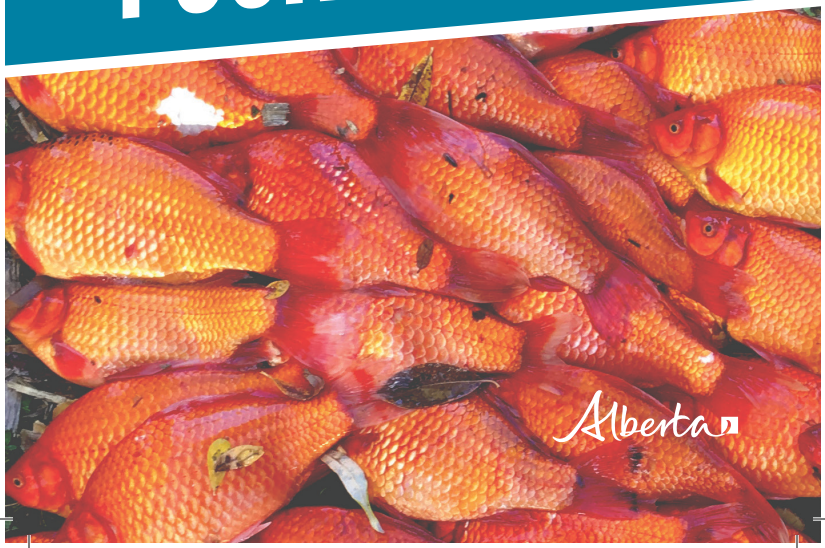
AQUATIC INVASIVE SPECIES POCKET GUIDE



Government of Alberta
April 24, 2025
Aquatic Invasive Species Pocket Guide

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Tanya Rushcall, Alberta Environment and Parks


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INTRODUCTION

Next to habitat loss, invasive species are the largest threat to biodiversity worldwide. These non-native organisms cause, or have high potential to cause, harm to our environment, economy, and human health as they become established outside their natural range.

In Alberta, aquatic invasive species (AIS) and diseases pose a major threat to our freshwater ecosystems. To help combat this threat, the Alberta government has worked closely with industry and stakeholders to identify potential vectors and develop prevention strategies. Within this guide you will find 52 prohibited species listed in the *Fisheries (Alberta) Act* – all of which are illegal to import, transport, sell, and possess in Alberta. Additional species and pathogens that are not listed under the *Fisheries (Alberta) Act* have been included in this guide, as they are also of high concern in Alberta.

LEGISLATION

Fisheries (Alberta) Act

In 2015, the *Fisheries (Alberta) Act* was amended to include regulations for the prevention and management of AIS; this included the creation of a prohibited species list, mandatory watercraft inspections, creative enforcement solutions, and in the event of an infestation, authorized personnel that could respond immediately. Additionally, these amendments allowed the use of the General Fisheries Alberta Regulations and the Ministerial Regulations [both under the *Fisheries (Alberta) Act*] to make new rules or revisions concerning AIS in the future.

In 2016, amendments were made to include the following regulations:

- Standing water, such as in aquariums and watercraft bilges, is not to be released into surface waters or drain sewers due to the risk of invasive species or disease present in the water;
- "Pull the plug" legislation provides assurance that boaters will drain all water from their watercraft prior to leaving the launch by removing their drain plugs; this ensures that any residual water will continue to drain during transportation; and
- It is now mandatory to report the presence of any prohibited AIS listed in the *Fisheries (Alberta) Act* if found. This will allow for early detection and rapid response. AIS can be reported online at **https://www.eddmaps.org** or via the **Aquatic Invasive Species Hotline 1-855-336-BOAT (2628)**.

Federal Fisheries Act

The federal government has made strides in addressing AIS. The Aquatic Invasive Species Regulations under the federal *Fisheries Act* came into force in June 2015. These regulations strengthen the prevention and management of AIS in Canadian waters by providing the following measures:

- Prohibit the import, possession, and transport of zebra and quagga mussels, as well as four species of Asian carp (silver, black, bighead and grass) in Canada, with the exception of Ontario and Quebec (where mussels are already present);
- Prohibit the release of all non-native aquatic species into natural/public waters; and
- Enable the Minister of Environment and Protected Areas to authorize the deposit of deleterious substances (such as pesticides) or fishing measures to control AIS (defined here as "non-indigenous to the particular region or body of water" of interest).

For the most up-to-date *Fisheries (Alberta) Act, Federal Fisheries Act* and Alberta Fisheries (Ministerial) Regulations, visit **www.alberta.ca/alberta-kings-printer.aspx**.

WHAT YOU CAN DO TO PROTECT ALBERTA'S WATERS FROM AQUATIC INVASIVE SPECIES

There are three main actions we ask you to take to help prevent the spread of invasive species and diseases:
Don't let it loose, Pull the Plug, and Clean Drain Dry Your Gear.

Common aquarium and pond species can become invasive when released into the wild. Releasing domestic pond water, fish or other aquatic species, dead or alive, is illegal and can result in large fines or even jail time! Pour aquarium water over dry land and freeze aquarium plants before throwing them in the garbage. Unwanted pets can be returned to the pet store, given away, or donated to schools and other community organizations. After your pet passes on, please bury it or dispose of it in the garbage rather than flushing it to prevent the spread of disease.

PULL the PLUG

Standing water in watercraft and equipment is a known source of introductions of AIS and fish diseases. Pulling out your drain plug before leaving the boat launch ensures that any residual water will continue to drain during transportation. It is illegal to transport your watercraft with the drain plug still in place and can result in large fines or a court appearance.

CLEAN + DRAIN + DRY YOUR GEAR

CLEAN

- Clean and inspect all items used in water including but not limited to watercraft, trailer, and gear.
- Remove all plants, animals, and mud at the access area or dock.
- Rinse, scrub or pressure wash your boat away from storm drains, ditches and waterways. Use hot water if possible (max. 60°C).

DRAIN

- On land, before leaving the waterbody, drain all water from bait buckets, ballasts, bilges, coolers, internal compartments, live wells, etc.
- For paddle boats, kayaks and canoes, drain by inverting or tilting the watercraft, opening compartments and removing seats if necessary.

DRY

- Dry the watercraft and gear completely between trips.
- Leave compartments open and sponge out standing water.

FISH

FISH DIAGRAM

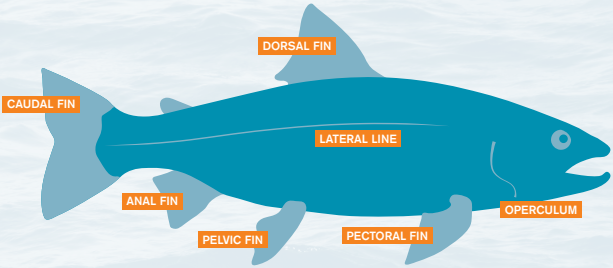


Photo: Shawn Good, Vermont Department of Fish and Wildlife, Bugwood.org

ALEWIFE
Alosa pseudoharengus

STATUS
Prohibited

DESCRIPTION

Laterally compressed, small greenish-brown body with a lower jaw longer than the upper, large eyes and a single black spot behind the eye. Scales line up on the midline of its silvery belly creating a distinctly serrated surface.

HABITAT

Alewife are anadromous fish, meaning adults will migrate into freshwater lakes, rivers, and streams to spawn but spend most of their time in coastal waters. Due to a sensitivity to light, they prefer deep open waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to the East coast of Canada and the United States, the introduction of alewife is often disputed; intentional stocking, dispersal through canals and a decline in predators are among the potential causes of spread. Regardless, alewife range has increased to freshwater lakes where they survive cold winters and do not return to the sea, contrary to its natural anadromous life cycle.

IMPACTS

Land-locked populations do not face the same pressures as their anadromous counterparts, allowing for the rapid establishment of alewife due to an increase in egg survival. Alewife feed extensively on zooplankton and may cause early mortality syndrome (EMS) and Cayuga Syndrome in trout and salmon populations when they eat the alewife. Alewife also quickly out-compete native zooplanktivores and eliminate their primary predator, respectively.

Photo: Rebecca Baldwin, Alberta Environment and Parks

Photo: Rebecca Baldwin, Alberta Environment and Parks

BLACK BULLHEAD

Ameiurus melas

STATUS

Prohibited

DESCRIPTION

Brown to black body with yellow bellies, no mottling, a large rounded head, and small eyes. All fins are dark; the tail fin is rounded and unforked, occasionally with a pale stripe at the base. Long whisker-like barbels protrude around the mouth and chin as well as the nostrils, which resemble horns. The black bullhead is distinguished by it's completely dark chin barbels.

HABITAT

Slow-moving backwaters, lakes, and streams with sand or mud bottoms and moderate vegetation. Black bullhead are able to tolerate a wide range of conditions such as polluted or turbid waters and high temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southern Canada, the United States and Northern Mexico. It has been intentionally stocked for sport fishing and as a food fish, which has led to the accidental and intentional spread of this species. Black bullhead can bury itself in the mud to escape intolerable conditions and live out of water for long periods if kept moist; this allows for colonization of new areas.

IMPACTS

Due to their voracious and generalist feeding habits, this catfish species will consume a wide range of prey, including amphibians and the offspring of native fish, reducing the available food for native species as well as their overall populations. They affect waters by increasing turbidity, which makes it difficult for native fish to survive and feed. Black bullhead have spines on the sides of their bodies that contain small amounts of venom. The spines become erect when the fish are threatened which may cause a painful sting to humans or other predators.

Photo: Dale Knox, iNaturalist.org

YELLOW BULLHEAD

Ameiurus natalis

STATUS

Prohibited

DESCRIPTION

Yellow to olive body, often mottled grey or black with cream bellies, a large rounded head, and small eyes. All fins are dark; the tail fin is rounded and unforked. Long whisker-like barbels protrude from around the mouth and chin as well as the nostrils, which resemble horns. The yellow bullhead is distinguished by white chin barbels.

HABITAT

Shallow, slow-moving backwaters, lakes, and streams with sand or mud bottoms and moderate vegetation. Yellow bullhead are able to tolerate high levels of pollution.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern Canada, Central and Eastern United States. It has been intentionally stocked for sport fishing and as a food fish, which has led to accidental and intentional spread of this species. Yellow bullhead can bury itself in the mud to escape intolerable conditions and live out of water for long periods if kept moist; this allows for colonization of new areas.

IMPACTS

Due to their voracious and generalist feeding habits, this catfish species will consume a wide range of prey, including amphibians and the offspring of native fish, reducing the available food for native species as well as their overall populations. They affect waters by increasing turbidity, which makes it difficult for native fish to survive and feed. Yellow bullhead have spines on the sides of their bodies that contain small amounts of venom. The spines become erect when the fish are threatened which may cause a painful sting to humans or other predators.

Photo: Lubomir Hlasek

Photo: Manu Chretien, iNaturalist.org

BROWN BULLHEAD

Ameiurus nebulosus

STATUS

Prohibited

DESCRIPTION

Black to brown body, often mottled black or brown with cream bellies, a large rounded head, and small eyes. All fins are dark; the tail fin is rounded and unforked. Long whisker-like barbels protrude around the mouth and chin as well as the nostrils, which resemble horns. The brown bullhead is distinguished by light ends of the chin barbels.

HABITAT

Shallow, slow-moving backwaters, lakes, and streams with sand or mud bottoms and moderate vegetation. Brown bullhead are able to tolerate high levels of pollution and high temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern Canada and Eastern United States. It has been intentionally stocked for sport fishing and as a food fish, which has led to accidental and intentional spread of this species. Brown bullhead can bury itself in the mud to escape intolerable conditions and live out of water for long periods if kept moist; this allows for colonization of new areas.

IMPACTS

Due to their voracious and generalist feeding habits, this catfish species will consume a wide range of prey, including amphibians and the offspring of native fish, reducing the available food for native species as well as their overall populations. They affect waters by increasing turbidity, which makes it difficult for native fish to survive and feed. Brown bullhead have spines on the sides of their bodies that contain small amounts of venom. The spines become erect when the fish are threatened which may cause a painful sting to humans or other predators.

Photo: Brian Gratwicke, iNaturalist.org

BOWFIN
Amia calva

STATUS
Prohibited

DESCRIPTION

Elongated body with a long continuous dorsal fin, a rounded tail, and a large toothy mouth. Bodies are olive coloured with dark mottling and a cream-coloured belly. As juveniles, both sexes have a black oval 'eye' spot on their tails that is surrounded by an orange-yellow halo; this spot will remain only for males.

HABITAT

Warm, clear waters, with abundant vegetation in areas such as marshes, oxbow lakes, backwaters, and lakes.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern Canada and Eastern United States. Introduced by humans as intentional stockings for ponds and lakes as well as in the aquarium trade. This fish is able to breathe out of water, thus it can survive buried in the mud without water for up to 21 days; this allows for colonization of new areas.

IMPACTS

Bowfins are voracious feeders and will outcompete native predators for food. The well-armoured fish have few natural enemies other than man, which causes significant impact to sport fish populations when bowfin are relatively abundant.

Photo: Tanya Rushcall, Alberta Environment and Parks

GOLDFISH

Carassius auratus

STATUS

Of concern

DESCRIPTION

Elongated, stocky and deep-bodied with 25-31 large scales on the lateral line and a forked caudal fin. Body colour ranges from olive-bronze to a silvery-white as well as the characteristic golden-orange. Large head and eyes with a small, protruding mouth that has pharyngeal teeth (throat teeth). Distinguished by a stiff, serrated spine at the origin of the dorsal and anal fins.

HABITAT

Still or slow-moving lakes, rivers, ditches, and dugouts with abundant vegetation, occasionally brackish waters. Its indiscriminate habitat requirements allow goldfish to thrive in a wide range of habitats, such as high turbidity, high temperatures, pollution, and eutrophic waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Asia, goldfish were introduced as an ornamental and pet fish; however, currently, they can be found in many man-made ponds in Alberta such as golf course, stormwater and campground ponds. The spread of this species is the result of aquarium releases, which is facilitated by their ability to survive in conditions that are not tolerable to native species, specifically freezing temperatures and low dissolved oxygen.

