M.Blackmore

CLEAN DRAIN DRY

Prevent the Spread of Aquatic Invasive Species

Aquatic Invasive Impacts on Pacific Salmon

Oncorhynchus spp.

MAY 2024

Invasive Species Council of BC

Shawna Kiesman

Chinook salmon

WHAT ARE AQUATIC INVASIVE SPECIES?

Aquatic invasive species (AIS) are non-native plants, fish, invertebrates, pathogens and diseases that have the potential to harm the environment, economy and society. AIS may be introduced to new locations by human activity, either intentionally or unintentionally through:

- Pets and plants from aquariums, ponds, or water gardens
- Live food
- Live bait
- Sport and recreational fishing
- Recreation
- Floatplanes
- Shipping – Ballast water and hull fouling
- Aquaculture

AIS may also disperse naturally by actively swimming, drifting in currents or via movement of animals, such as waterbirds that can carry aquatic invasive plants and invertebrates both internally and externally.

They compete with native biodiversity for resources like food and habitat, predate on native species, spread diseases or parasites and may modify habitats and ecosystems making them less favourable for native species.

PACIFIC SALMON (*Oncorhynchus* spp.)

Pacific salmon is an iconic group of fish found in the genus *Oncorhynchus* of the family Salmonidae. Five species of Pacific salmon have been integral parts of BC's aquatic and terrestrial ecosystems and are crucially important to the Indigenous people of the Pacific Northwest since time immemorial: chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*) and chum salmon (*O. keta*). Pacific salmon are known for their dramatic morphological changes as they migrate from the ocean and travel up rivers to their birthplace to spawn in gravel beds where they, like their offspring, begin and end their life cycle. There are over 9,000 populations of Pacific salmon found in British Columbia, approximately half of which are in a state of decline.

AQUATIC INVASIVE SPECIES AND THEIR IMPACTS ON PACIFIC SALMON

Predation: Several invasive fish species including northern pike (*Esox lucius*), and large and smallmouth bass (*Micropterus salmoides and M. dolomieu*) have contributed to the decline of fry and juvenile salmon numbers in BC through predation.

Northern pike

NYS DEC CC BY-NC-ND 2.0

Largemouth bass

NYS DEC CC BY-NC-ND 2.0

Smallmouth bass

Competition: Invasive species are often strong competitors. Studies have shown the survival and growth rates of stocked salmonids in lakes with yellow perch (*Perca flavescens*) are very low. Also, following the establishment of yellow perch, the salmonids drastically changed their feeding habits, leading to growth rates reduced by up to 50%. With similar diets of zooplankton, insects, and small crustaceans, juvenile Smallmouth bass are also intense competitors with juvenile salmonids.

S. Stukel; USFWS PDM

Yellow perch

HABITAT MODIFICATION

Ideal freshwater habitats for salmonids to spawn and rear are characterized by well-oxygenated, moderately fast-flowing waters, complemented by slower-flowing and sheltered areas where salmon can rest and conserve energy. Infestations of freshwater aquatic invasive plants like Eurasian watermilfoil (*Myriophyllum spicatum*) and Brazilian elodea (*Egeria densa*) can disrupt these conditions. Dense mats of vegetation and excessive growth from these invasives impede water flow, crowd

C. Evans, Bugwood.org

Eurasian watermilfoil

G. Lovell, Bugwood.org

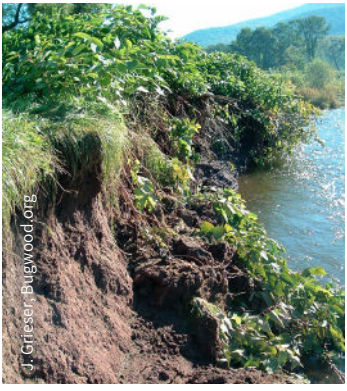
Brazilian elodea

out native species and lead to reduced dissolved oxygen levels. These conditions collectively impact the growth and development of salmon across all life stages, as well as the migration, feeding and reproductive abilities of juveniles and adults.

