 117

Giant Salvinia—110, 111  
Golden Algae—72, 73  
Hairy Willow-Herb—118, 119  
Heartshape False Pickerelweed—98, 99  
Himalayan Knotweed—122  
Hydrilla—77, 78, 79  
Indian Swampweed—80  
Invasive Knotweeds—122  
Japanese Knotweed—122  
Karibaweed—110  
Limnophila—84  
Miramar Weed—80, 81  
Monochoria—98  
Mosquitofern—102, 103  
Oxygen-weed—82  
Parrotfeather—86, 87  
Pickerelweed—98  
Purple Loosestrife—96, 97  
Rock Snot—70, 71  
Simplestem Bur-reed—100  
South African Oxygen-weed—82  
South African Waterweed—82  
South American Waterweed—76  
Swollen Bladderwort—114, 115  
Water Hyacinth—104, 105  
Water Plantain—90  
Water Thyme—78  
Water Velvet—102  
Water Weed—78

Wild Cane—116  
Yellow Flag Iris—120, 121  
Yellow Floating Heart—108, 109

### **Pathogens:**

Bacterial Kidney Disease (BKD)—129  
Epizootic Epitheliotropic Virus (EEV)—124, 125  
Proliferative Kidney Disease (PKD)—127  
Viral Hemorrhagic Septicemia Virus (VHSV)—8, 126, 127  
Whirling Disease (WD)—127, 128

## **Species Scientific Names**

### **Animals:**

*Bythotrephes longimanus (cederstroemi)*—16  
*Cercopagis pengoi*—16  
*Daphnia lumholtzii*—16  
*Dreissena polymorpha*—14  
*Dreissena rostriformis bugensis*—14  
*Eriocheir sinensis*—18  
*Lithobates catesbeiana*—22  
*Lithobates clamitans*—24  
*Orconectes rusticus*—20  
*Potamopyrgus antipodarum*—12  
*Xenopus laevis*—26

## **Fish:**

- Amia calva*—28
- Apeltes* spp.—64
- Aulorhynchus* spp.—64
- Carrassius gibelio*—33
- Carrassius* spp.—36
- Catla catla*—32
- Catlocarpio siamensis*—34
- Catlocarpio* spp.—34
- Channa* sp.—63
- Cirrhinus cirrhosis*—37
- Cirrhinus* spp.—37
- Clarias batrachus*—48
- Ctenopharyngodon idella*—46
- Ctenopharyngodon idella* x *Aristichthys nobilis*—46
- Culaea* spp.—64
- Culaea inconstans*—65
- Cyprinus acutidorsalis*—38
- Cyprinus barbatus*—38
- Cyprinus catla*—32
- Cyprinus centralus*—38
- Cyprinus chilia*—38
- Cyprinus cocea*—38
- Cyprinus dai*—38
- Cyprinus daliensis*—38
- Cyprinus exophthalmus*—38
- Cyprinus fuxianensis*—38
- Cyprinus hyperdorsalis*—38
- Cyprinus ilishaestomus*—38

*Cyprinus intha*—38  
*Cyprinus longipectoralis*—38  
*Cyprinus longzhouensis*—38  
*Cyprinus mahuensis*—38  
*Cyprinus megalophthalmus*—38  
*Cyprinus micristius*—38  
*Cyprinus multitaeniata*—38  
*Cyprinus pellegrini*—38  
*Cyprinus qionghaiensis*—38  
*Cyprinus rubrofuscus*—38  
*Cyprinus spp.*—38  
*Cyprinus yilongensis*—38  
*Cyprinus yunnanensis*—38  
*Gasterosteus spp.*—64  
*Gibelion catla*—32  
*Gobiidae*—54  
*Gymnocephalus cernuus*—62  
*Hoplias malabaricus*—68  
*Hypophthalmichthys molitrix*—40  
*Hypophthalmichthys nobilis*—30  
*Labeo rohita*—42  
*Labeo spp.*—42  
*Lepisosteidae*—52  
*Leuciscus catla*—32  
*Marone americana*—56  
*Monopterus albus*—50  
*Mylopharyngodon piceus*—44  
*Mylopharyngodon spp.*—44  
*Neogobius melanostomus*—54, 55