IMPACTS

Goldfish can affect native fish populations, habitat, and food availability through competition and predation. The risk of algal blooms may also increase due to growth of cyanobacteria in goldfish intestines. They also affect water quality by increasing turbidity. Goldfish can be carriers of viral, bacterial, and parasitic fish pathogens of concern.

Photo: Jason Cooper, Alberta Environment and Parks

PRUSSIAN CARP

Carassius gibelio

STATUS

Of concern

DESCRIPTION

Plump, silvery-brown and deep-bodied with 29-33 large scales on the lateral line; commonly mistaken for goldfish, *Carassius auratus*. The last dorsal and anal rays are strongly serrated; the caudal fin is forked. Distinguished by pharyngeal teeth (throat teeth) and a black peritoneum, which is a membrane lining the body cavity.

HABITAT

Still or slow-moving lakes, rivers, ditches, and dugouts with abundant vegetation, occasionally brackish waters. Its indiscriminate habitat requirements allow Prussian carp to thrive in a wide range of habitats, such as high turbidity, high pollution, and eutrophic waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Asia and Europe, the initial introduction of Prussian carp is unknown; however, Alberta and Saskatchewan are the only jurisdictions in North America with Prussian carp. Their spread is facilitated by their ability to survive out of water for long periods of time and thrive in conditions that are not tolerable to native species.

IMPACTS

Prussian carp rapidly reproduce identical female copies using the sperm of other species to activate, but not fertilize, their own eggs, resulting in Prussian carp becoming the dominant species. This is detrimental to the spawning of native species as well as the access to food and space. They also affect water quality by increasing turbidity. As cyprinids, Prussian carp can also carry pathogens capable of infecting other fish species.

Photo: Jason Cooper, Alberta Environment and Parks

Photo: Museum of Comparative Zoology, Harvard University

SNAKEHEAD (WHOLE FAMILY)
Channidae spp.

STATUS
Prohibited

DESCRIPTION

Elongated, tan to black, cylindrical bodies covered in large scales, which resemble that of snakes, and patterned with various designs and spots. Distinguished by their long continuous dorsal and anal fins, small flat heads as well as their wide protruding mouths.

HABITAT

Depending on the species, most will be found in streams and rivers, but have also been spotted in swamps, ponds, reservoirs, and ditches near vegetation; all species are intolerant to saltwater. Snakehead are also highly adaptable and can tolerate a wide range of temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Africa and Asia, snakehead were accidentally and intentionally stocked for aquaculture and sport fishing. Not only can this species breathe air and survive without water for up to 4 days, they have the ability to 'crawl' short distance on land, which allows for rapid colonization of new areas.

IMPACTS

Snakehead quickly outcompete native species by dominating the food web with their generalist diet of fish, amphibians, crustaceans, birds, mammals and even their own young when food is scarce. This species also has the potential to carry many parasites.

RED SHINER
Cyprinella lutrensis

STATUS
Prohibited

DESCRIPTION

Deeply compressed, olive-green to silver body with diamond shaped scales arranged in a crosshatch pattern. The beginning of the dorsal fin is close to the start of the pelvic fin. Breeding males will have a reddish-orange head, caudal, pelvic, and pectoral fins as well as a purple crescent behind the gills and a pink to blue sheen to the body.

HABITAT

Silty, sandy rivers, streams, and creeks where water is turbid. Red shiner prefer disturbed and low gradient habitats, but have adapted to a wide range of environmental conditions, such as poor water quality and high temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Central United States, red shiners are used as bait and aquarium fish; they may be sold in pet stores under the name Rainbow Dace. Their spread is facilitated not only by bucket and aquarium releases, but by its ability to rapidly multiply, disperse, and colonize after the initial introduction.

IMPACTS

Red shiners are known to prey on larvae and eggs and occupy breeding habitats, which has attributed to the decline of native and endangered species. Additionally, hybridization with native *Cyprinella* species could threaten minnow diversity and populations as well as cause selective loss of genotypes.

Photo: Sam Kieschnick, iNaturalist.org

WESTERN MOSQUITOFISH

Gambusia affinis

STATUS

Prohibited

DESCRIPTION

Small, robust greenish-brown body with silvery-white bellies and a faint dark lateral stripe. The dorsal and caudal fins are rounded and have 1-3 rows of small black spots; the dorsal fin lies behind the anal fin. Large, flat head with large eyes and a small, protruding mouth that points upwards. Distinguished by a net-like pattern on the body and a small dark bar or 'teardrop' below the eye.

HABITAT

Shallow, standing to slow-moving lakes, backwaters, streams, and brackish waters with abundant vegetation and high temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern United States and Mexico, western mosquitofish were brought in as a biological control agent for mosquitoes, which has led to continued intentional release around the world; currently, they can be found in the Banff Hot Springs area. This species is considered cold intolerant; however, some populations are known to overwinter under ice, which could expand their spread.

IMPACTS

It is argued that western mosquitofish are no more effective at controlling unwanted organisms than native species and may be more harmful than helpful as it is highly aggressive, often attacking and sometimes killing other fish. This predatory fish also consumes almost double their body weight per day and will feed on the eggs, larvae, and juveniles of endangered and threatened species. Additionally, western mosquitofish are hosts of various parasites that may further affect native fish.

Photo: Bryant Olsen, iNaturalist.org

UTAH CHUB
Gila atraria

STATUS
Prohibited

DESCRIPTION

Deeply compressed, olive-brown to grey body with a blunt snout and large eyes. The clear-yellow dorsal fin lies directly over the pelvic fins. Breeding males will have a golden sheen.

HABITAT

Lakes, creeks, and streams with dense vegetation, but are tolerant of a wide range of chemical and physical conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to midwestern United States, introduction and establishment are the results of bait bucket releases. They have since spread due to natural dispersal and their ability to thrive in unfavourable conditions and habitats.

IMPACTS

Competition for food and habitat has impacted the growth and abundance of sport fish, such as trout and salmon, as well as endangered species.

RUFFE
Gymnocephalus cernuus

STATUS
Prohibited

DESCRIPTION

Slimy, small olive to brown body with small dark spots and yellowish-white bellies. Dorsal fins are spiny and fused with 11-16 spines followed by 11-16 soft rays; rows of dark spots are found between the spines. Head is narrow and lacks scales, eyes are glassy, and mouth is slightly down-turned.

HABITAT

Slow-moving rivers and lakes with soft bottoms, no vegetation, and sometimes brackish waters. Ruffe's indiscriminate habitat requirements allow it to thrive in a wide range of habitats, such as high turbidity, shallow or deep areas, low light conditions, and eutrophic waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Asia, likely introduced in the ballast water of ships and has spread through similar means.

IMPACTS

Native and sport fish populations are at risk due to the high reproductive capacity, rapid growth, high predation on native fish eggs, and aggressive feeding habits of ruffes. The spiny, well-armoured fish have few natural enemies, and it quickly displaces other species when in relatively high abundance. Additionally, its ability to thrive in eutrophic conditions has allowed for colonization of areas that native species cannot inhabit.

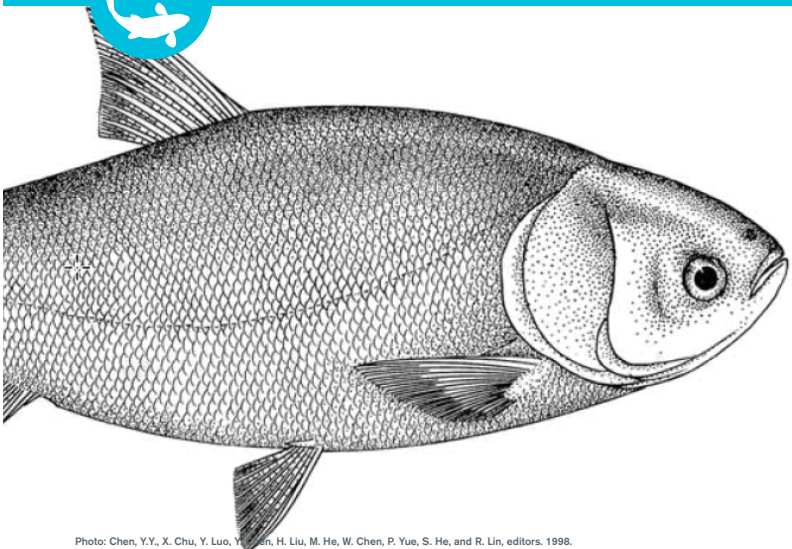


Photo: Chen, Y.Y., X. Chu, Y. Luo, Y. Xie, H. Liu, M. He, W. Chen, P. Yue, S. He, and R. Lin, editors. 1998. Fauna Sinica. Osteichthys: Cypriniformes II. Science Press, Beijing, China: 531

LARGESCALE SILVER CARP

Hypophthalmichthys harmandi

STATUS

Prohibited

DESCRIPTION

Robust, deep silver body covered entirely in large scales, excluding the head; 77-88 scales along the lateral line and 21-23 scale rows. The beginning of the dorsal fin starts close to the end of the pelvic fin. Mouth is upturned and without teeth, but they have pharyngeal teeth (throat teeth).

HABITAT

Clear, slow subtropical lakes, streams and rivers, and requires warm flowing water to spawn.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern Asia, this species is used in the aquaculture industry for culinary purposes. It has not been found in North America.

IMPACTS

Native fish populations are at risk due to the high reproductive capacity and rapid growth of largescale silver carp. Hybridization with *Hypophthalmichthys molitrix (silver carp)* produces viable offspring that are tolerant to temperate climates, such as those found in North America. It is also potentially harmful to humans, as it is a known host to various parasites.

Photo: H.T. Cheng, iNaturalist.org

SILVER CARP

Hypophthalmichthys molitrix

STATUS

Prohibited

DESCRIPTION

Deep olive to silver body covered entirely in tiny scales, excluding the head; 85-108 scales along the lateral line and 29-30 scale rows. The dorsal fin lies almost directly over the pelvic fins. The mouth is upturned and without teeth, but they have pharyngeal teeth (throat teeth).

HABITAT

Clear, slow lakes, streams and rivers, and requires warm flowing water to spawn. Silver carp can adapt to many different environments, such as brackish waters and low dissolved oxygen.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Asia, silver carp were introduced for aquaculture and for control of algal blooms. They have since spread due to escapes, accidental or intentional releases, and have been reported in fish markets in several Canadian and US cities.

IMPACTS

As planktivores, silver carp dramatically affect available plankton for native fish, mussels, and larval fish by consuming double their body weight per day. They often swim near the surface and are known to jump out of the water, which can affect recreational and commercial boat users. Silver carp can be carriers of viral, bacterial, and parasitic fish pathogens of concern.

Photo: South Dakota Game, Fish and Parks, Bugwood.org

BIGHEAD CARP
Hypophthalmichthys nobilis

STATUS
Prohibited

DESCRIPTION

Deep, compressed grey body covered entirely in tiny cycloid scales, excluding the large head; 85-100 scales along the lateral line and 26-28 scale rows. The beginning of the dorsal fin starts close to the end of the pelvic fin. The mouth is upturned and without teeth, but they have pharyngeal teeth (throat teeth). It closely resembles silver carp, *Hypophthalmichthys molitrix*, but is distinguished by dark blotches on its sides and back, and low positioned eyes that project downward.

HABITAT

Clear, slow lakes, streams and rivers, and requires warm flowing water to spawn. Bighead carp can adapt to many different environments, such as brackish waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Asia, bighead carp were introduced for aquaculture and for phytoplankton control. It has since been spread intentionally for the live fish food industry.

IMPACTS

As planktivores, bighead carp dramatically affect available plankton for native fish, mussels, and larval fish because of their non-stop feeding, which allows them to attain a large size. Bighead carp can be carriers of viral, bacterial, and parasitic fish pathogens of concern.

Photo: Sarah Roberts, iNaturalist.org

GREEN SUNFISH

Lepomis cyanellus

STATUS

Prohibited

DESCRIPTION

Laterally compressed blueish-green body with scattered teal flecks. The two dorsal fins appear as one; the first with 9-11 spines while the second has 10-12 soft rays. The anal fin has 3 spines and 9-10 soft rays. A dark spot is sometimes visible where the rounded dorsal and anal fins meet the tail. Juveniles are plain and lack bright colour; however, colours will enhance as they mature and females will develop faint vertical bars, while the anal, pelvic and dorsal areas of males will have an orange tint.

HABITAT

Slow streams, lakes, and ponds often near vegetation, rocks or logs. However, green sunfish are highly adaptable and can tolerate a wide range of aquatic conditions, such as turbidity, high temperatures, and siltation.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Central and Southeastern Canada as well as Eastern United States, green sunfish were accidentally stocked in aquaculture and as bait for sport fishing; it has since spread rapidly between waters.

IMPACTS

Due to its tolerance of crowding as well as their high fecundity and rapid growth, green sunfish can quickly invade waterbodies, which can drastically reduce native fish populations. As competition for food decreases from native species, their aggressive nature, and large mouth allows them to compete for larger prey; this has been attributed to the decline of rare salamander and frog species.

Photo: Jeff Skrentny, iNaturalist.org

PUMPKINSEED

Lepomis gibbosus

STATUS

Prohibited

DESCRIPTION

Laterally compressed, oval shaped body scattered in gold, brown and blue flecks on a blueish-orange body. The two dorsal fins appear as one; the first with 10-12 spines while the second has 10-12 soft rays. The anal fin has 3 spines and 8-11 soft rays. Adults are distinguished from other *Lepomis* species by a red crescent moon shape around the opercle flap, whereas juveniles have a pale crescent.

HABITAT

Slow streams, reservoirs, lakes, and marshes with abundant vegetation and clear, cool waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Canada and Northeastern United States, introduced as intentional stocking for sport fishing and in the aquarium trade; pumpkinseed have since spread rapidly between waters.

IMPACTS

Due to its tolerance of crowding as well as their high fecundity and rapid growth, pumpkinseed can quickly invade waterbodies, which can drastically reduce native fish populations. As competition for food decreases from native species, their aggressive nature, and large mouth allows them to compete for larger prey; this has been attributed to the decline of rare salamander and frog species.


