

Whitehorse Rapids

Fish Ladder and Hatchery



photos: eggs, Peter Long; fish, Yukon government



photo: www.sarabould.com

YUKON
ENERGY



An Ancient Salmon Migration

For thousands of years, salmon have traveled up the Yukon River to spawn in its many tributaries. Some traveled as far as the Yukon River's headwaters, near the present day location of the Whitehorse Rapids Fishway. The salmon laid their eggs in the gravel where they developed over the winter and hatched into tiny alevins in the early spring. These tiny fish began to feed and grow in the cold, clean water. The young salmon spent one to two years in the river before they made their way to the ocean, only to return in a few years as adults to begin the cycle anew.

Thus the cycle continued, uninterrupted, until the late 1950s, when the Northern Canada Power Commission built the Whitehorse Rapids Hydroelectric Facility to meet the electricity needs of a growing community. In 1959, the Whitehorse Rapids Fishway, known locally simply as 'the fish ladder', was built to help this ancient migration continue by allowing passage of the salmon around the dam. In 1983 and 1984, the Whitehorse Rapids Fish Hatchery began a salmon transplant program in a further effort to build and maintain the salmon stocks.

This booklet is meant to give you a greater understanding of the chinook salmon and freshwater fish that inhabit the Yukon River, and the work being done to preserve and enhance this precious resource.

below

chinook salmon at the fish ladder

photo: Yukon government



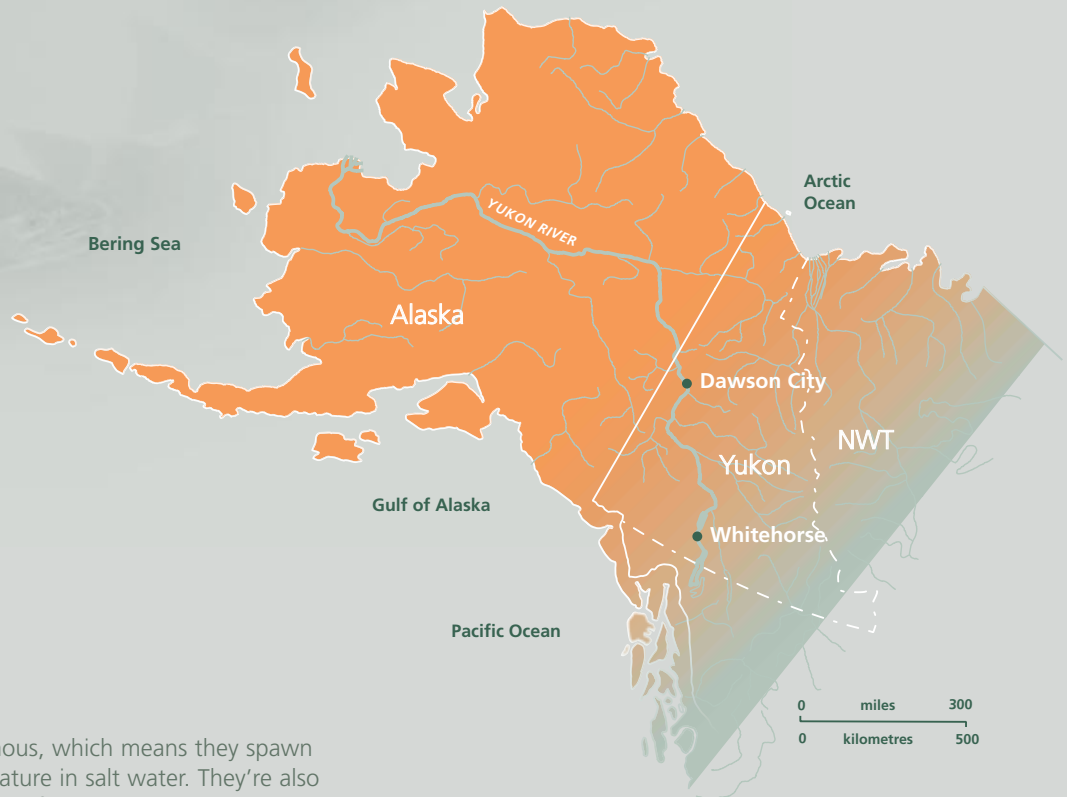
the salmon migration route begins at the Bering Sea and continues to Yukon River tributaries south of Whitehorse

The Salmon Resource

Chinook salmon are anadromous, which means they spawn in fresh water and live and mature in salt water. They're also semelparous, meaning they die after spawning only once.

