



YUKON RIVER
CHINOOK SALMON
STOCK RESTORATION



Fisheries and Oceans
Canada

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Canada



Chinook spawning, Tatchun Creek (P. Mather)

YUKON RIVER CHINOOK STOCK RESTORATION WORKSHOP BACKGROUND

OVERVIEW / OBJECTIVE

Through the combination of effective management, conservation and restoration measures, First Nations, governments, members of the public and stakeholders can contribute towards restoring the health of wild salmon populations to healthy, harvestable and self-sustaining levels.

It is important to consider the health of both fish stocks and habitat when developing a strategy to restore Chinook salmon in the Yukon River. Both aspects can play a role in conservation and restoration efforts, but each has to be considered carefully in order to decide on the appropriateness and likely effectiveness in supporting the restoration goal. The next step is to consider the technique or strategy that is most likely to be successful.

CHINOOK LIFE HISTORY AND HABITAT NEEDS

To understand what strategies and techniques to use, it is important to understand Yukon River Chinook salmon and their life cycle and habitat requirements. Like all species of Pacific salmon, Chinook salmon rely on both freshwater and marine environments. After hatching, juvenile Yukon River Chinook salmon remain in fresh water for one or two years before migrating to the ocean as smolts. The young salmon will then stay in the Bearing Sea and North Pacific Ocean for 3 to 5 years before returning to their natal streams and rivers to spawn. Throughout their lives, Yukon River Chinook salmon will travel thousands of kilometres during their freshwater and marine migrations.

Habitat use in the early rearing period in fresh water is an important consideration in Yukon River Chinook conservation and restoration. Juvenile Chinook salmon



Separating eggs (YEC)



Collecting milt (YEC)

prefer streams with an abundance of pools, large woody debris, and with coarse substrates such as boulders that provide cover and complexity, and large rivers with gravel bars and cobble shorelines. Suitable over-wintering habitat is critical to their survival through the long, cold northern winters. Over-wintering fish are found in the Yukon River's mainstem but also in tributary streams and rivers where strong groundwater flows prevent the water from freezing.

Attention to the link between early life stages and habitat use is an important lens through which to consider conservation and restoration efforts and priorities.

THE ROLE OF HATCHERIES

Rehabilitation of Chinook salmon populations through hatchery-related programs can, and have, been used successfully in certain circumstances to restore the numbers of wild fish to desired levels.

What is it?

The primary goal of a hatchery is to improve the rate of survival of eggs, fry, and juveniles – early life stages that typically experience high mortality in the wild. By collecting

salmon eggs from the wild, a successful hatchery program can produce proportionally more returning adults than would have occurred in the natural environment due to decreasing the level of mortality resulting from predation, disease, environmental conditions, and other factors. The basic approach includes collection of salmon eggs from specific adults, growing the fish to the fry or smolt stage, and then releasing the fish back into the original system.

Advantages of Hatcheries:

- Hatcheries can reduce short-term extinction risks by helping to maintain a population at a safe level until factors responsible for declines can be addressed.
- Hatcheries can dramatically improve survival between eggs and fry, or smolts, through their careful rearing in a controlled hatchery environment, and proper fish culture.
- The use of hatcheries can then lead to more adults returning and contribute to the acceleration of stock restoration.
- Using adult salmon from the local stocks means the hatchery released fish are genetically the same as the natural spawning population.
- The use of hatchery raised fish can further stock recovery by providing fry for reintroduction into vacant habitats.

Releasing local broodstock hatchery fish into wild systems in areas of the Pacific Northwest has resulted in returns that spawn naturally with, and among, wild fish.

Concerns with Hatcheries:

- There is the risk that mechanical and technical difficulties could occur in the hatchery (disruption of power or water supplies) resulting in egg or fry mortality.
- Disease outbreaks can result in the loss of large numbers of fish in the hatchery, and fish health must be managed very carefully with a veterinarian's oversight.
- Hatcheries are often relatively costly to operate, typically involve a significant initial investment, and require constant supervision while operating. They are a long term commitment.
- When not managed carefully, fry produced through hatchery programs can pose genetic, behavioural, and ecological threats to wild populations. Appropriate guidelines, standards, and proper operations can manage these risks.

- Increasing the abundance of salmon through hatchery production, in absence of appropriate and complimentary fishery management strategies, could lead to overharvest of wild stocks and further suppress the rate of recovery.

There are two active Yukon River Chinook Salmon hatchery projects operating in Canada. Both use eggs from adult fish taken from the Whitehorse Rapids Fishway, with juvenile salmon released at carefully selected release sites in the upper Yukon River watershed. All juvenile Chinook salmon produced by these projects are marked utilizing an adipose fin clip and coded wire tag which enables biologists to identify and track these fish throughout their lives.