Photo: Aaron Reed, iNaturalist.org

BLUEGILL
Lepomis macrochirus

STATUS
Prohibited

DESCRIPTION

Laterally compressed green body with a bluish-purple sheen and a black opercle flap. The two dorsal fins appear as one; the first with 6-13 spines while the second has 11-12 soft rays. The anal fin has 3 spines and 10-12 soft rays. A faint black spot on the rear edge of the dorsal fin distinguishes this species from other *Lepomis*. Juveniles lack bright colour compared to adults; however, colours and faint vertical bars will develop as they mature. Breeding males are brightly coloured with blue and orange hues.

HABITAT

Slow, warm streams, lakes and reservoirs often near abundant vegetation and may be found in saline conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern North America, bluegill were intentionally stocked for sport fishing and have since spread rapidly between waters.

IMPACTS

Due to its tolerance of crowding as well as their high fecundity and rapid growth, bluegill can quickly invade waterbodies, which can drastically reduce native fish populations. As competition for food decreases from native species, their aggressive nature, and large mouth allows them to compete for larger prey; this has been attributed to the decline of rare salamander and frog species.

ORFE OR IDE
Leuciscus idus

STATUS
Prohibited

DESCRIPTION

Thick, minnow-shaped body with dark grey back, silver sides and small lateral-line scales. The fins are reddish-pink, except the dorsal fin, while the mouth is small, snout is blunt, and nape is humped. Colour varies with orange backs, silver to gold sides, and in ornamental varieties, a bright orange tail and dorsal fin.

HABITAT

Clear, deep rivers, streams, and lakes, but can tolerate a wide range of conditions such as high salinity.

PATHWAY OF INTRODUCTION AND SPREAD

Native to northern Europe and western Asia, orfe were introduced for ornamental purposes. Currently, introductions and establishment are the results of aquarium releases and accidental escapes.

IMPACTS

Impacts are generally unknown; however, orfe share the same family as the highly invasive carp. Its predatory nature on insects, invertebrates, and small fish and long lifespan could quickly outcompete native populations. In its native range, orfe migrate between freshwater and brackish waters, which could allow for colonization of critical bottlenecks for anadromous species. As a cyprinid, orfe may be carriers of viral, bacterial, and parasitic fish pathogens of concern.

Photo: Bernard Kuhajda, Department of Biological Sciences, University of Alabama, Tuscaloosa, AL, Bugwood.org

Photo: Noel M. Burkhead, U.S. Geological Survey

ORIENTAL WEATHER LOACH

Misgurnus anguillicaudatus

STATUS

Prohibited

DESCRIPTION

Greenish-brown, eel-like body with light to bold speckled patterns and a characteristic dark spot on the upper caudal fin. It has a stout spine on its pectoral fin and a small fleshy mouth surrounded by barbels.

HABITAT

Shallow, slow rivers and streams as well as swamps, canals, and backwaters that are heavily vegetated with mud or silt bottoms. However, oriental weather loach are very tolerant to extreme conditions, such as desiccation, temperature and starvation.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Asia, oriental weather loach introductions are attributed to the aquarium industry as well as its use for bait. It can survive out of the water for extended periods of time by secreting a mucous layer around its body, which aids in survival in drought conditions as well as in dispersal.

IMPACTS

Oriental weather loach can quickly outcompete native species by reducing habitat and food, as well as by preying on the offspring of other species. Its high reproductive capacities, competitive abilities, and survivorship threaten native species.

Photo: Johnny Wilson, iNaturalist.org

WHITE PERCH

Morone americana

STATUS

Prohibited

DESCRIPTION

Deep, laterally compressed, small greyish-green body with silvery ctenoid scales. The two dorsal fins are slightly connected by a membrane; the first with 6-10 spines while the second has 1 spine and 10-13 rays. The anal fin has 1 spine and 8-10 rays. The head is depressed, nose is pointed and mouth is terminal with small pointed teeth.

HABITAT

Slow, shallow shorelines and brackish waters with muddy bottoms. Able to tolerate a wide range of conditions such as freshwater.

PATHWAY OF INTRODUCTION AND SPREAD

Native to the east coast of Canada and the United States, white perch were intentionally stocked for sport fishing and have likely spread through similar means.

IMPACTS

White perch are known to aggressively prey on fish larvae and eggs (primarily of walleye), as well as other prey food, which was attributed to the decline of multiple native species. White perch further alter the food web due to declines in top predator populations, like walleye. Additionally, hybridization with native fish species could threaten diversity and populations by polluting the gene pool. White perch may be carriers of Viral Hemorrhagic Septicemia Virus (VHSV).

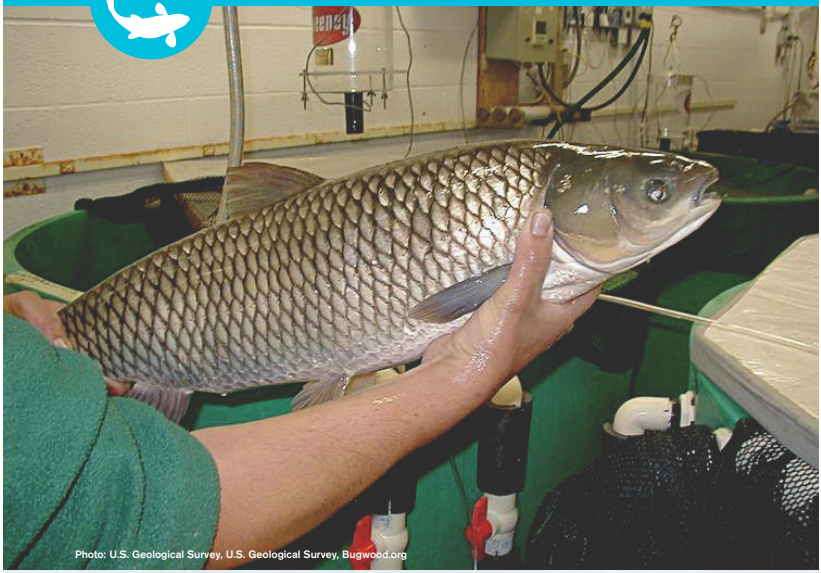


Photo: U.S. Geological Survey, U.S. Geological Survey, Bugwood.org

BLACK CARP

Mylopharyngodon piceus

STATUS

Prohibited

DESCRIPTION

Elongated, compressed grey to brown body covered entirely in large 'chain-link' scales, excluding the head. The mouth is slightly downturned and its pharyngeal teeth (throat teeth) are similar to human molars. The dark pointed dorsal fin lies directly over the pelvic fin.

HABITAT

Clear, slow lakes, streams, and rivers, and requires flowing water to spawn.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Asia, black carp was introduced as a contaminant in baitfish stocks and was later brought in as a biological control agent for disease-carrying snails. They have since spread due to large-scale floods and as a continued contaminant in baitfish shipments.

IMPACTS

Not only will native mussel and snail populations dramatically decrease from black carp predation, but it has the potential to completely restructure benthic communities. This species is also an intermediate host to many parasites and diseases, which could impact fish and human health.

Photo: Eric Engbretson, US Fish and Wildlife Service, Bugwood.org

ROUND GOBY
Neogobius melanostomus

STATUS
Prohibited

DESCRIPTION

Small, soft cylindrical grey to olive body with fine cycloid scales, dark blotches, a fused pelvic fin and occasionally a large black spot on the first dorsal fin; the second dorsal fin and anal fin almost line up and are approximately the same length. The head is large and frog-like with bulbous eyes and large lips.

HABITAT

Shallow, warm brackish waters with mussel beds, sand or rock bottom, and abundant vegetation. They also occur in freshwater systems and can tolerate a wide range of conditions such as poor water quality and low temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Asia, it is ideally suited for transport in the ballast water of ships and was likely spread through similar means.

IMPACTS

Round goby aggressively outcompete native species by occupying spawning sites, overlapping diets and preying on other species' offspring. They feed nocturnally, primarily on zebra mussels, *Dreissena polymorpha*, which no other fish species consume, allowing them to exploit a resource that could fuel a population explosion and cause an increase in algal blooms due to lack of molluscs. This species will accumulate toxic contaminants from its prey, which could bioaccumulate and impact birds, fish and ultimately, humans. VHS has also been reported from Round goby in the Great Lakes.

Photo: Yuriy Kvach, iNaturalist.org

TUBENOSE GOBY

Proterorhinus marmoratus

STATUS

Prohibited

DESCRIPTION

Small, cylindrical, tan body with dark banding, fine cycloid scales, and a fused pelvic fin; the second dorsal fin and anal fin almost line up and are approximately the same length. They are distinguished by small tubes extending out over the upper lip from each nostril. The head is large and frog-like, with bulbous eyes and large lips.

HABITAT

Shallow, warm freshwater or brackish water with sand or rock bottom and abundant vegetation.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southern Europe, introduced in the ballast water of ships and was likely spread through similar means.

IMPACTS

Aggressively outcompete native species by occupying spawning sites, overlapping diets, and preying on other species' offspring, which may disrupt native food webs.

Photo: U.S. Geological Survey

ZANDER
Sander lucioperca

STATUS
Prohibited

DESCRIPTION

Long, slender, greenish-brown body with dark spots and bluish-white bellies. They are distinguished by 1-2 large canine teeth in the front of the mouth. The two dorsal fins are separated by a narrow space; the first with 13-20 spines while the second has 18-24 rays. The anal fin has 2-3 spines and 11-13 rays. The fins are yellowish-grey; dorsal and caudal fins have rows of dark spots between the spines. As juveniles, both sexes have 8-10 dusky bars on their sides; these will fade as they mature.

HABITAT

Turbid, eutrophic lakes and rivers with abundant vegetation, stones and sandy bottoms, occasionally brackish waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Southwestern Asia, zander were intentionally stocked for sport fish and as a food fish, which has led to the accidental and intentional spread of this species.

IMPACTS

Outcompete native species with their overlapping diets and by preying on other species offspring, which may cause fisheries to collapse as juveniles will not be able to grow and reproduce. Hybridization with native fish species could also threaten diversity and populations by polluting the gene pool. Additionally, zander are carriers of several fish diseases and parasites that may further affect native species.

Photo: U.S. Geological Survey, U.S. Geological Survey, Bugwood.org

RUDD

Scardinius erythrophthalmus

STATUS

Prohibited

DESCRIPTION

Deep, laterally compressed, brown to olive green back with silver or gold sides and robustly marked scales. All fins are reddish-orange and the tail fin is forked. The mouth is distinct with a protruding lower lip and strongly serrated pharyngeal teeth (throat teeth).

HABITAT

Slow streams, lakes, reservoirs and brackish waters with abundant vegetation.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Central Asia, introduction into new areas is due to bait bucket releases and sport fisheries. Rudd are highly adaptable to unfavourable conditions and habitats, which has contributed to its wide distribution.

IMPACTS

Modify natural benthic communities by aggressively consuming vulnerable plants and invertebrates, which ultimately affects native species habitat and food availability. Additionally, consequences of hybridization with native species are unknown but potentially threatening.

TENCH
Tinca tinca

STATUS
Prohibited

DESCRIPTION

Thick, laterally compressed, blackish-olive body with gold reflections, tiny scales, and thick, slimy skin. The mouth is terminal with thick lips and barbels; one at each corner of the mouth. They have a relatively long rounded snout and reddish-orange eyes.

HABITAT

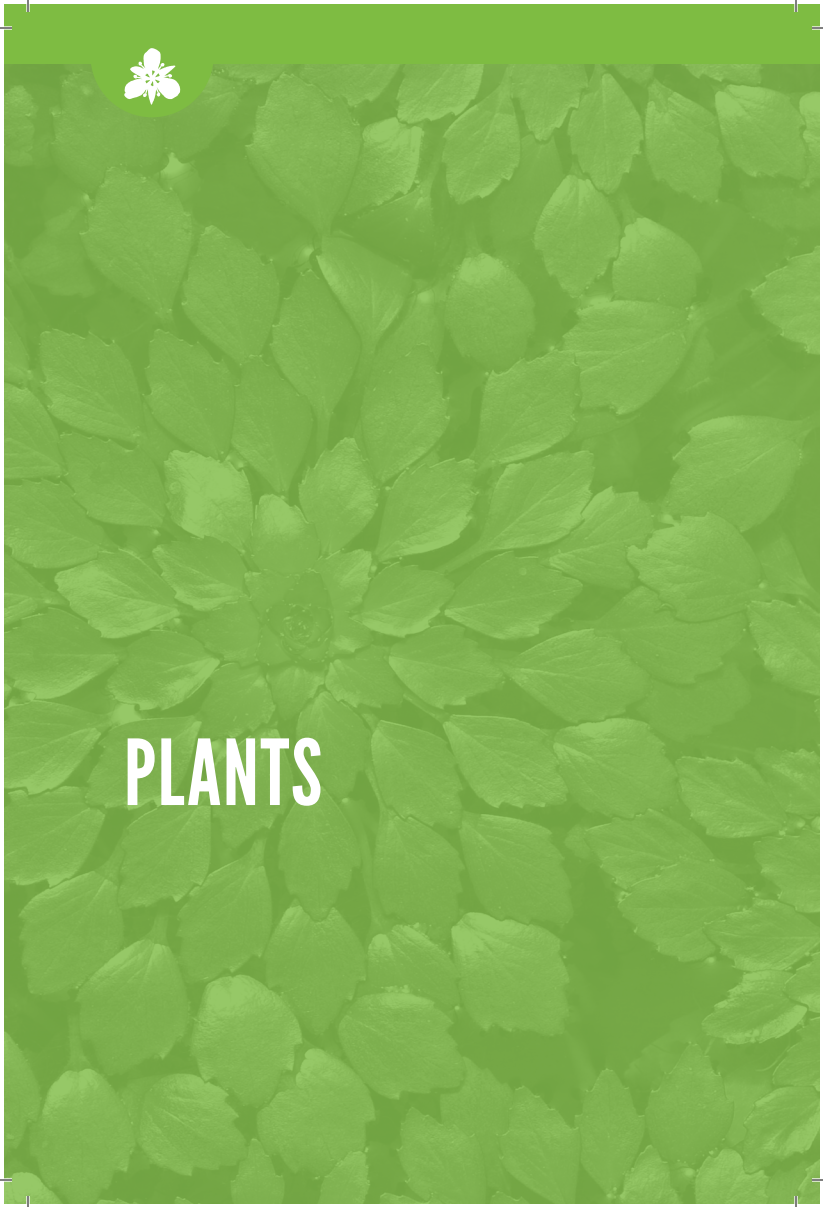
Shallow lakes and backwaters with abundant vegetation and muddy bottoms; often overwinters buried in the mud.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and western Asia, introduction into new areas was the result of intentional stockings. Tench have since spread due to escapes and their ability to thrive in unfavourable conditions and habitats.