Once the adult female deposits her eggs in a gravel nest or "redd", and the male fertilizes them, the eggs incubate in the cold Yukon water throughout the winter. The eggs hatch during late-winter/early spring and the resulting "alevins" remain under the gravel using their yolk-sac as their sole source of nutrients. Once the yolk supply is used up the small fish (known as 'fry' at this stage) emerge from the gravel and begin to feed and grow in their freshwater environment. After spending one winter in fresh water, the fish begin their downstream migration to salt water where they will mature to adults.

The young fish (smolts) eventually enter the Bering Sea off the west coast of Alaska. They spend the next two to six years (usually three to five) migrating throughout the North Pacific Ocean. Responding to genetic and environmental triggers, the adults enter the mouth of the Yukon River in early summer and begin a 3,200 kilometre journey upstream, to the same stream or river where they were originally spawned. They don't eat during the two months it takes them to swim from the Pacific Ocean to Whitehorse, relying instead on stored body fats for energy.



Their journey is a perilous one. Many of these salmon become victims of predation and fishing. Only a small portion of the original number survives to pass through the Whitehorse Rapids Fishway. From there, they continue on to the Upper Yukon River tributaries, where they, like their parents, spawn and die, completing their life cycle.

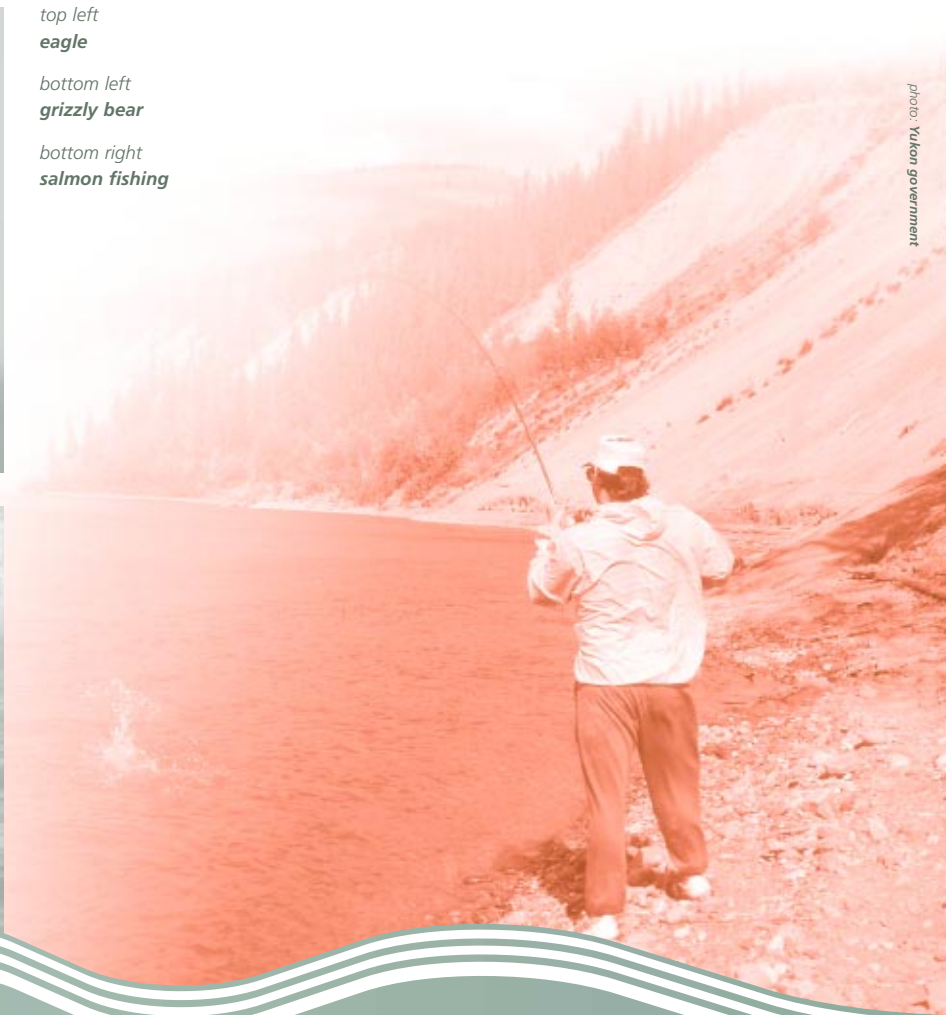
The migrating salmon support fishers in Alaska and the Yukon. As the salmon spawn and die, they provide a rich food source to a wide variety of birds and mammals. These animals carry the nutrients from the salmon carcasses to the surrounding land. Carcasses left in the stream support rich and diverse populations of invertebrates. The land and waters around the spawning areas are therefore enriched with nutrients brought back from the sea by the returning chinook.



