



Invasive Non-Native Fish Species in the Lower Mainland

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Invasive non-native fish species have been in the Lower Mainland for more than 50 years. Until recently very little attention had been given to their management. However, an increasing number of reports were being received of new introductions or established populations. In 2004, Ministry of Environment staff started investigating new reports of established non-native fish populations, and in particular, Largemouth Bass. Ministry biologists expected some spread from introductions in the 1940's. However, what they found was that many Lower Mainland waterbodies now supported several species of invasive non-native fish species and the list of species was increasing, indicating that the spread was likely enhanced by illegal introductions. Today more than 50 waterbodies in the Lower Mainland support Largemouth Bass, and many other invasive non-native fish species.

What are exotic or non-native species?

Non-native or exotics are species (plant or animals) that have evolved elsewhere and have been purposely or accidentally relocated outside of their native range. While the movement of species can be natural (eg. migration, movement by wind, ocean currents), the majority of non-native movement is through human intervention. People move exotic species accidentally (through boat hulls and bilges), for aesthetic enjoyment, or, as is the case of spiny rayed fishes (basses and sunfishes), small number of anglers are illegally stocking fish to increase their own recreational opportunities.

How do invasive species differ from other exotic species?

Invasive species are a subset of exotic species. Not all exotic species become invasive. Some are relatively benign (eg. turf in residential yards), but many others are strong competitors or predators, with devastating effects on the natural flora and fauna. Invasive species are exotic species that persist, proliferate, and cause environmental and/or economic harm or harm to human health.

How do invasive species affect the environment?

Invasive species cause declines or eradication of native species through one or more of the following means:

- Competition – Invasive alien species often out-compete native species for resources (space, water, food). Alien species also often reproduce more successfully, or in greater numbers, than native species and quickly outnumber the native species.

- Predation – Alien species are often aggressive herbivores or predators – overgrazing on native plants or preying on native animals or fish, causing population declines.
- Disease – Introduction of non-native species can contribute to the spread of disease that can have devastating effects on the native ecosystem
- Parasitism – Invasive species may parasitize native species thereby weakening but not necessarily killing it outright (e.g. Sea lamprey in the Great Lakes). Over time this contributes to an overall decline in native species health and ultimately populations numbers.
- Hybridization – Alien species can weaken and dilute the gene pool by interbreeding with the native species.
- Habitat alteration – Alien species that change the structure or composition of a habitat, making it unsuitable for other species (e.g. Eurasian milfoil – form dense mats of vegetation, often interfering with the local nutrient cycle).

For more information go to:

Canadian Wildlife Services Hinterland page at: <http://www.hww.ca/hww2.asp?id=220>

Identification of Invasive Fish Species in the Lower Mainland

Smallmouth Bass (*Micropterus dolomieu*)

Mouth reaches to near the front of the eye. 2 dorsal fins that are joined – first dorsal fin is spiny-rayed. Colour is golden brown to olive green; ventral surface cream to white. Head with dark bars radiating backwards from eyes and sides with 8-15 spotted vertical bars (bars less pronounced in adults). Caudal fin of young is unmistakably marked orange at base.



Biology:

Reproduction - Spawn in late spring to early summer (egg deposition occurs in temperatures of 16 – 18°C). The male builds a nest in 2 – 20 feet of water on a sandy, gravel, or rocky bottom, usually near the protection of rocks, logs or dense vegetation. Females lay an average of 7000 eggs per body weight pound. The male fans and guards the nest and guards the young after they hatch. Hatching takes place in 4-10 days.

Habitat - Prefer the protection of rocky shoals and talus slopes, or submerged logs. Prefer temperature in the range of 21 - 28°C and cannot stand temperatures as high as the largemouth bass.

Diet - A progression with increase in size from plankton, to immature aquatic insects, to crayfish and fishes by the time the bass reaches 5 cm in length.