IMPACTS

Impacts are generally unknown; however, tench are highly adaptable to degraded environments and are known to stir up bottom sediments, which allows colonization of areas that native fish avoid and degradation of water quality, respectively. Competition for food, such as insects and molluscs, may quickly reduce native populations. Tench are also carriers and/or susceptible to spring viremia of carp virus (SVCV).


PLANTS

PLANT DIAGRAM

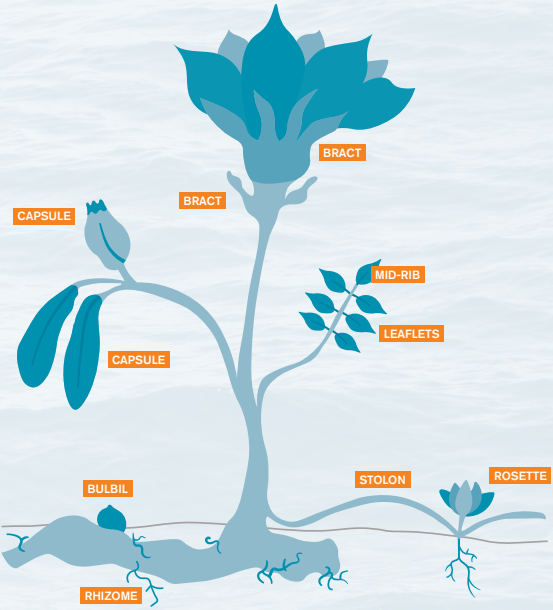


Photo: Nicole Kimmel, Alberta Environment and Parks

Photo: Tanya Rushcall, Alberta Environment and Parks

FLOWERING RUSH

Butomus umbellatus

STATUS

Prohibited

DESCRIPTION

Aquatic perennial, which can grow completely or partially submerged in water. It has umbrella-shaped clusters of pink to white flowers with three petals and three purple to brown bracts that bloom from June to August. Its stem is leafless, green and has a round cross-section, whereas the floating leaves are triangular in cross-section.

HABITAT

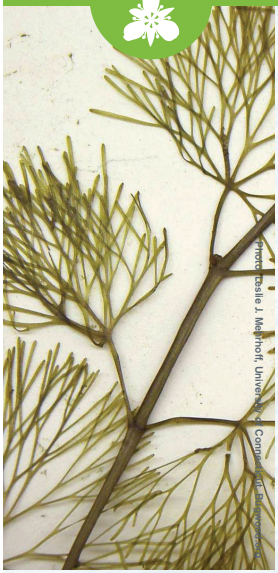
Thrives in water margins or submerged in depths of 3-6m in areas such as shallow freshwater lakes, rivers, marshes, sloughs, canals, and wet ditches.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, Asia and Africa. Introduced as an ornamental plant, but quickly spreads via rhizome fragments and small pea-sized rhizome buds called bulbils. Seed production is yet to be observed in North American populations. Flowering rush is present in Alberta.

IMPACTS

Can displace native riparian vegetation, hinder recreational uses of water and dramatically affect irrigation by changing or inhibiting the flow of water. The habitat created by flowering rush supports the great pond snail, which hosts the parasite that causes swimmer's itch.



FANWORT

Cabomba caroliniana

STATUS

Prohibited

DESCRIPTION

Aquatic perennial that can be submerged and rooted in substrates or free floating with red to green branched stems that reach the water's surface and grow up to 10m long. The submerged leaves are fan-like, feathery and opposite, whereas the floating leaves are small and diamond shaped. Solitary flowers emerge on stalks with white to yellow to pink petals surrounding a yellow center from May to September.

HABITAT

Slow-moving or stagnant water, such as lakes, reservoirs, streams, ditches, and canals. Requires permanent shallow water, usually 3-10m deep and is sensitive to drying out.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern United States and South America. Introduced as a popular aquarium plant and is still currently sold in the aquarium trade. Stems become brittle in late summer, causing the plant to break and the fragments to distribute to new waterways.

IMPACTS

Dense mats clog drainage systems, crowd out native plants, block light from penetrating submerged plants and disrupt aquatic wildlife. It can also hinder swimming, boating, and other recreational activities.

BRAZILIAN ELODEA, BRAZILIAN WATERWEED OR EGERIA

Egeria densa

STATUS

Prohibited

DESCRIPTION

Aquatic perennial that grows completely submerged up to 6m. Rooted in substrates, slender stems grow until they reach the water's surface. Bright green leaves are whorled, increasing from 3-4 leaves near the stem base and 5-6 leaves at the top of the stem. Flowers with three white petals emerge from July to August.

HABITAT

Tolerate a wide range of temperatures and depths of 7m, but prefer warm, sunny freshwater lakes and streams.

PATHWAY OF INTRODUCTION AND SPREAD

Native to South America, introduced as a popular aquarium plant that quickly disperses through stem fragmentation.

IMPACTS

Thick stands of Brazilian waterweed outcompete native vegetation and reduce habitat for fish. Recreational activities are disrupted due to restricted water movement, trapped sediments and changes in water quality.

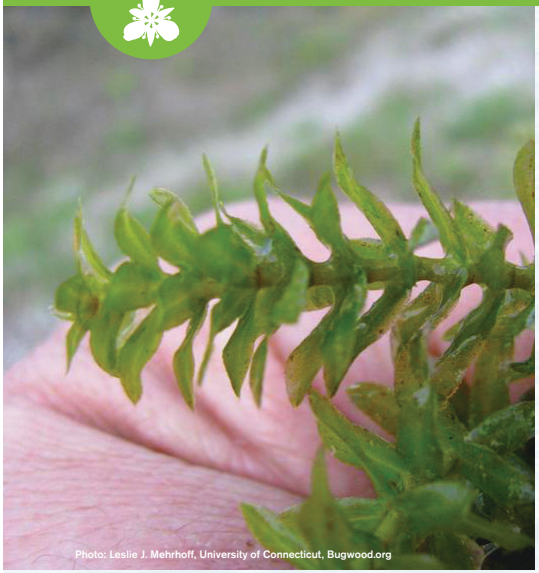


Photo: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

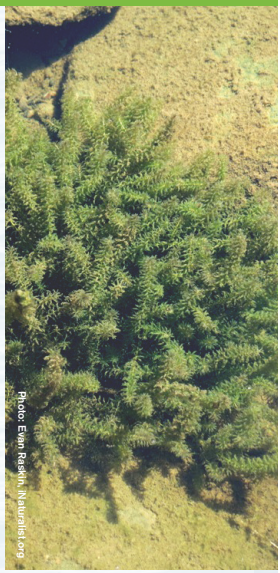


Photo: Evan Raskin, iNaturalist.org

HYDRILLA

Hydrilla verticillata

STATUS

Prohibited

DESCRIPTION

Submerged perennial with saw-toothed edged leaves and prickles on the underside. Three to eight leaves grow in whorls around a slender stem that can reach up to 7.5m. Flowers are very small, white-red or white-green, with red stripes that float to the water's surface on long stalks, and bloom from July to September.

HABITAT

Still or flowing waters, such as rivers, lakes, wetlands, streams, reservoirs, and wet ditches. Hydrilla is highly adaptive and can tolerate a wide range of light, nutrient and temperature changes.

PATHWAY OF INTRODUCTION AND SPREAD

Hydrilla has not been detected in Canada and its origin is still uncertain. Introduced as an aquarium plant, it has since been spread into waterways when aquariums are dumped. It spreads through fragmentation of very tiny stem tubers and plant pieces.

IMPACTS

Produces thick vegetative mats, which spread rapidly to outcompete native plants, reduce water quality, and disrupt recreational activities, such as swimming, boating, and angling. By causing stagnant water, Hydrilla may provide habitat that allows mosquitos to breed.

Photo: Leslie J. Mehrhoff, University of Connecticut; Bugwood.org

EUROPEAN FROGBIT

Hydrocharis morsus-ranae

STATUS

Prohibited

DESCRIPTION

An aquatic annual that is free floating or can put down roots up to 50cm long in shallow waters; however, it does not normally anchor to substrate. Produces a single white flower up to 2cm wide, with three rounded petals and a yellow center from July to August. Leathery, smooth leaves are 2.5-5cm wide and can be round or heart-shaped; the leaf bottom is purple-red with a spongy coating that allows for floatation.

HABITAT

Quiet open waters, such as rivers, streams, marshes, and ditches as well as sheltered coves and shorelines.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe but has been introduced as an ornamental plant it spreads rapidly by stolons that form interconnected floating mats. It is capable of forming turions, which are vegetative buds that break off the main plant and overwinter until spring when growth can resume. Seed production is quite low and sometimes non-existent.

IMPACTS

Thick tangled mats limit light penetration and fill the water column in shallow areas, which strongly affect aquatic life. These mats also hinder recreational use, such as swimming and boating, and clog drainage canals.

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

HIMALAYAN BALSAM

Impatiens glandulifera

STATUS

Prohibited

DESCRIPTION

Annual with irregular pink, purple or white flowers that have five petals and bloom from May until the first frost. Leaves are simple, large and oblong-shaped with serrated edges, oppositely arranged on the stem. The purple-tinged stem is smooth, hollow, four-sided and can grow up to 3m tall.

HABITAT

Requires moist soils and some soil disturbance (uprooted trees, flooding) to establish. It thrives best in nutrient-rich soils of disturbed riparian habitats and wet woodlands.

PATHWAY OF INTRODUCTION AND SPREAD

Native to India, Himalayan balsam was introduced as an ornamental plant. Although it reproduces only by seed, mature capsules will explode when touched, which can launch seeds in all directions up to 10m away from the parent plant, causing rapid expansion. Himalayan balsam is present in Alberta.

IMPACTS

Aggressively replaces native vegetation with dense stands along river banks, leading to soil erosion and reduced biodiversity. This species is also a prolific nectar producer, drawing pollinators away from surrounding native species.

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

YELLOW FLAG IRIS OR PALE YELLOW IRIS

Iris pseudacorus

STATUS

Prohibited

DESCRIPTION

Perennial with pale to deep yellow flowers that have three drooping petals with distinct purple-brown markings surrounding three smaller upright petals; flowers bloom from May to June. Flat brown corky seeds form in large, glossy green, triangular capsules. Stems can be 90 -130cm tall; leaves are long, dark green and sword-like with raised mid-ribs that are slightly off-centre. The leaves are also flattened and fan-like in an overlapping arrangement starting from the base.

HABITAT

Prefers full sun in wetlands, rivers and along the banks of lakes but can tolerate a range of soil acidity, water depths and salinity.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, Western Asia and Northern Africa. Introduced as an ornamental plant, pale yellow iris spreads through water systems by seeds, rhizomes and bulbs. Thick mats of rhizomes and long spreading roots can connect multiple plants and any rhizome fragments that break off can form new plants. Pale Yellow Iris is present in Alberta.

IMPACTS

Modifies its environment by forming dense rhizome mats that increase sedimentation and changes wetlands to a dry environment. This reduces available habitat for wildlife and alters wetland hydrology impacting irrigation. Pale yellow iris is also irritating to skin and poisonous to humans and animals, if consumed.

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

Photo: Nicole Kimmel, Alberta Agriculture and Forestry

PURPLE LOOSESTRIFE

Lythrum salicaria

STATUS

Prohibited

DESCRIPTION

Wetland perennial that grows in large stands. The stems are erect, mostly square and approximately 1.5-3m in height. The flowers attach closely to the woody stems in a tall vertical spike and bloom from May to September. Each flower has five to seven small pinkish-purple petals surrounding a small yellow-white center. Lance-shaped leaves are opposite but may be whorled at the base and sometimes covered in fine hairs.

HABITAT

Wetland and riparian areas with moist, highly organic soils and neutral to alkaline pH. Purple loosestrife tolerates shallow flooding and partial shade. It has low nutrient requirements but flourishes in areas where fertilizer runoff is prevalent.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Asia, introduced as a popular ornamental plant. It has tremendous reproductive capacity by seed; a single plant is able to produce more than two million seeds each year, which can remain viable up to 20 years. Purple loosestrife is present in Alberta.

IMPACTS

Overcrowds native plants and reduces wetland biodiversity. Encroachment in wetland habitat can alter wetland hydrology, disrupt water flow, and eliminate open-water space needed by migratory waterfowl.


Photo: Donald Cameron, GoBotany


Photo: Daniel Carter, iNaturalist.org

VARIABLE-LEAF WATER MILFOIL OR TWO-LEAF WATER MILFOIL

Myriophyllum heterophyllum

STATUS

Prohibited

DESCRIPTION

Submersed perennial that produces short, emergent red floral spikes above the waterline from June to September. The submerged leaves are feather-like, pinnate and in whorls of 4-6, whereas emergent leaves stand out of the water and are highly variable.

HABITAT

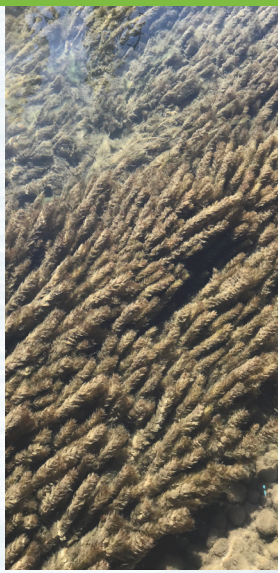
Grows in freshwater lakes, rivers, wetlands, and mudflats up to 2m deep with a wide range of conditions and temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern United States. Introduced as an aquarium plant and for water gardens. Vegetative fragmentation is the primary mode of dispersal, as the seed bank is not significant. Additionally, winter buds enable overwintering.

