



Coded Wire Tagging of Chinook Salmon at the Whitehorse Rapids Hatchery in 2010

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Abstract

Chinook salmon fry reared at the Whitehorse Rapids Hatchery were adipose fin-clipped and injected with “Agency-only” coded wire tags in the early summer of 2010. This was the fourth year the facility used an “Agency-only” coded wire tag. Tricaine methane sulphonate (MS222) was used to anaesthetize the fry prior to clipping and tagging. The 2010 release of a total of 124,920 fry in four areas upstream of the Whitehorse Rapids dam included:

- 12,000 into Wolf Creek on May 30,
- 24,242 into the main stem Yukon River on June 1;
- 68,964 into Michie Creek on June 1; and
- 19,714 into the McIntock River on June 1.

Three fry released with “Agency-only” coded wire tags in 2007 were recovered in mid-September in the Bering Strait during a surface trawl operation aboard a National Oceanic and Atmospheric Administration research vessel. These recoveries represent the most northerly recoveries of coded wire tagged Chinook salmon released in Whitehorse, Yukon.

The Whitehorse Rapids Fishway program, another program undertaken by the Yukon Fish and Game Association, has a number of components that relate to the Whitehorse Rapids Hatchery coded wire tagging program. In 2010, 328 of the 672 returning adult Chinook salmon counted at the fishway were of hatchery origin. The hatchery component included 59 females and 269 males and represented 49% of the Whitehorse Rapids Fishway count.

This year 21,736 visitors came to the Whitehorse Rapids Fishway! Last year there were 14,541 visitors. That is an increase of 7,195 visitors! While this is up from 2009 and 2008 (13,162) it is comparable to the numbers seen in 2007 (22,141) and lower than in 2006 (28,854).

There are many visitors that speak different languages. The most common language spoken was German with 1,247 visitors. The German translation of the brochure Whitehorse Rapids Fish Ladder and Hatchery was extremely helpful.

Visitors were provided opportunities to view the returning salmon and learn about the Upper Yukon Chinook salmon resource and the coded wire tag program. Local students employed at the Whitehorse Rapids Fishway provided information and answered the visitors’ questions. The Whitehorse Rapids Fishway staff also assisted hatchery staff in the collection of biological data and the recovery of coded wire tags from the hatchery fish which were used for broodstock.

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Introduction

Coded-wire tags (CWT's) are small, metal, coded tags that are injected into the nose cartilage of juvenile salmon. The first tags, developed in the 1960's, were replaced by binary-coded tags in 1971. The improved readability and an increase in the number of available codes provided additional data to tagging programs. In addition, juvenile fish tagged with CWT's are given a secondary, external mark, typically the removal of the adipose fin, to allow visual identification (Johnson 1990).

Coded wire tags are widely used in North America. Studies involving them generally fall into one of the three following categories: experimental, stock assessment and stock contribution. Experimental studies are designed to compare the survival of two or more groups of fish, or their contribution to a specific fishery or fisheries. Stock assessment studies are designed to measure contributions to fisheries, survival rates, and distribution of a given stock. Stock contribution studies focus on exploitation of the stock in a fishery or fisheries and require more tagged fish to generate meaningful results (Johnson 1990).

Groups of Upper Yukon River Chinook salmon have been tagged with coded wire tags annually in the Yukon Territory since 1985¹, principally by Fisheries and Oceans Canada. In excess of 80% of all the fish tagged have originated from the Whitehorse Rapids Fish Hatchery (WRFH). The hatchery was constructed in 1984 in concert with the construction of a fourth turbine at the Whitehorse hydroelectric facility in order to offset a perceived impact that the hydro generating facility was having on Chinook salmon. Over the 1985 to 2006 period, the WRFH released a total of 5,092,147 Chinook salmon fry. Of these, 3,626,512 fry were tagged with CWT's and externally marked using adipose fin clips. An additional 291,022² fry were released with an adipose clip but not tagged and 1,174,613 fry were released without a tag or adipose clip. Annually, 34% to 100% of the hatchery release has been tagged. The tags are applied to young of the year fry (also known as age "sub 1's" or "0-check" fry) in late May or early June, after a period of hatchery rearing. Almost all of the fry have been released into the Yukon River at sites located upstream of the hydroelectric facility.