*Ophiocephalus* spp.—63  
*Oreochromis* spp.—66  
*Parachanna* spp.—63  
*Pungitius pungitius*—65  
*Pungitius* spp.—64  
*Pygocentrus* spp.—58  
*Sarotherodon* spp.—66  
*Scardinius erythrophthalmus*—61  
*Serrasalmus* spp.—58  
*Spinachia* spp.—64  
*Tilapia* spp.—66  
*Tor* spp.—43

**Plants:**

*Arundo donax*—116  
*Azolla pinnata*—102  
*Butomus umbellatus*—94  
*Cabomba carolinana*—74  
*Chrysochromulina parva* Lackey—72  
*Didymosphenia geminata*—70  
*Egeria densa*—76  
*Eichhornia crassipes*—104  
*Epilobium hirsutum*—118  
*Fallopia japonica*—122  
*Hydrilla verticillata*—77, 78  
*Hygrophila polysperma*—80  
*Iris pseudacorus*—120  
*Lagarosiphon major*—82  
*Limnophila sessiliflora*—84

*Ludwigia peploides*—106  
*Lythrum salicaria*—96  
*Monochoria vaginalis*—98  
*Myriophyllum aquaticum*—86  
*Myriophyllum spicatum*—88  
*Nymphoides peltata*—108  
*Ottelia alismoides*—90  
*Polygonum cuspidatum*—122  
*Polygonum polystachyum*—122  
*Polygonum sachalinense*—122  
*Polygonum* spp.—122  
*Polygonum x bohemicum*—122  
*Potamogeton crispus*—92  
*Salvinia auriculata*—110  
*Salvinia biloba*—110  
*Salvinia herzogii*—110  
*Salvinia molesta*—110  
*Sparganium erectum* Linneaus—100  
*Trapa natans*—112  
*Utricularia inflata*—114

**Pathogens:**

*Myxobolus cerebralis*—127  
*Renibacterium salmoninarum*—129  
*Tetracapsula bryosalmo*—127

# Resources

For more information about the species in this guide book and other ANS, check these sources:

**ANS Taskforce**

[www.anstaskforce.gov](http://www.anstaskforce.gov)

**Center for Invasive Species and Ecosystem Health**

[www.invasive.org](http://www.invasive.org)

**Colorado Department of Agriculture  
Noxious Weed Management Program**

[www.colorado.gov/ag/weeds](http://www.colorado.gov/ag/weeds)

**Colorado Parks & Wildlife Boat Inspection Information**

[http://wildlife.state.co.us/Fishing/Pages/  
MandatoryBoatInspections.aspx](http://wildlife.state.co.us/Fishing/Pages/MandatoryBoatInspections.aspx)

**Colorado Parks & Wildlife Invasive Species Information**

[http://wildlife.state.co.us/WildlifeSpecies/Profiles/  
InvasiveSpecies/Pages/ZebraandQuaggaMussels.aspx](http://wildlife.state.co.us/WildlifeSpecies/Profiles/InvasiveSpecies/Pages/ZebraandQuaggaMussels.aspx)

**Sea Grant—Minnesota**

[www.seagrants.mn.edu](http://www.seagrants.mn.edu)

**Stop Aquatic Hitchhikers**

[www.protectyourwaters.net](http://www.protectyourwaters.net)

**United States Department of Agriculture  
Invasive and Noxious Weeds**

<http://plants.usda.gov/java/noxiousDriver>

**U.S. Fish & Wildlife Service Invasive Species**

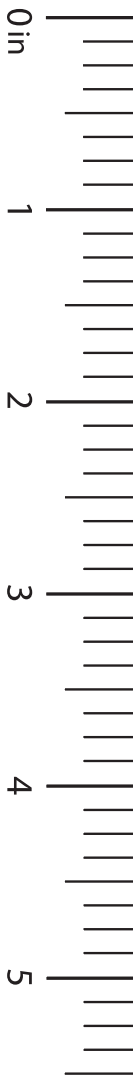
[www.fws.gov/invasives/](http://www.fws.gov/invasives/)

**U.S. Geological Survey Nonindigenous Aquatic Species**

<http://nas.er.usgs.gov>



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Denver, CO 80216

(303) 291-7295 • [www.parks.state.co.us](http://www.parks.state.co.us)

(303) 297-1192 • [www.wildlife.state.co.us](http://www.wildlife.state.co.us)



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