Largemouth Bass (*Micropterus salmoides*)

Typically 20 – 38 cm in length (similar to that of smallmouth bass) in Canada. Mouth reaching to at least middle of eye. 2 dorsal fins, joined, but separation more obvious than that of smallmouth bass – spiny-rays on front dorsal fin. Colouration bright green to olive on dorsal surface to lighter green or golden green on side. Ventral surface white to yellow. Black lateral band, sometimes across opercle through eye to the snout; visible in young but often broken or inconspicuous in adults.



Biology:

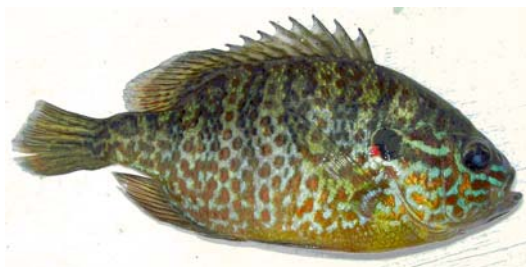
Reproduction - Spawns from late spring to mid-summer, in water temperatures of 16 - 18°C. The largemouth bass prefers to spawn in shallower water than smallmouth bass, in protected bays among emergent vegetation. The very aggressive male sweeps clean a 2-3 foot diameter nest in gravelly sand to marl or soft mud. Males actively guard and fan the eggs. The male guards the young bass for up to 1 month after emerging. Eggs per female are 2000 – 7000 per pound of body size.

Habitat - Largemouth bass prefer the upper layers of warm water in small lakes and shallow bays of large lakes, and more rarely in slow rivers (rarely caught in depths greater than 20 feet). The largemouth bass prefers habitat with soft bottoms and submergent vegetation, especially water lilies and cattails. Largemouth bass can tolerate warmer temperatures than smallmouth bass (preferred temperature is 26 - 28 °C).

Diet - Adult largemouth bass are largely piscivores. However, their diet shifts from plankton to insects to crayfish, frogs, salamanders and fish as they increase in size. **Largemouth bass begin eating fish once they attain a size of 5 cm.**

Pumpkinseed (*Lepomis gibbosus*)

Usually 17 – 23 cm in length. In small productive bodies of water, stunting often takes place, with maximum lengths of only 10 – 13 cm. 2 dorsal fins, which are joined – first dorsal fin is spiny-rayed. Side of head with prominent, wavy, blue-green stripes. Opercular flap has a wide, black centre and small half-moon spot of bright red. Sexual maturity is usually achieved by age 2, with maximum age of 7 to 9 years.



Biology:

Reproduction - Spawning occurs in late spring/early summer. Nest is constructed by male in shallow water near shore in areas of submerged aquatic vegetation (bottom substrate can be clay to rock – male sweeps an area to expose hard bottom). Nest building begins when water temperature reaches 20°C. Males may spawn more than once in the same season, with the same or different females. The average number of eggs per spawning is estimated at 1600 to 3000. The male guards the nest, fanning the eggs, and then guards the newly hatched for a few days. Hatching usually occurs in 3-5 days. Sexual maturity is usually achieved by age 2.

Habitat - Small lakes and ponds, shallow bays of large lakes, and in the quiet water of slow moving streams. Prefers clear water and cover of submerged vegetation. Usually found at or near the surface, in large numbers, exposed to the sun.

Diet - Food is mainly a variety of insects, and secondarily, other invertebrates. Small fish or vertebrates can make up a large portion of the adult fish's diet.

Small pumpkinseed form part of the food of almost all predatory fish, including bass and yellow perch.

Black Crappie (*Pomoxis nigromaculatus*)

Body is deep, laterally compressed is 10 – 30 cm. 7-8 dorsal fins, obviously separated and the anal fin base is equal to or greater than the dorsal fin base. Adult colouration includes irregular pale yellow to green spots on a dark background on the dorsal, anal and caudal fins. Maximum age is usually 10 years.



Biology:

Reproduction - Spawn in the spring when water temperatures increase above 15°C. Adults migrate into the shallows of lakes and tributaries of rivers to spawn. The male creates a nest at <3 m water depth. The nest is guarded by the male for 3 -4 days until the young disperse. Sexual maturity is usually achieved by males at 2 years and by females at 3 years of age.