Invasive riparian plants like yellow flag iris (*Iris pseudocorus*), reed canary grass (*Phalaris arundinacea*), cordgrasses (*Spartina* spp.) and knotweeds (*Reynoutria* spp.) also impact critical breeding and rearing habitats for salmon. These plants clog waterways, displace native species, disrupt water flow, trap sediment and reduce the availability of nutrients necessary for the growth of juvenile salmon. Species like knotweeds exacerbate the problem by causing bank erosion and interfering with salmon habitat formation as they outcompete native tree seedlings and reduce the presence of essential large woody debris.

Yellow flag iris

Reed canary grass



Japanese knotweed

Cordgrass

European green crab (*Carcinus maenas*) is an ecosystem engineer known for its destructive impact on eelgrass (*Zostera* spp.) meadows. By burrowing for prey it uproots eelgrass plants, leading to the destruction of these vital habitats. Eelgrass meadows act as nurseries for juvenile salmon, attracting their preferred food sources and offering shelter from predators.

Male European green crab

DISEASES AND PARASITES

Whirling disease, named for the erratic circular, or "whirling" swimming behaviour it causes, is an infectious disease of salmonids caused by the freshwater parasite *Myxobolus cerebralis*. In infected juvenile salmonids, mortality rates can reach as high as 90%. Affected fish often exhibit skeletal deformities of the body and/or head, with shortened mandibles being a common characteristic. The tails of infected fish may appear dark or black due to damage to the caudal nerves controlling pigment deposition. Fry or juvenile fish are more susceptible to infection by the parasite and more likely to show symptoms of the disease.

Whirling Disease

Goldfish (*Carassius auratus*) in North America reportedly carry 23 species of parasites, one of which, *Ichthyophthirius multifiliis*, contributed to high mortalities of adult sockeye salmon in the Skeena watershed.

Northern pike and yellow perch also carry some parasites and diseases that are harmful to salmonids.

HOW YOU CAN HELP

CLEAN DRAIN DRY

Always remember to Clean, Drain and Dry all gear, clothing, boats, vehicles, and trailers before traveling to a new waterbody to ensure you don't bring invasive species along with you. Build in some time at the end of every trip on the water to follow these best practices for preventing the spread of invasives.

Always stop at the boat inspection stations throughout the province to ensure that you are not transporting invasive species by mistake.

Don't Let it Loose! Never release any pets into the wild, or dump aquarium water or plant parts into water bodies. Invasive species such as the red-eared slider turtle, goldfish, American bullfrog, and parrot's feather were introduced by aquarium dumping.

Never introduce any fish to a water body or use live bait when fishing — it is illegal and can introduce invasive species that will damage habitats and native species.

REPORTING

Report invasive species by using the mobile Report Invasives BC app for Apple and Android platforms, available for download at bcinvasives.ca/take-action/report.

IAS

You can report any invasive species through the ISCBC website, emailing info@bcinvasives.ca or 1-888-933-3722.

REFERENCES/LINKS

Invasive Species Alert – European Green Crab, Pacific Salmon Foundation.

Eelgrass Meadows, Parks Canada.

Five Invasive Species That Harm Salmon and Their Habitats, CIAA.

Vulnerability of Pacific salmon to invasion of northern pike (*Esox lucius*) in Southcentral Alaska, PLoS one.

State of Salmon, Pacific Salmon Foundation.

Fisheries and Oceans Canada. 2023. Southern Salmon Integrated Fisheries Management Plan 2023/2024.

Biological Synopsis of Largemouth Bass (*Micropterus salmoides*), Fisheries and Oceans Canada 2009.

Ichthyophthirius multifiliis (Ich) Epizootics in Spawning Sockeye Salmon in British Columbia, Canada, Journal of Aquatic Animal Health 1998.

A Biological Synopsis of Yellow Perch (*Perca flavescens*), Fisheries and Oceans Canada 2009.

Biological Synopsis of Smallmouth Bass (*Micropterus dolomieu*), Fisheries and Oceans Canada, 2009

The role of waterbirds in the dispersal of aquatic alien and invasive species, Diversity and Distributions 2015.

PACIFIC SALMON FOUNDATION

This project was undertaken with the financial support of:
Ce projet a été réalisé avec l'appui financier de :
Environment and Climate Change Canada | Environnement et Changement climatique Canada

BCINVASIVES.CA
info@bcinvasives.ca
1-888-933-3722

iSC Invasive Species Council of BC

ADDITIONAL CONTACT INFO