top left
eagle



bottom left
grizzly bear



bottom right
salmon fishing



photo: Yukon Energy

above right
construction of the dam and fish ladder

The Building of the Whitehorse Rapids Dam and Fishway

In the mid-1950s, the Yukon underwent many changes. The Alaska Highway (built during World War II) and the Klondike Highway linked many Yukon communities. The sternwheelers, which had operated on the Yukon River between Whitehorse and Dawson for half a century, became obsolete. The capital of the Yukon moved from Dawson to Whitehorse, contributing to the rapid growth around Whitehorse.

above left
the Whitehorse Rapids Fishway

At that time, the Yukon Electrical Company provided the city with electricity from a diesel generator located downtown beside the White Pass railway depot. However, as the demand for electricity grew, the Northern Canada Power Commission decided to build the Whitehorse Rapids Hydroelectric Facility.

Construction began in 1956 and electricity was first generated in 1958. The Whitehorse dam backed up the Yukon River, forming Schwatka Lake. The infamous White Horse Rapids that had posed such a hazard to gold seekers during the Klondike Gold Rush disappeared as the water level rose.

At the time of construction a number of structures were designed to ensure that the salmon could bypass the dam and reach spawning grounds upstream. Special underwater screens were installed to stop the fish from swimming into the turbines. A concrete dam or weir was built to help direct the fish toward the fishway. An underwater canal was added to help the salmon find their way, and the fish ladder was constructed. At 366 metres it is considered to be the longest wooden fish ladder in the world.

At the interpretation centre adjacent to the Whitehorse Rapids Fishway, you can view fish migrating through the ladder by way of observation windows, while learning more about the salmon and other fish species from displays inside the building and the viewing platforms above the Yukon River.



photo: Yukon government

below
salmon in observation window



photo: Yukon government

top right
on the observation deck at the fish ladder

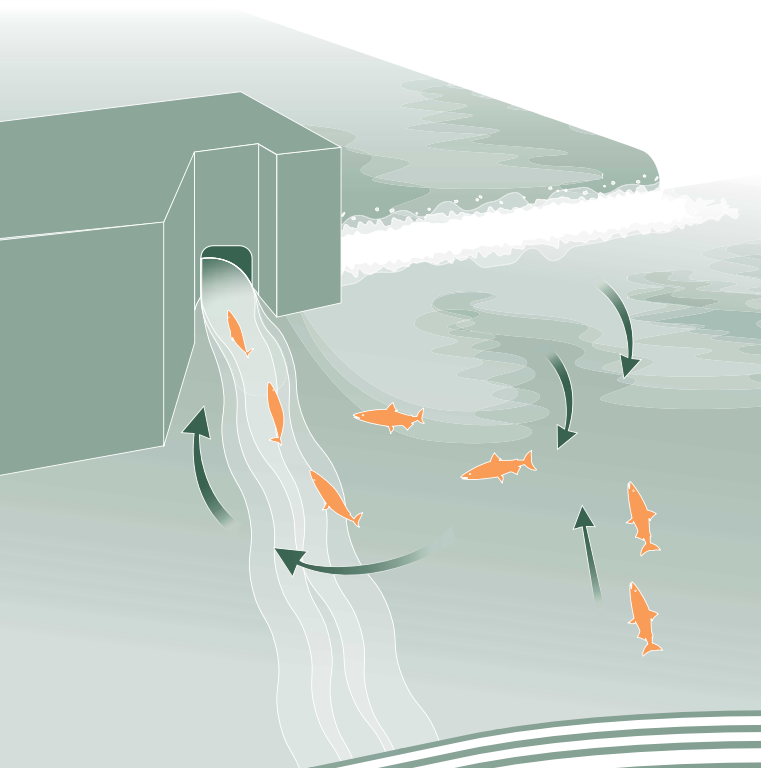
bottom right
inside the fish ladder interpretive centre