A decision was made in early 2007 to change the tags applied from binary coded, coded wire tags to "Agency-only" type tags and to discontinue the carcass recovery portion of the Whitehorse Rapids Fish Hatchery Coded Wire Tagging project. The long-term objectives of the WRFH Chinook salmon CWT program are to:

¹ An exception occurred in 1999 when all fry released from the Whitehorse Rapids Hatchery were marked with the removal of their adipose fin, but coded wire tags were not applied.

² This total includes 240,040 fry released in 1999; these fish had their adipose fins clipped, but they were released untagged.

- (1) Obtain information on survival and exploitation rates, run timing, and distribution of Chinook salmon in the upper Yukon River system;
- (2) Permit the identification of returning hatchery fish in order to assist the WRFH broodstock collection;
- (3) Provide information on the return of hatchery-reared fish as they move upstream through the WRF; and
- (4) To provide data upon which to base assessments of the success/failure of the WRFH in producing Chinook salmon.

The specific goals of the 2010 WRFH Chinook salmon CWT program were to:

1. Apply CWT's to all Chinook fry released from the WRFH;
2. Monitor the return of adult salmon as they pass through the WRF and assist in the biological sampling of these fish; and
3. To encourage stewardship of the Yukon River Salmon fishery through interpretive displays and talks at the Whitehorse Fishway.

Materials and Methods

Coded Wire Tag Application

Phyllis Nelson of 'Eh! Fish' was contracted to conduct the tagging and fin clipping. Ms. Nelson, one additional tagger and four adipose fin clippers were employed. Operations commenced on May 24, 2010 and were completed on June 8.

The "Agency only" tag code identifies the fry as being tagged by DFO. Other (i.e. southern) DFO CWT programs use the same tag code; however, the Whitehorse Rapids Hatchery was the only facility that tagged Chinook salmon with this code in 2010.

Fry were sorted according to size and condition prior to tag application. Small or deformed fry were not tagged. Feeding was suspended for at least 24 hours prior to tagging and resumed afterwards. Feeding was suspended again for a period of 24 to 48 hours prior to release.

Batches of approximately 50 fry were held in a nine-litre capacity plastic tub containing anaesthetic, for a minimum of two minutes prior to fin clipping. The anaesthetic used was tricaine methane sulphonate (MS222). Anaesthetic baths were changed frequently to prevent thermal shock of the fry, and to refresh the anaesthetic. Once the fry were fin clipped, they were made accessible to a tagger for "Agency-only" tag application.

After tagging, each fry was immediately passed through a quality control device (QCD) to check for successful tag implantation.

The QCD automatically detects, separates, and enumerates tagged and untagged specimens. Untagged fry identified by the QCD were checked a second time for tag implantation. All untagged fry were then retagged with a CWT. Once tagging was complete, the fry were held in rearing tanks for five days, and sample lots were passed through a QCD to determine CWT retention.

Results and Discussion

Coded Wire Tagging

Table 1. Summary of tagging and release dates for fry released from the Whitehorse Rapids Fish Hatchery in 2010.

<u>Location</u>	<u>Date</u>	<u>Number released</u>
Wolf Creek	May 30	12,000
Michie Creek	June 1	68,964
M'Clintock	June 1	19,714
Main stem Yukon River	June 1	24,242
	Total	124,920

The total number of fry tagged and released in 2010 was 124,920 (Appendix 2). Fry weight at time of release ranged from 2.9 grams to 3.0 grams with an average weight of 3.0 grams.

One difficulty encountered when evaluating differential survival based on CWT data is the requirement to obtain an adequate CWT sample from the returning adults. This requires sampling at least 20% of the return for coded wire tags. It has been difficult to mount a statistically valid sampling program in the existing fisheries (particularly the U.S. based commercial and subsistence fisheries) and it has been difficult to obtain samples from spawning locations due to access issues and a lack of available carcasses. To resolve this shortcoming, a representative sample of 20% of the return of adult salmon could be harvested as the fish pass through the Whitehorse Rapids Fishway; however this method of destructive sampling is not desired, particularly in years of low returns.

The broodstock collection guidelines established for the WRFH prior to YR 2000 required that the use of hatchery-origin fish be minimized. This approach was reviewed by DFO prior to the YR 2000 broodstock program.

A literature review by Whitehorse DFO staff found that hatchery broodstock requires only a 10% infusion of a wild component every second generation to maintain genetic diversity (Bonnell 1999). The requirement to minimize the number of hatchery fish used for broodstock has since been relaxed. This approach has facilitated the recovery of CWT's by the hatchery and fishway staff when broodstock is collected, however, the overall number of CWT's collected as a result of this still remains low.