IMPACTS

Thick mats have the ability to completely congest waterways, degrade habitat for aquatic wildlife, and provide breeding habitat for mosquitos. It also hinders recreational activities, such as swimming, boating, and angling.



EURASIAN WATER MILFOIL

Myriophyllum spicatum

STATUS

Prohibited

DESCRIPTION

Submerged perennial with soft, green, feather-like leaves, which have 3-6 (usually 4) leaves arranged in whorls around each stem. Each leaf has 12 or more leaflet pairs. Brownish-red to whiteish-pink stems that grow up to 4m long and can take root if contacted with mud. Small clusters of pink flowers are held above water in late July and early August. It is difficult to distinguish from Northern water milfoil, which is native to Alberta.

HABITAT

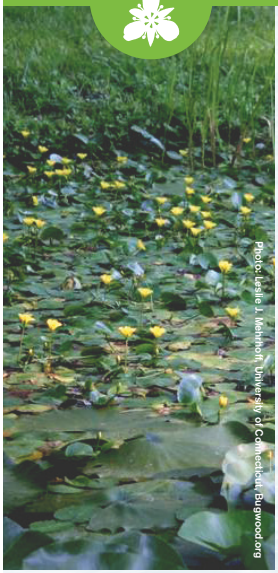
Still or flowing waters up to 10m deep in freshwater lakes, rivers, and streams. Can tolerate highly alkaline water and prefers eutrophic conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, Asia and North Africa. Introduced through the dumping of aquariums and has escaped cultivation. It does produce seed; however, germination rates are poor. Stem fragmentation and underground runners are the main sources of dispersal; a single segment can form a new colony.

IMPACTS

Form large, floating mats that prevent light penetration into water bodies, thus shading native plants. Decaying mats of dense floating material decrease oxygen levels, negatively impacting native fish and birds. As a result, swimming, angling, and boating will also be restricted.



YELLOW FLOATING-HEART

Nymphoides peltata

STATUS

Prohibited

DESCRIPTION

Perennial herb that has five yellow, fringed petals on a single stalk visible flowering from June to September. The floating leaves, which arise from rhizomes, are opposite, heart-shaped and often purple underneath. Long branching stolons that lie just below the water surface root this plant.

HABITAT

Found in the margins of slow-moving rivers, lakes, reservoirs, and swamps. Grows in water 0.5-4m deep and is able to tolerate anaerobic conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Asia and Europe, introduced as an ornamental plant. Interconnected waterbodies and recreational activities rapidly disperse the stolons and plant fragments of yellow floating-heart. Additionally, the hairy seeds float in the water and may disperse by attaching to animals or by a chain-like raft of floating seeds.

IMPACTS

Yellow floating-heart forms dense mats on the water's surface, which aggressively crowd out native plants, trap sediment and create stagnant areas with reduced oxygen levels. This plant can also interfere with recreational activities and create hazardous entanglement.

Photo: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

CURLY LEAF PONDWEED

Potamogeton crispus

STATUS

Prohibited

DESCRIPTION

Perennial aquatic that grows completely submerged; the whole plant is generally less than 3m. The leaves are deep green or greenish-red in colour, oblong in shape, and finely toothed with distinct wavy margins. The flower spikes are similar in colour and emerge from the water in early June.

HABITAT

Prefers lakes, rivers, streams, ditches, and canals less than 3m deep. Highly tolerant of low light and low water temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eurasia, Australia, and Africa. Curly leaf pondweed survives under winter ice, entirely intact, where it spreads through vegetative turions (burr-like winter buds) that are able to break dormancy and rapidly grow in cool temperatures in early spring. Seeds are also produced but do not appear to be viable. Curly leaf pondweed is present in Alberta.

IMPACTS

Among the first plants to grow in spring, giving it a competitive advantage where it is able to form dense mats on the water's surface. These mats crowd out native species, disrupt water flow, and recreational activities, such as swimming, angling, and boating. Since plants die off mid-summer, the decaying matter can reduce oxygen levels, impacting aquatic wildlife.

PHRAGMITES OR EUROPEAN COMMON REED

Phragmites australis subsp. australis

STATUS

Prohibited

DESCRIPTION

Aquatic perennial reed that grows from elongated rhizomes and stolons. Green-blue leaf blades with leaf sheaths that tightly adhere to hollow stalks that can reach up to 6m tall. Flowers in feathery panicles, usually white, gold or purple bloom from June to September. Identification is complicated by a native Phragmites; DNA analysis is required to determine species.

HABITAT

Disturbed and pristine areas including wetlands, marshes, river edges, and lake shores as well as any wet roadsides or ditches. Prefers full sun and can tolerate a wide range of soil types and temperatures, with the exception of severe frost.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eurasia, it was introduced for erosion control. Able to spread by seeds dispersed by wind and water or vegetatively through rhizomes and rhizome fragments. A thick network of rhizomes and roots can extend over a metre below ground. Invasive Phragmites is present in Alberta.

IMPACTS

Damages ecosystems by displacing native plants, hindering access to water for wildlife, including several Species at Risk, as well as increases the potential for fire from remaining dead dry stalks. This plant grows very fast and dense thereby causing low water levels, which impacts recreational activities, such as swimming, angling, and boating.

GIANT SALVINIA OR KARIBA WEED

Salvinia molesta

STATUS

Prohibited

DESCRIPTION

Perennial free-floating fern that lacks roots and does not produce flowers. The emergent leaves are green and obovate with waterproof hairs that split and rejoin at the tips; submerged leaves are brown, feather-like and often mistaken for roots.

HABITAT

Calm and warm waters of lakes, ditches, streams, rivers and water gardens. It cannot tolerate brackish water.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Brazil, introduced by the horticulture and aquarium plant industry. Giant salvinia is a sterile fern; thus, reproduction is exclusively by vegetative growth and fragmentation.

IMPACTS

Giant salvinia has exponential growth and can double its population size in a week to ten days. Impenetrable mats (up to 1m thick) block sunlight and reduce oxygen in the water; this affects water quality and disrupts aquatic plants and wildlife, as well as provides habitat for mosquitos and snails. Recreational activities, such as boating, swimming, and angling, are virtually impossible with this species present.

WATER SOLDIER OR WATER PINEAPPLE

Stratiotes aloides

STATUS

Prohibited

DESCRIPTION

Similar in appearance to an aloe plant, this aquatic perennial has emergent and submerged growth forms. As the rigid, spiny, sword-shaped leaves mature, the plant forms a large rosette that sinks below the water's surface. Flowers, if present, are white with three petals around a yellow center; blooms from July to August. This plant can be free floating or loosely rooted in mud up to 6.5m deep.

HABITAT

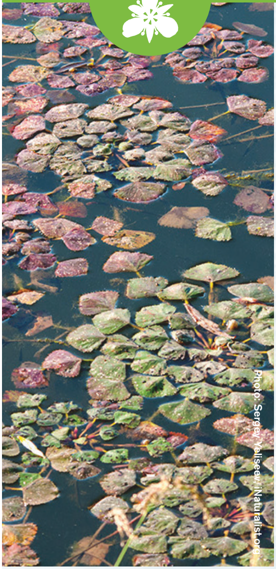
Shallow stagnant freshwater areas such as sheltered bays of lakes, backwater ponds, ditches, and canals.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Northwest Asia, the only known population in North America occurs in Ontario. Introduced as an ornamental plant, water soldier forms dense mats of floating vegetation. Reproduction occurs vegetatively by stolons, buds, and offsets of the adult plant.

IMPACTS

Floating vegetative mats crowd out native vegetation and decrease plant biodiversity; this may alter water chemistry and hinder recreational activities, such as boating, angling, and swimming. The sharp leaves can cut individuals who handle this plant.



EUROPEAN WATER CHESTNUT
Trapa natans

STATUS
Prohibited

DESCRIPTION

Floating annual aquatic plant with submerged stems up to 5m long; stem has feather-like leaves and very fine roots for anchoring. A rosette of saw-toothed, triangular leaves float at the water's surface and hold small flowers with four white petals that bloom from July until frost. A four-horned nut with sharp barbed spines is produced underwater.

HABITAT

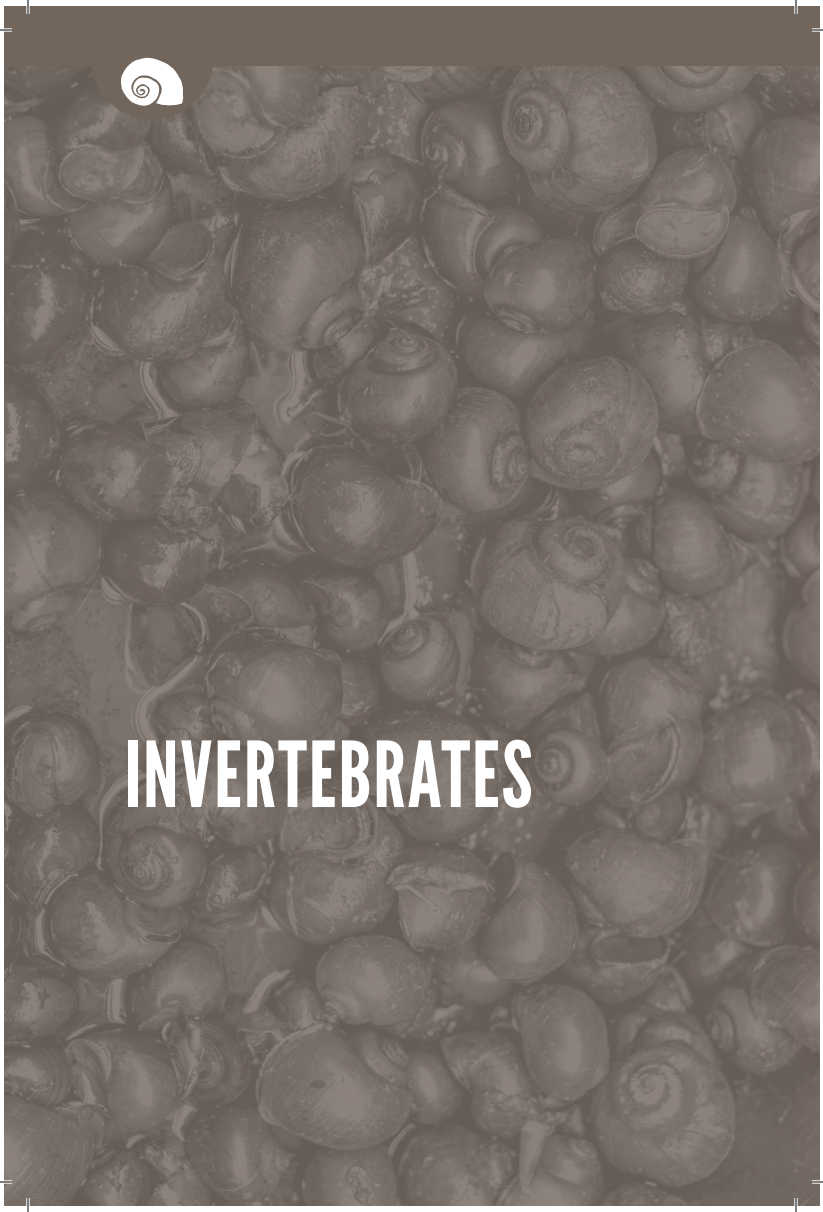
Grows in any freshwater setting, from freshwater regions of estuaries to exposed mud flats, but prefers nutrient-rich lakes and rivers.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, Asia, and Africa. First introduced as an ornamental plant, it spreads rapidly between waters through seed or by plant fragment.

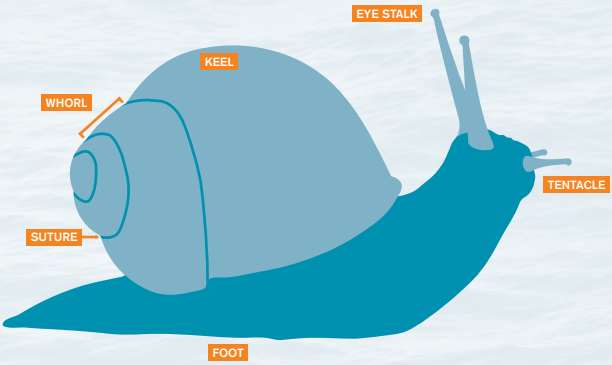
IMPACTS

Forms large dense floating vegetative mats that restrict light penetration; this decreases dissolved oxygen levels and negatively impacts native plant and fish populations. Infestations limit recreational activities, such as swimming, angling, and boating, and the sharp fruits may cause wounds if stepped on.

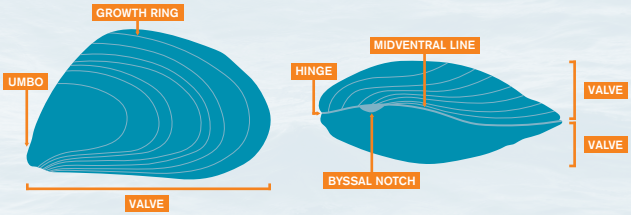


INVERTEBRATES

SNAIL DIAGRAM



MOLLUSK DIAGRAM



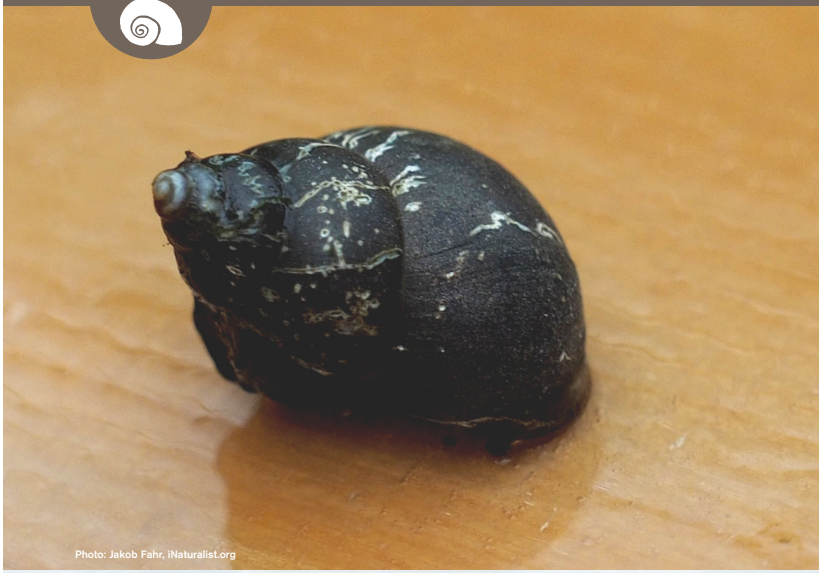


Photo: Jakob Fahr, iNaturalist.org

FAUCET SNAIL

Bithynia tentaculata

STATUS

Prohibited

DESCRIPTION

Shiny, teardrop-shaped, light brown to black shell with 4-6 large, flattened whorls, sometimes with mottling; sizes reaching up to 2cm. Their dark brownish-black body has small yellow spots, long tentacles and big black eyes.