How Yukon Energy's Fish Ladder Works

The fish ladder is built in a series of steps that span a rise of more than 15 metres, from the Yukon River up to Schwatka Lake. Each step has a vertical baffle and a submerged opening, allowing the option of jumping over or swimming through. The flow of water through each section creates a series of eddies, allowing the fish to rest between each step, while providing enough flow to encourage the fish to continue swimming. If you examine a section of the ladder, you will see that each eddy spins in the opposite direction from the one below and above.

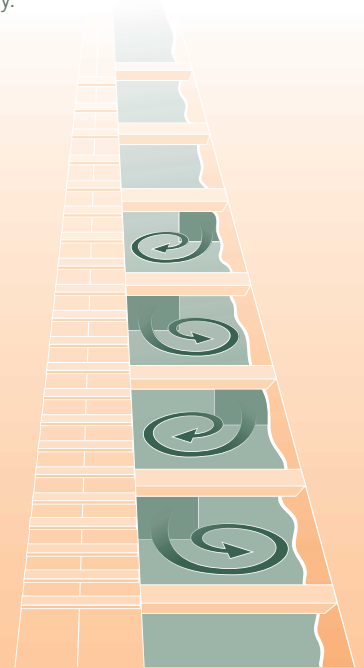
About halfway along the ladder, the fish enter a holding area. At this point they can be seen through the observation window in the interpretation building.

When the salmon enter the holding area, gates on both the upstream and downstream sides are closed temporarily while staff observe and record the size, sex, origin (wild or hatchery) and condition of the fish. Also at this time, some chinook salmon are collected for the brood stock program at the Whitehorse Rapids Fish Hatchery.



right
**eddies in the
fish ladder**

left
**Underwater baffles
cause the flow
to move to the
right bank, nudging
fish over to
the downstream
entrance of the
fishway.**



The Whitehorse Rapids Fish Hatchery

The Whitehorse Rapids Fish Hatchery was constructed and began operation in 1984. Its purpose was to compensate for the loss of downstream migrating chinook salmon fry as they passed through the turbines at the Whitehorse Rapids Generating Facility in Whitehorse.

The Department of Fisheries and Oceans Canada played a major role in the design of the hatchery and the Northern Canada Power Commission oversaw its construction. Yukon Energy took over ownership of and responsibility for the hatchery in 1987.

The Facility

The hatchery was built to produce a specific number of chinook salmon fry for release each year at natural spawning sites in tributaries of the Upper Yukon River system. The facility is supplied by a constant supply of clean, cold (6°C) well water. This water is pumped from the ground to the top of the hatchery building. From there it falls through a large aeration chamber where nitrogen gas is removed and oxygen is enhanced. The water is then collected in a large reservoir tank and gravity fed throughout the hatchery. The building is kept warm using a heat pump that draws heat from the same water that is used for the fish.

*behind
fry at the fish hatchery*

*below
outdoor tanks at the fish hatchery*

photo: www.archbould.com





trays with fish eggs



chinook salmon eggs, ranging in colour from pink to bright orange, are about the size of a green pea



alevin—these 2.5 centimetre-long hatchlings retain their yolk sacs for nourishment until they are ready to swim and obtain their own food

photos: Peter Long

right fry—the salmon weigh approximately three grams and are released into Yukon River tributaries upstream of Whitehorse