It is interesting to note that three fry released this spring bearing the "Agency-only" tag code (i.e. DFO tags) were recovered at 65 19⁰N and 168 07⁰ W on September 13, 2007 during surface trawl operation aboard the NOAA Ship Oscar Dyson. The most interesting aspect of these tag recoveries is that they identify a northward migrating component in Yukon salmon within the Bering Strait (Appendix 1).

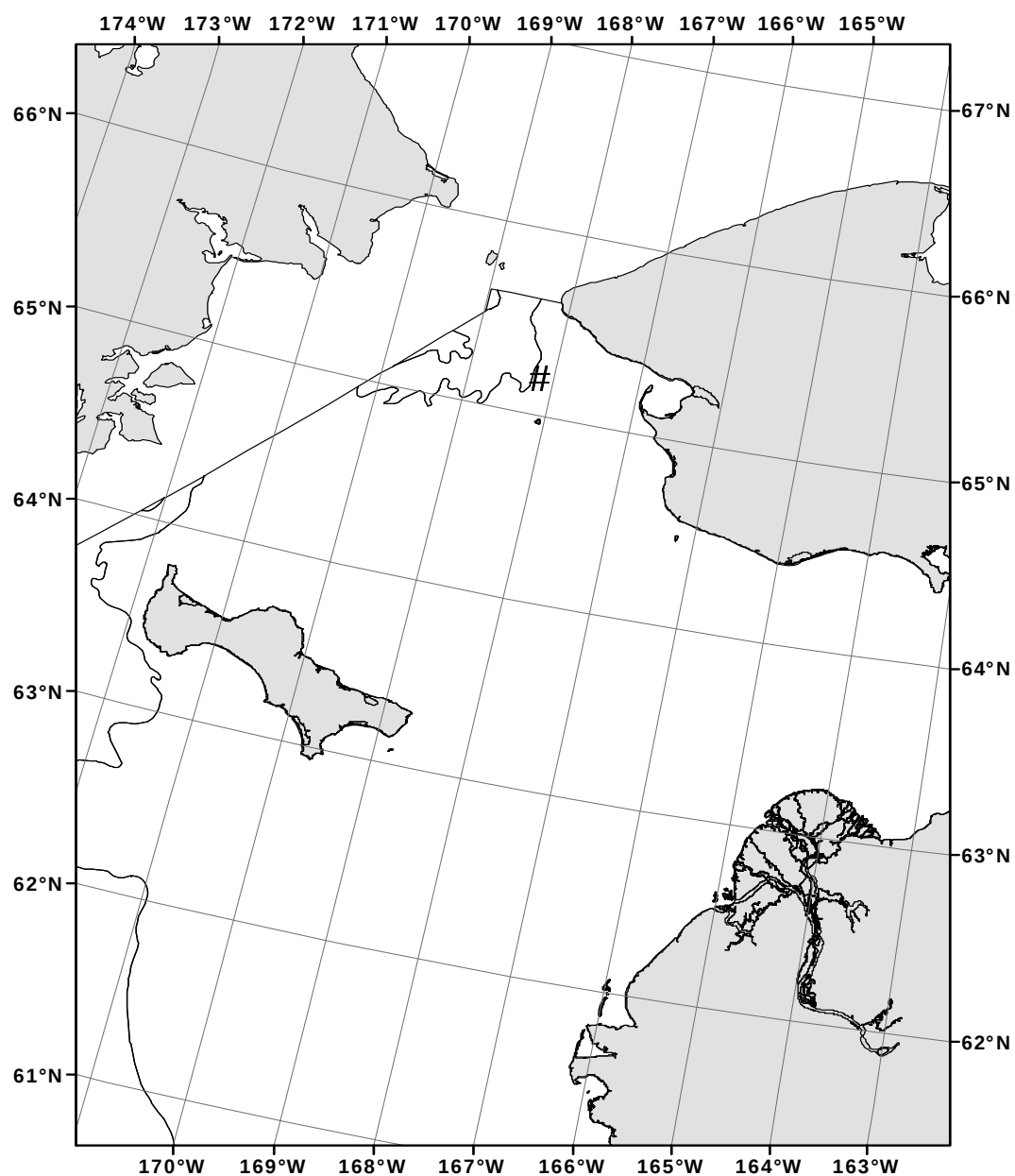
Recommendations

- 1) Additional assistance should be provided to staff at the Whitehorse Fishway to enable more adequate sampling of adult Chinook salmon.