HABITAT

Still or slow-moving, eutrophic freshwater lakes, marshes, rivers and swamps with abundant vegetation and mud or silt bottoms. The faucet snail is able to tolerate high levels of pollution.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, introduced in the ballast water of ships, faucet snails have rapidly spread through its ability to attach to boats, gear, plants and other substrates. This species is also able to survive without water for several days by closing their shells; this allows for rapid colonization of new areas.

IMPACTS

Faucet snails compete with native species for resources and may clog water intake pipes, infest water supplies and other submerged equipment. This species is also an intermediate host to many parasites that contribute to massive die-offs of waterfowl.

Photo: Gary Montz, 144, Bugwood.org

Photo: Michigan Department of Natural Resources

SPINY WATER FLEA

Bythotrephes longimanus

STATUS

Prohibited

DESCRIPTION

Tiny translucent bodies with a pair of sickle-shaped mandibles and a bulbous egg pouch; body length ranges from 1.5-5mm. The head is clearly defined from the abdomen and consists primarily of a large, black compound eye. Distinguished by a long caudal tail spine that doubles, sometimes triples, its body length with 1-4 pairs of barbs; on average the tail spine is 5-7mm. Often their presence is noted by masses on fishing lines and cables that look and feel like gelatin with tiny black spots.

HABITAT

Large, deep, clear freshwater lakes and reservoirs. Juveniles prefer deeper waters, but all ages can be found in upper waters. Able to tolerate brackish waters but cannot tolerate high temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to northern Europe and Asia, introduced in the ballast water of ships, spiny water flea have rapidly spread through boats and fishing equipment contaminated with females carrying eggs. Although adults will die out of the water, their 'resting' eggs will resist desiccation and ultimately establish new populations through sexual and asexual reproduction.

IMPACTS

Modify abundance and diversity of native zooplankton that larval fish eat, which may dramatically affect higher trophic levels and limit the amount of available food for native species as spiny water flea is quite an aggressive predator of zooplankton. It disrupts angling as it clogs the rod eyelets, damages reels and may prevent a fish from being caught.

Photo: Igor Grigorovich, Bugwood.org

FISHHOOK WATER FLEA

Cercopagis pengoi

STATUS

Prohibited

DESCRIPTION

Tiny translucent bodies with a pair of sickle-shaped mandibles and an elongated egg pouch that ends in a fine point; body length ranges from 1-3mm. The head is clearly defined from the abdomen and consists primarily of a large, black compound eye. Distinguished by a long angled caudal tail spine that triples its body length with 1-3 pairs of barbs and an S-shaped loop at the end; on average the tail spine is 10mm. Their presence is often noted by masses on fishing lines and cables that look and feel like gelatin with tiny black spots.

HABITAT

Large, deep, clear freshwater lakes and reservoirs as well as brackish waters; found primarily in upper waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe and Asia, introduced in the ballast water of ships, fishhook water flea have rapidly spread through boats and fishing equipment contaminated with females carrying eggs. Although adults will die out of the water, their 'resting' eggs will resist desiccation, freezing, and ingestion, and ultimately establish new populations through sexual and asexual reproduction.

IMPACTS

Modify abundance and diversity of native zooplankton that larval fish eat, which may dramatically affect the food web and limit the amount of available food for native species as fish hook water flea is quite an aggressive predator of zooplankton. It disrupts angling as it clogs the rod eyelets, damages reels and may prevent a fish from being caught.

Photo: Amy Benson, U.S. Geological Survey, Bugwood.org

CHINESE MYSTERY SNAIL

Cipangopaludina chinensis

STATUS

Prohibited

DESCRIPTION

Large, globular brownish-olive shell with very fine growth lines, a black outer lip, 6-7 whorls, and distinct sutures; sizes reaching up to 6cm. It has a dark brownish-black to cream body with small yellow spots and long tentacles.

HABITAT

Slow-moving freshwater lakes, streams, rivers, and ditches with lush grass and soft muddy or sandy bottoms. Chinese mystery snails are able to tolerate pollution but cannot tolerate high temperatures or highly eutrophic waters.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Asia, introductions are attributed to the pet trade industry as well as the aquaculture industry for culinary purposes. Their spread is facilitated not only by aquarium releases but through its continuous release of fully developed juveniles and its ability to survive without water for several days; this allows for colonization of new areas.

IMPACTS

Competition for food and habitat have impacted the growth and abundance of native snail species. Chinese mystery snails may clog water intake pipes and other submerged equipment. This species is also an intermediate host to multiple parasites and diseases, which could impact human health.

Photo: Sam Kieschnick, iNaturalist.org

Photo: Sam Kieschnick, iNaturalist.org

ASIAN CLAM

Corbicula fluminea

STATUS

Prohibited

DESCRIPTION

Triangular, yellowish-brown to dark olive shell with raised, evenly spaced growth rings and a distinctly rounded umbo; sizes rarely exceed 2.5cm but can reach up to 6.5cm. The valves are bilaterally symmetrical and have anterior and posterior lateral serrated teeth.

HABITAT

Clear, moving streams, rivers, lakes and brackish waters with coarse sand, silt or mud bottoms.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Southeastern Asia, introduced through intentional and accidental release from bait buckets. Asian clams spread through its ability to attach in thick clusters to multiple surfaces and through its high reproductive output of up to 70,000 eggs per season.

IMPACTS

Due to its large filtration capacity, this mollusc outcompetes native species for food and space, and significantly alters the ecosystem by increasing light penetration and water transparency. Asian clams are known to damage irrigation canals, electrical and nuclear power plants as large numbers, dead or alive, can quickly clog up water intake pipes and other submerged equipment.

Photo: Amy Benson, U.S. Geological Survey, Bugwood.org

ZEBRA MUSSEL
Dreissena polymorpha

STATUS
Prohibited

DESCRIPTION

Laterally compressed, tiny, triangular shell with brown and yellowish-cream striping, or zigzag banding on the shell, can also be solid in colour; sizes rarely exceed 2.5cm but can reach up to 5cm. The valves are bilaterally symmetrical and have an obvious ridge opposite the hinge. It sits flat on the ventral side and midventral line is straight.

HABITAT

Slow-moving, freshwater or brackish lakes, reservoirs, and rivers up to 60m deep where it is able to attach to any suitable hard, rocky or soft surface, such as rocks, docks, pipes, and more. Can adapt to many different environments.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, introduced in the ballast water of ships, zebra mussels have rapidly spread through its ability to attach in thick clusters to virtually any surface as well as through its high reproductive output of up to one million microscopic eggs per season. This species is able to survive without water for up to 30 days and can remain attached to substrates until physically removed.

IMPACTS

Its large filtration capacity (up to a litre of water per day) can lead to drastically reduced plankton populations, competition with native species and significant changes to the ecosystem by increasing light penetration and water transparency. Zebra mussels may use other organisms or pipes for attachment, causing stress and eventual starvation or causing submerged pipes to clog up, respectively. Infestations limit recreational activities, such as swimming, angling, and boating, and the sharp shells may cause wounds if stepped on.

Photo: Amy Benson, U.S. Geological Survey, Bugwood.org

Photo: Government of Alberta

QUAGGA MUSSEL

Dreissena rostriformis bugensis

STATUS

Prohibited

DESCRIPTION

Round, small, D-shaped shell with dark brown to yellowish-cream bands that fade near the hinge; sizes reaching up to 4cm. The valves are asymmetrical and lack a ridge opposite the hinge. It topples over on the ventral side as it is convex and the midventral line is uneven.

HABITAT

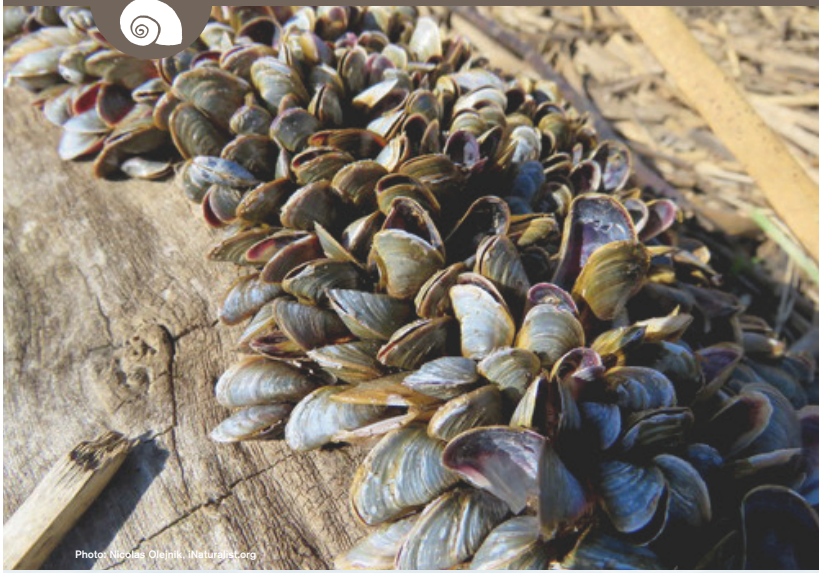
Slow-moving, freshwater or brackish lakes, reservoirs, and rivers up to 130m deep where it is able to attach to any suitable hard, rocky or soft surface, such as rocks, docks, pipes, and more.

PATHWAY OF INTRODUCTION AND SPREAD

Native to the Ukraine, introduced in the ballast water of ships, quagga mussels have rapidly spread through its ability to attach in thick clusters to virtually any surface as well as through its high reproductive output of up to one million microscopic eggs per season. This species is not as widespread as that of zebra mussels; however, it is able to survive without water for up to 30 days, which allows for colonization of new areas.

IMPACTS

Its large filtration capacity (up to a litre of water per day) can lead to drastically reduced plankton populations, competition with native species and significant changes to the ecosystem by increasing light penetration and water transparency. Quagga mussels may use other organisms or pipes for attachment, causing stress and eventual starvation or causing submerged pipes to clog up, respectively. Infestations limit recreational activities, such as swimming, angling, and boating, and the sharp shells may cause wounds if stepped on.



GOLDEN MUSSEL

Limnoperna fortunei

STATUS

Prohibited

DESCRIPTION

Triangular, shiny, yellowish-brown shell with prominent growth rings that sometimes darken near the hinge; sizes rarely exceed 2cm but can reach up to 5cm. Valves are bilaterally symmetrical and lack a byssal notch. Distinguished from *Dreissena* species with the presence of a nacreous layer (inner surface of the shell), which is purple.

HABITAT

Slow-moving, freshwater or brackish lakes, reservoirs, and rivers where it is able to attach to any suitable hard, rocky or soft surface, such as rocks, docks, pipes, and more.

PATHWAY OF INTRODUCTION AND SPREAD

Native to China and Southeastern Asia, introduced in the ballast water of ships. It has not been found in North America. Golden mussels spread through its ability to attach in thick clusters to virtually any surface as well as through its high reproductive output. This species is tolerant to a wider range of habitats than *Dreissena* species, such as polluted and contaminated waters, and is able to survive without water for up to a week.

IMPACTS

Its large filtration capacity (up to a litre of water per day) can lead to drastically reduced plankton populations, competition with native species and significant changes to the ecosystem by increasing light penetration and water transparency. Golden mussels may use other organisms or pipes for attachment, causing stress and eventual starvation or causing submerged pipes to clog up, respectively. Infestations limit recreational activities, such as swimming, angling, and boating, and the sharp shells may cause wounds if stepped on.

Photo: James Stuart, iNaturalist.org

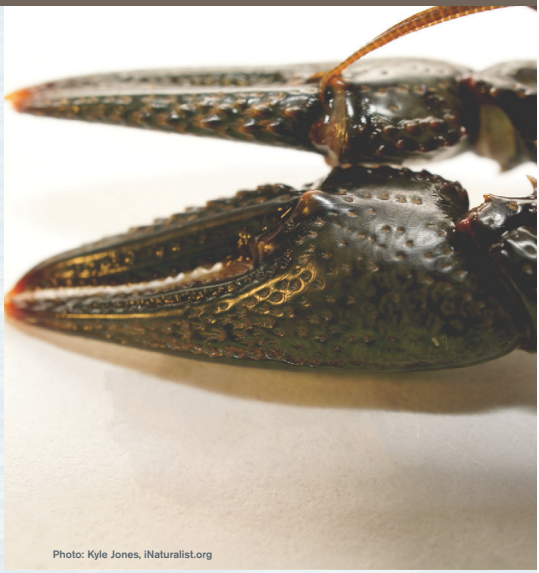


Photo: Kyle Jones, iNaturalist.org

NORTHERN CRAYFISH

Orconectes virilis

STATUS

Of Concern

DESCRIPTION

Reddish-brown to olive with long antennae, straight rostrum and bumps on the sides of the carapace and claws; sizes reaching up to 13cm. They have large, broad, flattened claws, often with dark specks and reddish-orange tips; claws and legs may also appear blue.

HABITAT

Slow, warm freshwater streams, lakes and rivers with abundant vegetation, rocks, and mud, silt or sand bottoms up to 10m deep where it is able to avoid freezing and overwinter. Also, able to tolerate a wide range of weather conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Central Canada and Central United States, which includes the Beaver River watershed in Alberta. Their spread is facilitated by bait bucket releases.