The Process

Broodstock are collected from the fish ladder each year during late July and August. The adult salmon are moved to the hatchery and held in the cold water until ripe for spawning. At that time, eggs and milt are collected and the fertilized eggs begin the incubation process. The hatchery is equipped with a large number of incubation trays where the eggs are placed and supplied with flowing water until they hatch in late winter. The resulting yolk-fry, or alevins, remain in the incubation trays until their yolks are absorbed. At that time, they are transferred to circular growing tanks where they are fed and cared for until time for their release in June at a weight of about three grams.



photo: www.archbold.com

Just prior to release, the young fish (fry) are anesthetized briefly so that tiny metal tags containing a binary computer code can be inserted into their nose cartilage. The nose tag provides scientific data regarding the age of the fish, migration patterns and release sites. As well, the small adipose fin on the back of each fish is clipped to indicate the presence of a nose tag.

The fry are released at designated sites in early June by way of tanks in trucks, boats or large release buckets carried by helicopter. Once released into the wild, the fry feed and continue to grow until it is time to begin their migration to the ocean. The hatchery reared fry tend to begin their migration to the ocean shortly after release, unlike the wild stock which will remain in fresh water for one winter before heading to the ocean.



photo: www.archbould.com



photo: www.archbould.com

*left to right
clipping adipose fins prior to
being released in local waterways;
fry release at Michie Creek*

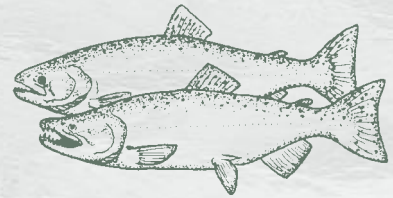
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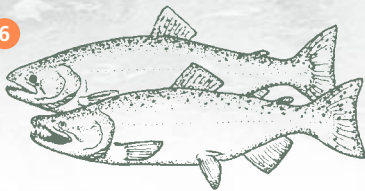
4



5



6



- | | |
|-------------------------------------|-------------------------------------|
| 1 lake trout | 4 bull trout |
| 2 arctic char | 5 rainbow trout |
| 3 chinook salmon
(male & female) | 6 kokanee salmon
(male & female) |

photo: www.archbould.com



photo: www.archbould.com



The Expansion

In 1996, an expansion of the hatchery began that allowed for the culture of several additional species of fish. Collectively called “freshwater species”, they have included bull trout, rainbow trout, arctic char, lake trout and kokanee salmon. This program is sponsored by the Yukon Department of Environment. These species are stocked into pothole lakes each year to provide additional angling opportunities while reducing fishing pressure on indigenous species such as lake trout.

right top to bottom
fish hatchery tanks; children help
hatchery staff release the salmon fry
into Wolf Creek



The Results

Since 1984, approximately 150,000 to 400,000 chinook salmon fry have been released into the Upper Yukon River system each year in an attempt to maintain this valuable stock of chinook salmon. The result of this effort can be seen every year at the Whitehorse Rapids Fish Ladder. All returning adult chinook salmon must pass through the ladder on the way to their respective spawning grounds upstream of Whitehorse. As they pass through the ladder, the fish can be counted, categorized by sex and wild or hatchery origin, and selected ones can be retained for the next year's broodstock to produce eggs and milt for the continuing hatchery operation.

The Whitehorse Rapids Fish Hatchery is the only chinook salmon hatchery on the Yukon River. It not only serves to supplement the natural Yukon River salmon stock but also, in conjunction with the Whitehorse Rapids Fishway, allows for one of the most popular tourist attractions in the Yukon.

*left to right
carrying the fry to release location by
helicopter; recording fish sex, size and origin;
child helping with release of fry*