Literature Cited

Bonnell, Greg. 1999. Genetic Practices For Hatcheries. Fisheries & Oceans Canada, Pacific Region, Habitat Enhancement Branch. Supplementation Workshop, July, 1999.

Johnson, Kenneth J. 1990. Regional Overview of Coded Wire Tagging of Anadromous Salmon and Steelhead in Northwest America. American Fisheries Symposium 7:782-816.



Yukon River coded wire tagged Chinook salmon caught in BASIS cruise on Sept. 13, 2007 at 65.19°N & 168.07°W.

Fish	Length (mm)	Weight (g)
1	176	58
2	125	18
3	179	58

CHINOOK EGG TAKES AND PRODUCTION 2010-2011

CHINOOK EGG TAKE (BY 2010)

The following are the results of the Chinook egg take results from the green egg stage to the end of the hatching stage from the brood year 2010.

Estimated Number of Green Eggs Taken: 140,000

Estimated Fertilization Rate: 97%

Pre-eyed Pick Dates (150 ATU'S) = September 25 to October 5

Number of Dead Eggs Removed = 6,235

Percent Development = 84%

Estimated Dates of Shocking (300 ATU'S) = October 13 to October 30, 2010

Shocking Mortalities= 12,374

Estimated number of Eyed Eggs= 158,022

Adjusted Estimated Number of Green Eggs Taken= 176,631

Estimated Survival Green to Eyed Egg= 89%

Average Fecundity Per Female = 5,352

Fecundity Range =Max: 7,433 Min: 3,794 Green Eggs Per Female

Number of Eyed Eggs Donated To the Fox Creek Project= 10,100

Date of Eyed Egg Transfer to McIntyre Creek Facility= November 2, 2010

Number of Eyed Eggs After Fox Creek Donation = 147,922

Number Of Mortalities Eyed to Hatch As Of December 5, 2010 = 11,662

Hatching Dates= Start November 20 (492 ATUs) End December 5 (541 ATU's)

Estimated Number of Alevins as Of December 5, 2010= 136,260

Estimated Survival Eyed To Hatch =92%

Estimated Adjusted Survival Green Egg To Hatch Stage = 82%

Estimated Ponding Dates= February 8 to February 23 @ 1000 ATU's

Estimated Number Of Fry To Be Ponded= 135,000

The chinook eggs (BY 2010) are now fully hatched and are using their yolk reserves to the swim up stage. Ponding of these fry should occur sometime during the month of February, 2011.

Wolf Creek: Tagged 12,000 – 0 mortalities = 12,000 fry. Tag retention was 100% -

12,000 x 100% = 12,000. Tag loss 0 - 12,000 x 0%= 12,000

Average weight at release = 2.89 grams

Total fry released 12,000 on May 30, 2010 transported via truck and live tanks for the Yukon Fish and Game Annual Fry Release into Wolf Creek. The attendance was excellent with an estimated 100 people at the event.

Mitchie Creek: Tagged 68,964 fry – 49 mortalities = 68,915 fry. Tag retention was 97%

- 68915 X 97% = 66,848 fry adipose clipped and tagged retained, 2,067 coded wire tags not retained, adipose clipped only.

Average weight at release was 3.00 grams

Total released 68,915 fry via 3 helicopter auto release buckets on June 1, 2010.

McClintock River: Tagged 19,714 – 0 mortalities = 19,714 fry. Tag retention was 100%-
19,714 X 100% = 19,714 fry adipose fin clipped coded wire retained.
Small un-tagable fry adipose fin clipped only = 1,369 adipose fin clipped only.
Average weight of released fry was 3.00 grams
Total released was 21,083 (includes small un-tagable fry) fry via 1 helicopter auto
release bucket on June 1, 2010.

Main Stem Yukon River: Tagged 24,242 – 15 mortalities = 24,227 fry. Tag retention
was 99% -24227 X 97% = 23,985 fry adipose clipped coded wire tag retained, 242 coded
wire tag not retained adipose clipped only. Average size of released fry was 2.98 grams.
Total released was 24,227 fry via 1 helicopter auto release bucket on June 1, 2010.