1. Whitehorse Hatchery – produces 150,000 to 400,000 fry each year.
2. McIntyre Creek – produces up to 100,000 fry per year.

Presently, these are the only two sites that produce hatchery-raised Chinook salmon for release into the Yukon River watershed.

HABITAT RESTORATION AND ENHANCEMENT

What is it?

Chinook salmon require streams and rivers with cool, clean, connected, and complex habitats with good water quality and low levels of fine sediment and turbidity. Juvenile Chinook are associated with streams that contain large woody debris (LWD) or boulders. Access to suitable habitats with abundant food sources are critical to juvenile Chinook salmon growth during the short northern summer, while availability and access to overwintering habitat enables survival during the coldest winter months. Spawning salmon and incubating salmon eggs are particularly sensitive to changes in the aquatic environment. Both environmental and human activities can reduce habitat complexity, connectivity, water quantity and quality, and riparian function creating challenges for Chinook salmon growth, survival and overall health.

Habitat Restoration or reclamation projects can help to ensure habitats are available for salmon by reconstructing elements of the stream that have been damaged or lost, thereby improving survival rates in the early life stages of Chinook salmon.

Common community-based habitat restoration techniques throughout the Pacific coast include bank stabilization, beaver dam management, log and debris jam management,



Fry release (D. Zimmermann)

boulder placement, large woody debris placement, gravel catchment/placement, and off-channel habitat improvement/development.

Habitat Enhancement involves the creation of habitat features that improve the quality or abundance of certain types of habitat, and in-turn, can improve the health or survival rates of juvenile salmon. Habitat enhancement programs can also involve improving or establishing access to new areas for salmon, typically through barrier removal or remediation.

Advantages:

All habitat restoration and enhancement strategies have benefits including improving water quality, restoring fish passage and access to upstream areas, improving spawning success, providing cover for both juvenile and adult fish, and creating additional spawning and rearing habitat.

Concerns with Habitat Restoration or Enhancement:

- The use and effectiveness of restored or enhanced habitats is contingent on the presence and abundance of salmon. Without sufficient numbers of salmon, the benefits of restored or enhanced habitats is likely to be diminished.
- The benefits resulting from successful habitat projects can take a long time to be realized (typically several life cycles).
- In some cases, habitat restoration or enhancement projects require considerable time and effort before changes in natural salmon production are observed. This means that often habitat projects involve a long-term commitment.
- Projects can be costly to build and maintain.
- Removing obstructions can be dangerous and may have the unintended consequence of reducing critical overwintering habitat.

- Off-channel development can be expensive to build, require engineering experience and heavy machinery, and poorly designed systems can trap fish.
- In northern or pristine environments there may be limited opportunity to successfully enhance or restore habitats to a level beyond what is naturally present.

Habitat conservation and restoration projects often require partnership and commitment, technical capacity, and adequate (sustained) funding. Generally, the rationale for selecting a habitat project as part of an integrated restoration strategy is based on the balance between the biological benefit and the cost and feasibility of carrying out the project.

How Habitat Projects Can Contribute to Stock Restoration Objectives

Objective	Action
Protect existing areas where high ecological integrity and natural ecosystem processes persist.	<ul style="list-style-type: none"> • Communication, education, outreach
Protect and restore riparian habitat and access along spawning and rearing streams.	<ul style="list-style-type: none"> • Improve fish passage • Relocation to productive habitats upstream (fish salvage) • Riparian habitat characterization and mapping • Overwintering habitat access
Increase habitat diversity in the short term by adding in-stream structures (e.g., LWD, rocks, etc.) where appropriate.	<ul style="list-style-type: none"> • Juvenile habitat utilization assessment • Structure placement for cover
Establish, restore, and protect stream flows and water quality suitable for spawning, rearing, and migration.	<ul style="list-style-type: none"> • Flow augmentation/flow deflectors • Sediment and erosion control



GET INVOLVED!

"Recovery cannot be accomplished through legislation, rules, or money. These are only tools for recovery. It depends on the cumulative effort of people working as individuals and collectively through and with organizations and governmental entities to achieve a common goal...recovery will require fundamental changes in how we view, care for, and manage our fish, streams, and watersheds. A successful recovery program must work for people and fish. It must be sound biologically and technically and also be sensitive and responsive to regional and local cultural, social, and economic values."

– Upper Columbia Salmon Recovery Board

Yukon Salmon Sub-Committee

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