IMPACTS

Modify abundance and diversity of insects and macroinvertebrates, which has contributed to the decline of many native and endangered species by limiting the amount of available food and changing the habitat.

Note: As per the Alberta Guide to Sportfishing Regulations "In all waters, other than the Beaver River, people may harvest crayfish without a licence by legal means which currently includes angling, dip net, seine net, minnow trap and capture by hand. The retention and transport of live crayfish is illegal and all retained crayfish must be immediately killed to prevent the spread of this species; it is also illegal to use live crayfish as bait."

Photo: Nicolas Olejnik, iNaturalist.org

CHANNELED APPLESNAIL

Pomacea canaliculata

STATUS

Prohibited

DESCRIPTION

Large, globular brownish-green to yellow shell, sometimes with spiral banding patterns around 5-6 whorls; sizes reaching up to 6.5cm. Their dark brownish-black to cream body has long tentacles and large, but short eye stalks. Distinguished by their deeply indented sutures or 'channels'. Their presence is often noted by their bright pinkish-red egg masses on emergent vegetation and other substrates.

HABITAT

Still or slow-moving, freshwater lakes, marshes, rivers and swamps with abundant vegetation, muddy bottoms and high temperatures. Channeled applesnails are able to tolerate high levels of pollution and drought conditions.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Central and Eastern South America, introductions are attributed to the aquaculture and pet trade industry. Their spread is facilitated not only by aquarium releases and accidental escapes but through its high reproductive output of up to 1200 eggs every few weeks.

IMPACTS

Due to their voracious and generalist feeding habits, this snail species will consume a wide range of food in large quantities; the more they consume, the more reproductively active they are, which leads to serious habitat modification for native species. Although adults have many predators, their eggs are only preyed on by one species, causing high survival in their offspring. This species is also an intermediate host to certain parasites and diseases, which could impact human health.

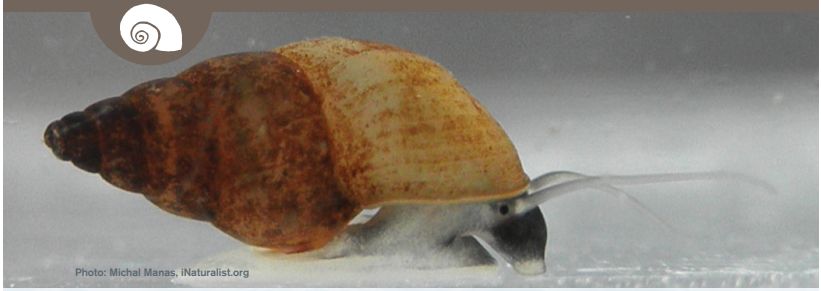


Photo: Michal Manas, iNaturalist.org

Photo: Mohammed El Damir, Bugwood.org

NEW ZEALAND MUD SNAIL

Potamopyrgus antipodarum

STATUS

Prohibited

DESCRIPTION

Small, light brown to black, elongated cone-shaped shell with 5-6 deep whorls, sometimes with keels or spines on whorls; sizes range from 4-12mm. They have a dark grey to translucent body with long tentacles.

HABITAT

Slow-moving freshwater lakes, streams, rivers and brackish waters with abundant vegetation and gravel, sand or mud bottoms. Prefer disturbed shallow areas but can be found up to 60m deep. Its indiscriminate habitat requirements allow New Zealand mud snails to thrive in a wide range of habitats, such as high levels of pollution, shallow or deep areas, and a wide range of temperatures.

PATHWAY OF INTRODUCTION AND SPREAD

Native to New Zealand, New Zealand mud snails have rapidly spread unknowingly through boats, gear, and other substrates as well as through its high reproductive output, requiring only one female to reproduce 230 offspring in a year and start a new infestation. This species is also able to survive without water for several days and survive the digestive tract of fish and birds unharmed.

IMPACTS

Modify natural benthic communities by aggressively consuming resources and by lacking predators outside its native range, it is able to achieve huge populations with densities of over 750,000 per square metre, which displaces native species, including multiple endangered mollusks, and significantly disrupts food webs. New Zealand mud snails may clog water intake pipes, infest water supplies and other submerged equipment. This species is also an intermediate host to parasites that may contribute to serious problems in hatcheries.

DISEASE

HETEROSPORIS

IHN IN TROUT

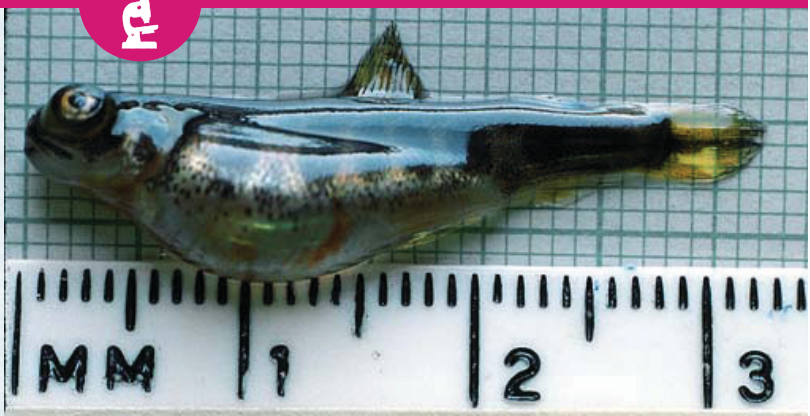


Photo: Auburn University, School of Fisheries, Aquaculture and Aquatic Sciences

INFECTIOUS PANCREATIC NECROSIS VIRUS (IPNV)

genus *Aquabirnavirus*

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

A bi-segmented, double-stranded RNA virus that primarily affects young salmonid fish; multiple strains exist. The lethality of the virus depends on the strain, the species and the age of the fish. The presence of IPN in fish is first noted through a sudden increase in fry or fingerling mortality, then through a spiral swimming motion, darkening of the skin, and swelling of the abdomen and/or eyes.

PATHWAY OF INTRODUCTION AND SPREAD

Its spread is the result of the natural movement of infected fish feces, spawning fluids, urine, and water as well as fish to fish and through recreational equipment, such as nets, containers, and other equipment. Currently, Alberta has the 'Canada-3' strain; however, additional strains may be introduced through imports.

IMPACTS

Considered a highly dangerous virus for salmonid fish populations in farms worldwide, causing a large number of mortalities, with no available treatment. Additionally, various strains are now found in a wide range of freshwater and marine fish, molluscs, and crustaceans belonging to families other than *Salmonidae*.

Note: As per the Canadian Food Inspection Agency "IPN is a reportable disease. This means that anyone who owns or works with aquatic animals, who knows of or suspects IPN in the animals that they own or work with, is required by law to notify the CFIA."

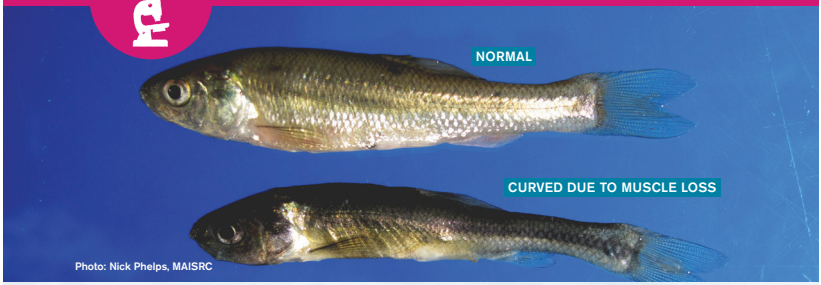


Photo: Nick Phelps, MAISRC

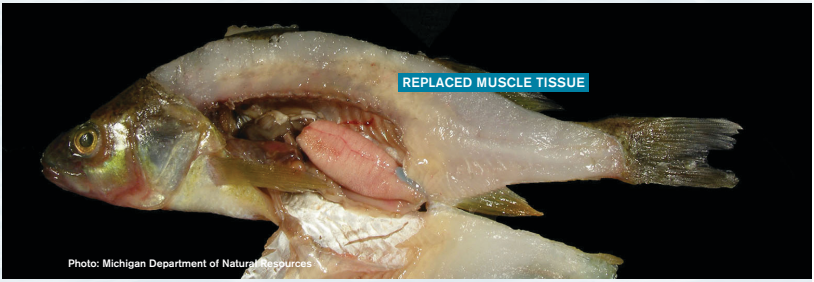


Photo: Michigan Department of Natural Resources

HETEROSPORIS
Heterosporis sutherlandae

STATUS
Of concern

LIFE CYCLE AND SYMPTOMS

Microsporidia are released into the water when an infected fish dies; they may be ingested, but other forms of transmission are not ruled out. Once ingested, developmental stages and mature spores replace muscle tissue and are surrounded by loose fibrous, connective tissue. The presence of Heterosporis in fish is noted through an opaque or 'freezer-burned' appearance when filleted. Fish appear emaciated and appear to curve inward and are soft when touched due to muscle loss.

PATHWAY OF INTRODUCTION AND SPREAD

Its origin and how it was introduced remains disputed; however, Heterosporis has spread through the movement of infected water or fish as well as through its simple life cycle, which requires no intermediate host and its low degree of host specificity allowing for transmission and establishment to approximately 15 known fish hosts. Also, the spores are able to remain viable for up to two months at room temperature (21°C) and up to a year at 4°C before finding a host, which allows for colonization of new areas.

IMPACTS

Heterosporis is increasingly important world-wide as it can affect numerous species, impacting wild and farmed fishes.

In severe cases, 80-90% of the muscle tissue can be affected in ecologically and economically important fish populations, such as walleye, rainbow trout, yellow perch, and fathead minnows. There is no treatment and eradication is difficult. The most significant threat seems to be loss of marketable sportfish.

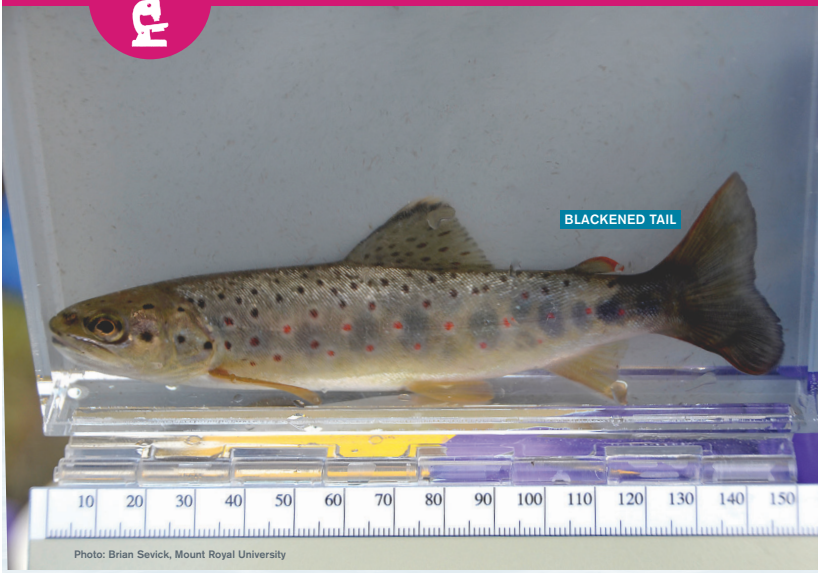


Photo: Brian Sevick, Mount Royal University

WHIRLING DISEASE

Myxobolus cerebralis

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

Spores are ingested by *Tubifex tubifex* worms where TAMs (triactinomyxons) develop within the gut of the worm. TAMs are released with the fecal material, floating in water until they come into near proximity with a salmonid. TAMs attach to the fish, where they continue to develop and destroy cartilage, and eventually produce myxospores within the cartilage, which are released when the fish dies. Clinical signs of whirling disease, blackened tail and skeletal deformities of the spine or skull, are not always present. Fish may be seen to abnormally whirl in a tail-chasing behaviour.

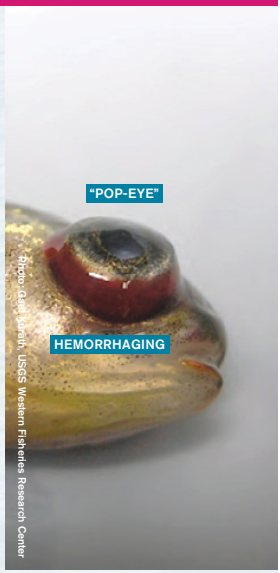
PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, introduced to the US by stocking of infected fish. It is unclear how it was introduced in Canada. Currently, the parasite can be found in the Oldman, Bow, Red Deer, and North Saskatchewan River watersheds. Its spread is by movement of infected fish, alive or dead, mud, water, and recreational equipment. Control is difficult as infected fish cannot be treated and myxospores are hardy and survive in the environment for some length of time.

IMPACTS

Whirling disease only affects salmonid fish like trout and mountain whitefish. The impacts of whirling disease on fish populations can be considerable depending on the age and size of the fish. Mortality rates can be as high as 90% for juveniles. There is no treatment available.

Note: As per the Canadian Food Inspection Agency "Whirling disease is a federally reportable disease. This means that anyone who owns or works with aquatic animals, who knows of or suspects Whirling disease in the animals that they own or work with, is required by law to notify the CFIA."



INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS (IHNV)

genus *Novirhabdovirus*

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

A non-segmented, single-stranded RNA virus that primarily affects young salmonid fish. The lethality of the virus depends on the species and the age of the fish. The presence of IHN in fish is first noted through a sudden increase in fry or fingerling mortality, then through frenzied swimming motion, darkening of the skin, trailing white fecal casts, swelling of the abdomen and/or eyes and anemia, exophthalmia (popeye) and hemorrhage.

PATHWAY OF INTRODUCTION AND SPREAD

Native to western North America, it has spread through the movement of infected fish, eggs, feces, spawning fluids, urine, invertebrates and water as well as through recreational equipment. The major source of spread occurring is through transmission of parent to offspring thus IHNV has been translocated to other continents with salmonid eggs.