photo: City of Whitehorse



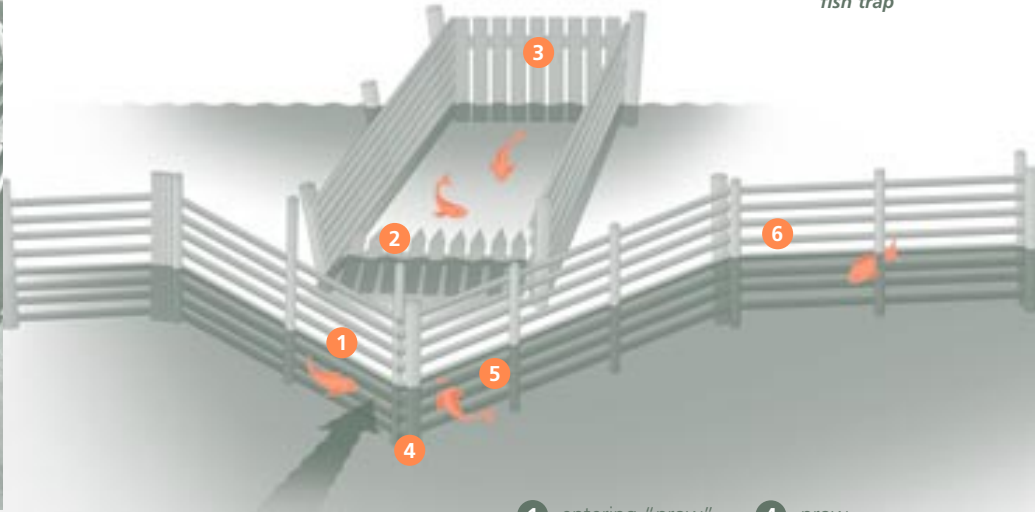
photo: www.archbould.com





photo: Yukon Archives, Robert Storm fonds, 94/76 #29

above
Yukon River fishing expedition, 1936



below
fish trap

- | | |
|--|---|
| 1 entering "prow" | 4 prow |
| 2 sharpened stakes allow fish in but not out | 5 fish turns downstream and enters trap |
| 3 rectangular trap | 6 fence |

First Nations and the Salmon

At the end of the last ice age, some 10,000 or 11,000 years ago, the great glaciers melted and the Yukon River linked up with the Pacific Ocean via the Bering Sea. It took thousands of years for the glaciers to melt and many more centuries for the melt water to be clear of glacial silts. Once the silts settled and the water was clear, salmon began to migrate up the river.

Until that time, the people in this area had been hunters. They may have originally come here following the herds of caribou across the Bering land bridge to the ice-free area of the northern Yukon and Alaska, known as Beringia. As the ice receded, vast grasslands opened up, drawing the grazing animals further to

the south. When the salmon began to run in the rivers, however, the people soon became very proficient fisher folk, making the annual migration of salmon part of their yearly harvesting routine.

Catching the Fish

The methods of catching the salmon varied. The simplest approach was to spear or gaff the fish where they stopped to rest in eddies or behind rocks. Later, nets were used with sinkers and floats attached to keep them in place in the current. This was much more efficient as the people only had to check them a few times a day.

Various types of traps were also designed. In shallower water, people sometimes constructed fences of sticks to funnel the fish into a narrow compound where they would be trapped. The rails of the fencing allowed the water through, but not the fish. The fish followed the fence to a narrow opening where they entered the prow. At this point they turned around to head downstream and enter the trap. Sharpened stakes prevented them from leaping out.

After an ample catch, the people would allow some fish to escape. This ensured there would be plenty of fish to spawn and maintain the stocks.

Much later, fish wheels were used. This device consisted of large buckets mounted on a wheel, which floated on a raft. The river current would turn the wheel, scoop up fish and dump them into a holding basket.

Preserving the Fish

In order to provide people with enough food to last them through a long Yukon winter, fish were preserved by drying. The fish were split and laid open or cut into strips and hung on a wooden rack over a smoky fire. The smoke dried the fish and acted as a natural preservative. This is still a popular method for preserving fish today.

Today

The First Nations' relationship with salmon has been forged over thousands of years. The annual chinook salmon run still provides food for the aboriginal people of the Yukon. The federal government relies on the traditional knowledge of First Nation elders to help manage the fish stocks.

photo: Yukon Archives, Claude and Mary Tidd fonds, #8411



left
fish wheel near Fort Yukon circa 1936

behind
fish drying rack near Forty Mile, 1930s

Come Visit Us!

The Whitehorse Rapids Fishway is open daily from June to early September. For further information, please call (867) 633-5965.

The Whitehorse Rapids Fish Hatchery is not set up to handle tours. However, it is possible to make special arrangements for small groups to visit the facility. Call (867) 668-3938 for details.