Habitat - Black crappie are adaptable, but are most abundant in clear warm lakes, and slow moving streams and sloughs.

Diet - Food changes with size and season, but is largely in mid-water for adult insects, small fish and plankton, and larger invertebrates.

Common Carp (*Cyprinus carpio*)

Body is deep and elongate and can be >60 cm in length. Large scales, large dorsal spine and strong serrated spines at the origins of the dorsal and anal fins. Well developed barbels at the corners of the upper jaw. Adult colouration is brown to golden. Maximum age is 10-15 years.



Biology:

Reproduction - Spawn in the spring, when water temperatures increase above 15°C. Aggregate spawners, they migrate into the shallows of lakes and tributaries of rivers to spawn with much thrashing and splashing about. They are very fecund and typically produce 36,000 to 2,000,000 small (1.0 mm diameter) eggs. Sexual maturity is usually achieved by males at 4 years and by females at 5 years of age.

Habitat - Inhabiting warm soft bottomed lakes and ponds or slow moving stream and sloughs. They are hardy fish that tolerate temperatures from 0 -30 °C. Prefer shallow weedy areas in summer and deeper offshore areas in winter.

Diet - Food changes with size and season, and but feeds heavily on the bottom on insect larvae, molluscs, worms, amphipods, fish eggs and plankton.

Brown Bullhead (*Ameiurus nebulosus*)

Body is elongate and up to 35 cm in length. Smooth skin with dorsal and pectoral spines, and long darkly pigmented barbels. Adult colouration includes irregular pale yellow to green spots on a dark background on the dorsal, anal and caudal fins. Maximum age is 6-8 years.



Biology:

Reproduction - Spawn in the spring, when water temperatures increase above 20°C. Adults migrate into the shallows of lakes and tributaries of rivers to spawn. The female creates a nest at <1 m water depth. The nest is guarded by the male and female until the young disperse. Sexual maturity is usually achieved by males at 2 years and by females at 3 years of age.

Habitat - Inhabiting warm soft bottomed lakes and ponds or slow moving stream and sloughs.

Diet – Omnivorous, food changes with size and season, and but feed heavily on aquatic insects, molluscs, worms, crustaceans, amphipods and fish eggs.

What kind of damage can invasive non-native fish do?

Biodiversity & Ecosystem Health Impacts

- Invasive species can out-compete and replace native fish and other aquatic species that have formed the native flora and fauna beneficial to maintaining the balance of local ecosystems. These changes can alter entire habitats, placing ecosystems out of balance and at risk.
- Compared to other threats to biodiversity, invasive introduced species rank second only to habitat destruction.
- The higher up the fish introduction into a watershed, the greater the impacts to native fish and other species. Introductions of non-native fish into headwater systems provides point sources capable of invading all downstream habitats. Fish are able easily able to move downstream past barriers that would have restricted upstream movement (Knapp et al. 2001).
- The Lower Mainland supports numerous endangered, SARA (*Species at Risk Act*) listed aquatic fish, amphibian, reptile and mammal species.

Socio-economic Impacts

- Supporting the largest human population centre in B.C., recreational activities are an important part of everyday living in the Lower Mainland, including nature walks and viewing, fishing and boating.
- The Fraser River is one of the largest salmon producing rivers in the world.
- Salmon have an important cultural, social, and economic link to the people of British Columbia.

Lower Mainland Fishery Resources

- Lower Mainland lakes and streams support populations of native trout, char and other native fishes that are desirable targets for recreational anglers.
- Cultus Lake Sockeye salmon were designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Sockeye smolts must migrate through waters frequented by bass and other non-native predatory fishes to reach the estuary and then the ocean.
- All species of salmon inhabit the Lower Fraser River and its tributaries. Their fry inhabit these waters for months to years before migrating to marine waters, and are subject to predation by voracious bass and other non-native fish.