IMPACTS

Considered a highly dangerous virus for salmonid fish populations in wild and farmed stocks worldwide, causing up to 95% mortality. The virus is able to survive for up to one month at cool temperatures before finding a host but is readily inactivated by drying and common disinfectants (as opposed to IPNV).

Note: As per the Canadian Food Inspection Agency "IHN is a reportable disease. This means that anyone who owns or works with aquatic animals, who knows of or suspects IHN in their fish is required by law to notify the CFIA."

Photo: Nick Phelps, MAISRC

VIRAL HEMORRHAGIC SEPTICEMIA VIRUS (VHSV) OR EGTVED DISEASE AND VIRUS
genus *Novirhabdovirus*

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

A single-stranded RNA virus that affects both fresh and saltwater fish species; several strains exist. The lethality of the virus depends on the strain, the species and the age of the fish. The presence of VHS in fish is first noted through darkening of the skin, hemorrhages throughout the body, and swelling of the abdomen and/or eyes; additionally, there could be no signs of illness whatsoever, thus testing is required to determine VHS infection.

PATHWAY OF INTRODUCTION AND SPREAD

VHSV was first detected in Europe although European strains are different from the North American strains. In both Europe and North America, it's thought to have been from marine fish that then spread to freshwater fishes. The virus is able to survive for up to two weeks depending on water quality and temperature before finding a host, which allows for colonization of new areas.

IMPACTS

Considered a highly dangerous virus for many ecologically and economically important fish populations, such as walleye, yellow perch, Northern pike and whitefish. VHSV-infected fish may vary from showing no clinical signs, to infection causing up to 80% mortality. As it is a viral disease, there is no available treatment. Currently, three main strains are found in North America.

Note: As per the Canadian Food Inspection Agency "VHS is a federally reportable disease. This means that anyone who owns or works with aquatic animals, who knows of or suspects VHS in their fish is required by law to notify the CFIA."

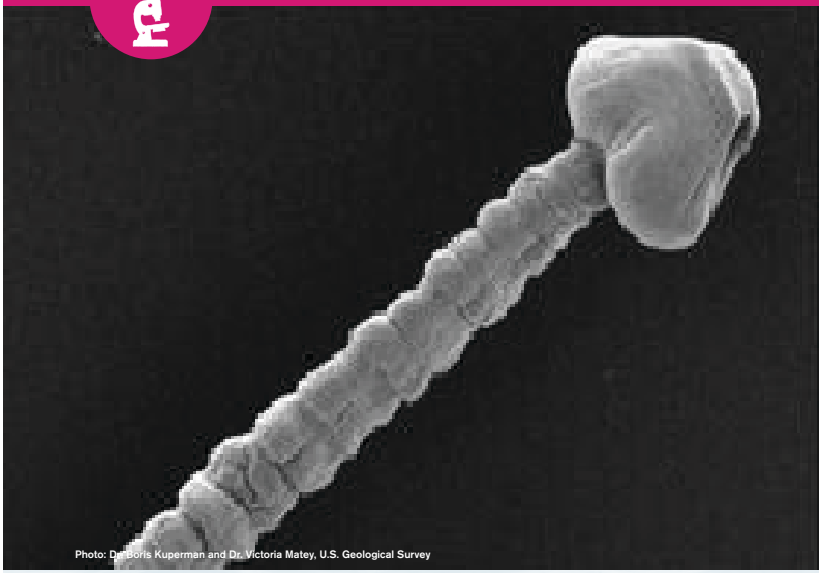


Photo: Dr. Boris Kuperman and Dr. Victoria Matey, U.S. Geological Survey

ASIAN TAPEWORM

Schizocotyle acheilognathi

STATUS

Prohibited

DESCRIPTION

Yellowish-cream, thin and fleshy with a distinctly segmented body that can reach lengths of over 50cm, depending on its host; cestodes are variable in size and number of segments. Distinguished by a wide arrow-head or heart-shaped scolex (head) with two short but deep slit-like openings and an undeveloped terminal disc. Often their presence is noted through an autopsy, with examination of intestinal or stomach contents.

HABITAT

Asian tapeworms are transmitted to a wide variety of fish hosts. Microscopic free-living larvae, hatched from recently released eggs, are eaten by copepods, then burrow into the copepod body. Once within the intestines of fish, the larvae will mature in 21-23 days at 28-29°C. Temperatures below 15°C delay completion of the life cycle.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Eastern Asia, likely introduced world-wide through one of its native carp hosts, Asian tapeworms have rapidly spread through bait bucket releases as well as through its simple, two-host life cycle and low degree of host specificity allowing for transmission to many hosts in multiple habitats.

IMPACTS

Considered a highly dangerous parasite for cultured, endangered, and native freshwater fish populations worldwide, particularly cyprinid fish, as it rapidly reproduces within the hosts' intestines reducing the ability to cope with stressors, reducing growth, causing anemia, temperature-dependent mortality and more.

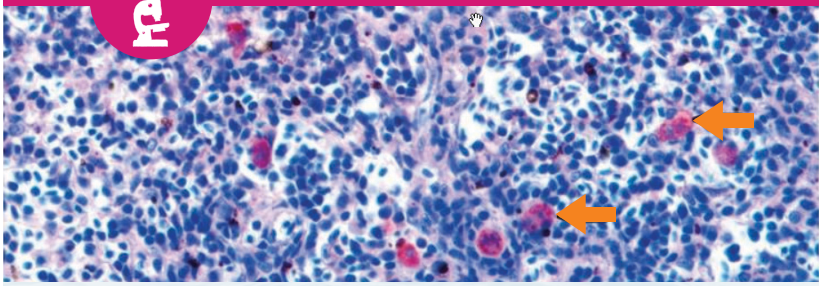


Photo: Kumar G., Abd-Elfattah A., Saleh M., and El-Matbouli M. 2013. Fate of Tetracapsuloides bryosalmonae (Myxozoa) after infection of brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss). Dis Aquat Org 107: 9–18.

PROLIFERATIVE KIDNEY DISEASE (PKD)

Tetracapsuloides bryosalmonae

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

Spores, released from fish, infect the colonial *Fredericella sultana*, a bryozoan or `moss animal' (through feeding), where they multiply within spherical sacs and burst, releasing a second type of spore which then attaches to a fish through skin or gills. The parasite first replicates in the blood and disperses to several organs like the spleen or kidney, where the spores will multiply and produce a tumor-like enlargement. The presence of PKD in fish is noted through abdominal swelling, due to fluid accumulation and grossly swollen kidneys; pale gills may also be observed.

PATHWAY OF INTRODUCTION AND SPREAD

First detected in Europe, and possibly introduced by waterfowl carrying infected bryozoans and accidental stocking of infected fish and has spread through similar means. Although the presence of PKD has not been detected in Alberta, the alternate host, *Fredericella sultana*, is present within the province. PKD is an emerging disease, with increasing outbreaks expected to extend its distribution northward with rising temperatures and eutrophication.

IMPACTS

Considered a highly dangerous parasite for salmonid fish and Northern pike populations as it may cause mortalities, with rates ranging from 20-100%, typically highest in juveniles.

Photo: Nick Phelps, MAISRC

Photo: Nick Phelps, MAISRC

SPRING VIREMIA OF CARP VIRUS (SVCV)

genus *Vesiculovirus*

STATUS

Of concern

LIFE CYCLE AND SYMPTOMS

A non-segmented, single-stranded RNA virus; several strains exist. The lethality of the virus depends on the strain, the species, and the age of the fish. The presence of SVC in fish is first noted in the spring through darkening of the skin, hemorrhages throughout the body, and swelling of the abdomen and/or eyes. There could be no signs of illness whatsoever, thus testing is required to determine SVC infection.

PATHWAY OF INTRODUCTION AND SPREAD

Native to Europe, likely introduced by the fish food industry and spread through baitfish releases, infected fish, feces, urine, and invertebrate vectors. The virus is able to survive in water and mud for various amounts of time (4 days to 6 weeks) under various temperatures which allows for colonization of new areas.

IMPACTS

Considered a highly contagious virus for cyprinid fish such as carp (including goldfish, grass carp, silver carp and minnows) as well as white suckers, northern pike and bass, causing up to 70% mortality. This is also great cause for concern in the bait fish industry.

Note: As per the Canadian Food Inspection Agency "SVC is a federally reportable disease. This means that anyone who owns or works with aquatic animals, who knows of or suspects SVC in their fish is required by law to notify the CFIA."

GLOSSARY

Abdomen: Commonly referred to as the belly or stomach, is the space between the chest and pelvis, or the third functional region of an invertebrate's body

Anadromous: Adult fish migrating up rivers from the sea in order to spawn

Anaerobic: Absence of free oxygen

Anal fin: Located on the underside of a fish between the tail and pelvic fins, near the anus

Annual: A plant that lives one year or less

Antennae: A pair of long, thin sensory appendages on the head of invertebrates

Anterior: Situated at or towards the front

Barbel: Long, whisker-like, fleshy sensory organ near the mouth or nostrils of some fish

Benthic community: Organisms that live on, in, or near the bottom of a body of water

Bilaterally symmetrical: A body that could be divided into matching halves

Brackish waters: Mixture of river and sea waters, slightly salty

Bract: A reduced leaf or leaf-like structure at the base of the flower, usually below the petals

Bulbil: A small, vegetative bulb or offset that forms and can grow to produce a new plant

Byssal notch: Small opening located on the ventral side of some mussel species, particularly Dreissena, for the passage of byssal threads that attach themselves to substrates

Capsule: Dry fruit chamber that holds multiple seeds

Carapace: Hard shell on the backs of crayfish or other animals

Caudal fin: Also known as a tail fin, it is located at the end of the fish and propels and steers the fish

Cycloid scales: Thin, large, round or oval scales arranged in an overlapping pattern

Deep-bodied: Laterally compressed (flattened from side to side) and rounded body type

Dorsal fin: Located on the top of a fish, it may be a single fin, with or without spines, or consist of two connected or unconnected parts — a sharp-spined part and a soft-rayed part

Emergent: Plants usually found above the water surface with flowers, fruits, leaves and stems that extend out of the water; they can be rooted in the sediment and have underwater leaves

Estuaries: Mouth of a large river, where the tide meets the stream

Eutrophic: Body of water rich in minerals and nutrients that promote a proliferation of plant life, especially algae, which kills animal life by depriving it of oxygen

Fecundity: The ability to produce an abundance of offspring; fertility

Fingerling: Juvenile fish with developed scales and working fins; typically the size of fingers

Fry: Immature fish from the time they hatch to the time they become fingerlings

Hemorrhage: Bleeding due to a ruptured blood vessel, may be internal or external

Hinge: Dorsal part of a mussel shell where the left and right valves attach

Hybridization: To produce hybrids; crossbreed individuals of two different species

Invasive species: Species that are not native to a given ecosystem, and cause (or have high potential to cause) harm, whether economic, environmental, or harm to human health

Invertebrate: An animal that lacks a spine, such as an arthropod, mollusc, cestode, etc.

Keel: Spines or ridges on shell whorls of some snail species

Lateral: Of, at, or from the side; in the direction of or toward the side

Lateral line: Line of very small pores, usually in the center of a fish body, that sense water movements and vibrations

Leaflet: A part or division of a compound leaf

Mandibles: Jaws or crushing organ in a crayfish's mouth

Microsporidia: A group of spore-forming unicellular parasites

Midline or midventral line: Of, relating to, or being the middle of the ventral surface

Mid-rib: The central vein or axis of a leaf blade or leaflet

Mottled or mottling: Marked with spots or smears of colour

Nacreous layer: Inner layer of a mussel shell, also called the "mother-of-pearl" layer

Nape: In fish, the part of the dorsal surface between the dorsal fin and the edge of the head

Obovate: Narrow end of leaf is at the base, rather than at the tip

Operculum or opercle flap: Any flap of skin covering an opening, as the gill cover of a fish or the plate of some gastropods (snails) that closes the opening of their shell

Opposite: Term applied to leaves occurring in pairs at a node

Panicle: Loose, branching cluster of flowers

Pectoral fins: Located on both sides of the fish near the gill; help with balance, steering, and controlling depth

Pelvic fins: Located on the bottom of the fish in front of the anal fin, can be fused; help balance the fish and keep it level

Perennial: A plant that lives two or more years

Peritoneum: Membrane lining of the body cavity

Pinnate: Leaflets developing from several different points on the main leaf axis

Pharyngeal teeth: Teeth in the throat of some fish species

Posterior: Situated behind or farther back

Rays: Parts that support and extend the fin of a fish

Rhizome: A horizontal stem growing beneath the ground, which can develop roots or sprouts at the joints

Rosette: A cluster of leaves radiating out from the base of the plant

Rostrum: Snout or prolongation of the head in a crustacean

Scale rows: Scales organized in various patterns across the sides of the body

Scolex: Anterior end of a tapeworm, essentially the head, bearing suckers and hooks for attachment

Serrated: Having a saw-toothed edge or margin notched with tooth-like projections

Spine: Sharp, rigid fin ray of a fish

Spore: Typically one-celled, reproductive unit capable of giving rise to a new individual without sexual fusion

Stolon: A horizontal stem growing above the ground, which can develop roots or sprouts at the joints

Submersed/submerged: Plants usually found entirely underwater, but the flowers and fruits may rise above the water surface; they are rooted in the sediment and have underwater leaves

Substrate: The surface on which an organism lives, grows, or obtains its nourishment

Sutures: Channels or indentation that forms a visible line, which is continuous and reaches the tip of the shell

Tentacles: Slender, flexible appendage used for grasping, moving, or sensory functions

Turbidity or turbid: A measure that provides an estimate of water cloudiness due to silt, organic and inorganic matter, plankton, and microscopic organisms

Turion: A vegetative bud that detaches from a parent plant and can produce new plants via asexual reproduction

Umbo: The raised portion of the dorsal margin of a shell, also called the beak

Valves: The right or left half of a bivalve shell

Ventral side: On a bivalve, the lower or bottom edge of a shell

Whorls or whorled: In plants, a ring of 3 or more similar structures radiating from a common point; in gastropods, a spiral or complete 360° revolution of the shell

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