For information about any of Yukon Energy's other facilities, visit www.yukonenergy.ca.

right

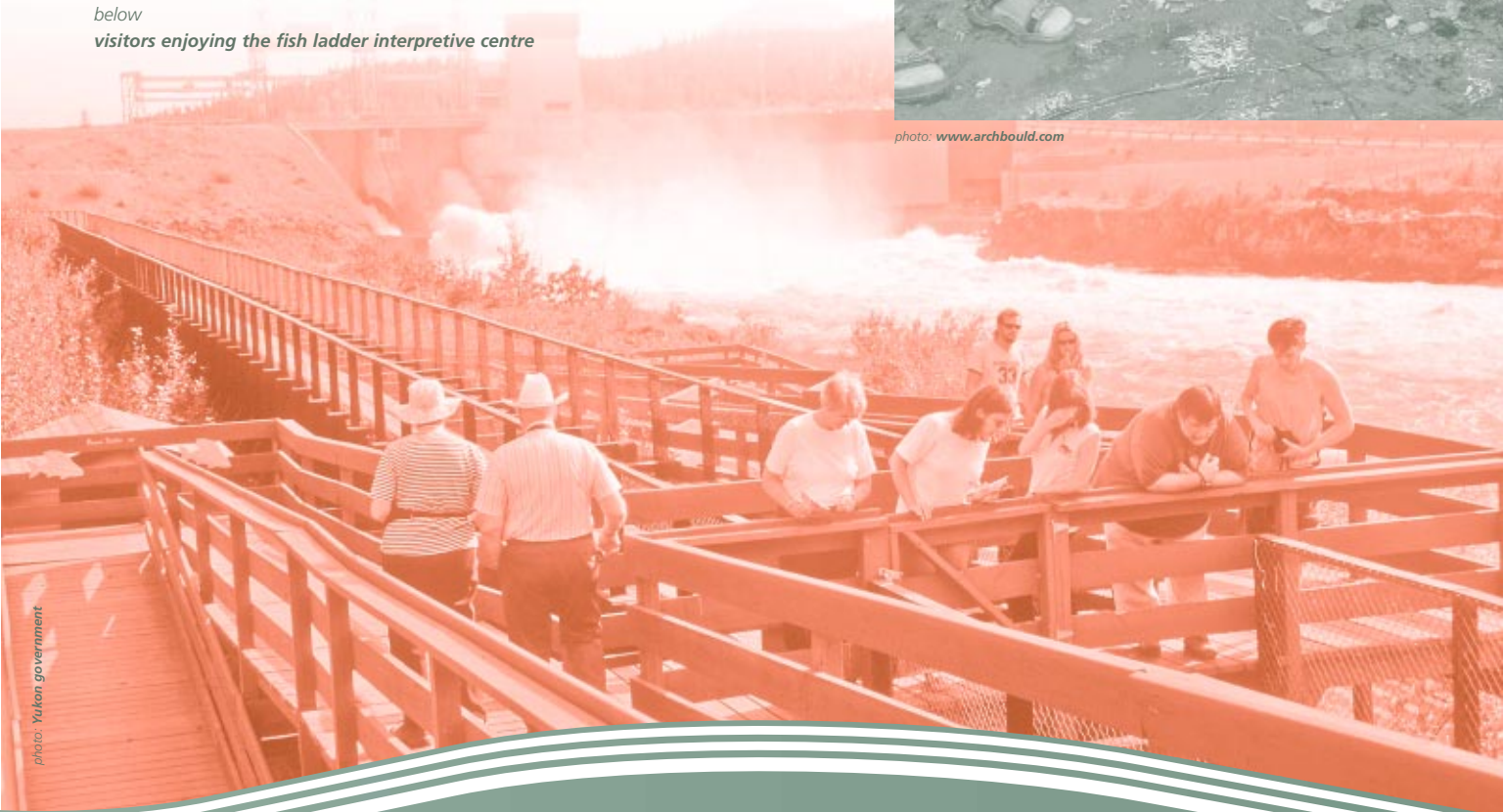
a Whitehorse family helps with the fry release

below

visitors enjoying the fish ladder interpretive centre



photo: www.archbould.com



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photo: Peter Long



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