Possible Methods of Control

BIOLOGICAL CONTROL MEASURES

Biological control involves the introduction of another living organism or a biochemical cue as a control agent. This can include:

- Diseases known to be specific to target species;
- Predators;
- Introduction of a control agent which diminishes habitat favoured by target species;
- target species which have been sterilized and act to mitigate spawning success;
- Immunocontraceptive agents to inhibit reproduction, as well as;
- Pheromones (i.e. external hormones) which are used to attract fish into traps or repel fish from specific areas.

Though biological control measures can be selective and cost efficient there are no developed methods for alien species in British Columbia. Development of such programs would be expensive, as well as time consuming, and public opposition is likely to be high in the case of introduced predators or viruses. Biological control programs elsewhere have not successfully eliminated target species, they have instead been used as continuous control measures in concert with other methods as part of a larger integrated management plan.

PHYSICAL CONTROL MEASURES

Physical control measures involve the use of mechanical and electrical methods including:

- nets and traps,
- barriers,
- explosives,
- electrical fields,
- water basin drainage, and
- increased fishing pressure.

Most physical methods are readily adopted by the public and many are environmentally sound and can be very selective. However, for complete eradication of a species from any given system, physical removal can be time consuming, expensive and take years to produce results. The only physical method which has achieved total eradication of non-salmonid target species is complete dewatering, and the only successful eradication programs using physical mean, not including dewatering, have been conducted on salmonids.

CHEMICAL CONTROL MEASURES

Chemical control involves the application of a chemical known to be toxic to a target organism. Chemical methods affect the most immediate results and are the most efficient and cost effective method used to eradicate fish populations (Finlayson et al, 2000; Ling 2003). Currently there is no compound which is specific to alien species in British Columbia. Rotenone is the only registered piscicide in Canada with general toxicity to alien species in British Columbia.

Rotenone is a natural toxin derived from tropical plants of the Leguminosae family. It has a high toxicity to gill breathing organisms while demonstrating an extremely low toxicity to birds and mammals. Rotenone can be applied as either a powder or suspended in liquid form for more effective dispersal.

Chemical application and complete dewatering are the only methods available to date which are capable of completely eradicating alien species from the British Columbian waterbodies discussed here. Rotenone use in North America has been extensive and over time, at

concentrations used to effect fish, rotenone has been proven both safe and effective with no impacts to human health if used as prescribed.

Considerable knowledge of rotenone application in North America exists, and the American Fisheries Society (AFS) has constructed a stewardship web site (<http://www.fisheries.org/html/rotenone/>) which serves to inform the public and other agencies of the issues and current uses of rotenone in North America.

What Can You Do?

Do Not Move Fish - Do not move fish, fish parts, or any other aquatic plants or animals without a permit. It is against the law and punishable with a penalty of up to \$100,000 for first time offenders, and/or a prison term of up to 12 months for a second offence.

Report Suspicious Activity - Report any suspicious or illegal activities associated with the intentional or accidental movement of live fish or any other aquatic organisms to the RAPP line at 1-877-952-7277.

Do Not Accidentally Spread Invasive Species - Thoroughly wash all boating and fishing gear. Transfer of aquatic alien species may occur through the movement of gear or equipment from one waterbody to another.

Report Invasive Species - If you find any non-native fish in other waterbodies, keep the fish, freeze it, and phone the local provincial fisheries biologists at the Ministry of Environment Office.

Education - Educate yourself, your family, friends and neighbours around issues of invasive species.

What We Are Doing?

Education – By developing brochures, information sheets, and posting signage, as well as conducting public meetings and creating availability to discuss these issues with members of the public and First Nations who pose questions, MoE and DFO have committed to the education of the public on this important issue.

Reward Program – MOE, BCWF and DFO are supporting a **reward of up to \$20,000** for information leading to the successful prosecution of the individuals responsible for transplanting spiny-ray fishes in the Thompson region

Monitoring – MoE monitoring the spread and establishment of non-native fish species.
Sampling for non-native fishes in key habitats.

Regulation Management

Angling Regulation Change Proposal – Regional staff are determining where increased angling pressure could help to control the spread of non-native fishes.

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