Coded Wire Tagging of Chinook Salmon at the Whitehorse Rapids Hatchery in 2007

Prepared by:
Yukon Fish and Game Association:
4061 4th Ave
Whitehorse Yukon Territory Y1A 1H1

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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 tag in the early summer of 2007. This was the first 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 2007 release of a total of 166,154 fry in four areas upstream of the Whitehorse Rapids dam included:

- 41,184 into Wolf Creek on May 24, May 28 and June 3;
- 35,609 into the mainstem Yukon River on May 29;
- 50,590 into Michie Creek on June 8; and
- 38,771 into the M'Clintock River on June 8.

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 2007, 238 of the 427 returning adult Chinook salmon counted at the fishway were of hatchery origin. The hatchery component included 74 females and 164 males and represented 55.7% of the Whitehorse Rapids Fishway count.

Over the course of the summer, from mid May to early September, 21,983 visitors from 75 countries visited the Whitehorse Rapids Fishway. 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 1985[1], 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 291,022[2] 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.

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[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 released untagged.

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) 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 2007 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 Yukon River Salmon fishery through interpretive displays and talks at 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, 2007 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 2007.

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 2007.

Location	Date	Number released
Wolf Creek	May 24 to June 03	41,184
Michie Creek	June 8	50,590
M'Clintock	June 8	38,771
Mainstem Yukon River	May 29	35,609
	Total	166,154

The total number of fry tagged and released in 2007 was 166,154 (Appendix 1) Fry weight at time of release ranged from 2.3 grams to 3.2 grams with an average weight of 2.9 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 19^0N and 168 07^0 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).

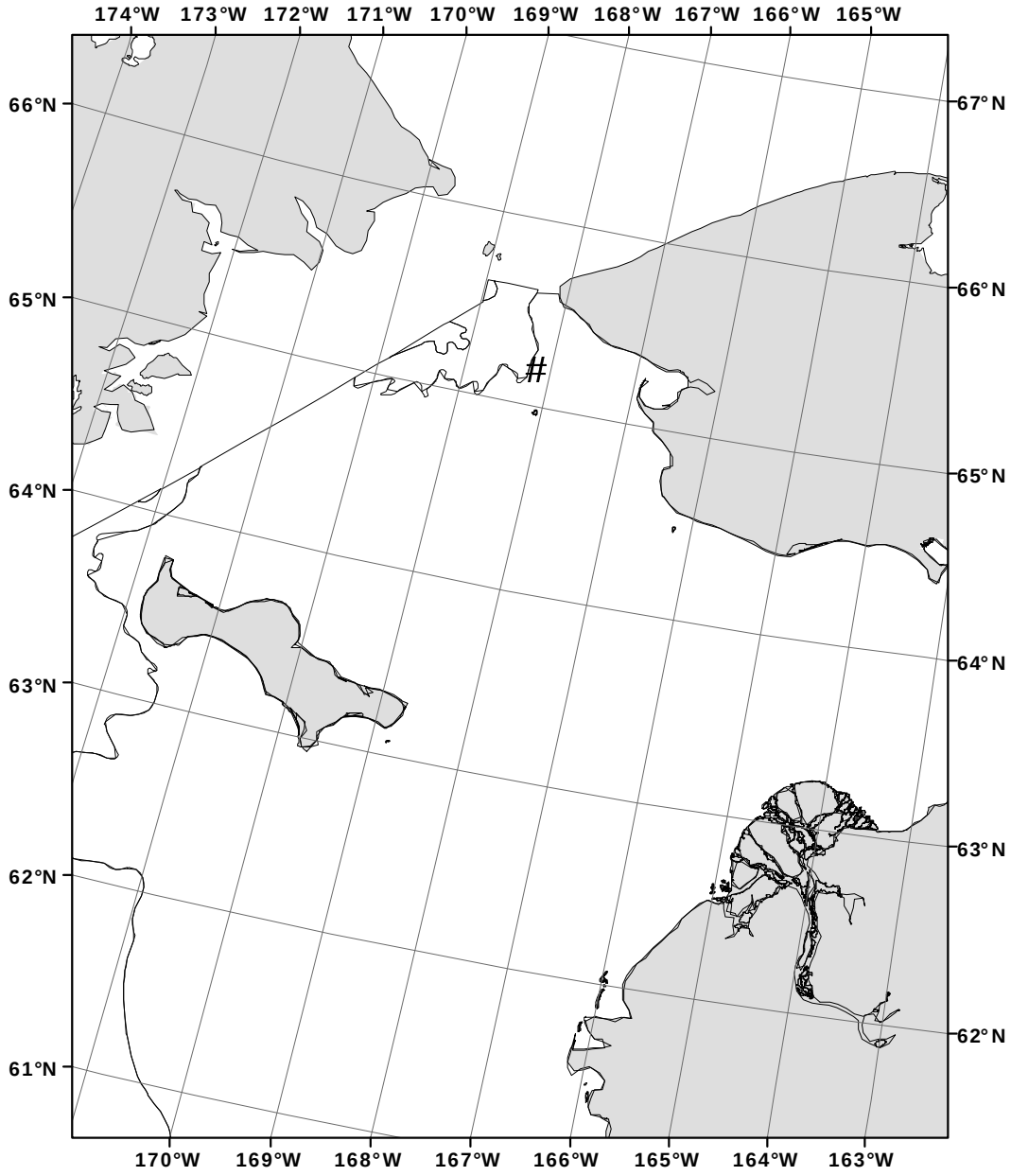
Recommendations

1) Additional assistance should be provided to staff at the Whitehorse Fishway to enable more adequate sampling of adult Chinook salmon.
2) Tagging equipment such as cutters are often delayed at the border. It is critical to order this type of equipment well in advance of the planned work. This did not occur in 2006 when the replacement cutters were not received until after the completion of the project.

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^{o}N & 168.07^{o}W.

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

CWT AND ASSOCIATED NON-CWT GROUPS RELEASE REPORT

HATCHERY PROJECT Whitehorse Rapids Fish Hatchery/Enhancement **SPECIES** CN-124 (Yukon River Chinook) 15-Jun-07

CONTACT Lawrence Vano - Operations Manager

									CODED WIRE TAGGED FISH					ASSOCIATED NON-CWT FISH					
CWT TAG CODE	BROOD YEAR	RUN	STUDY	STOCK TYPE	STOCK	RELEASE	REL PERIOD	RELSTAGE	CWT FINCLIP	# CWT TAGGED	# SHED CWT	SAMPLE SIZE	TAG LOSS	FINCLIP	ENUM METHOD	TOTAL RELEASE	LENGTH	WEIGHT	ABNORM SURV
					CODE	CODE	DDMMYY												
Ag D1 D2			R S		NAME	NAME	DDMMYY						DAYS %				mm	gm	
Agency Tags 18	2006	2	H P	W	Yukon River	Wolf Creek	24-May-07 28-May-07 03-June-07	FF	Adipose	38,552	771	661	2 2.0	2,632	C	41,184		2.33	
COMMENTS	Tagged 38,597 - 45 mortalities = 38,552 x 2 % tag loss (98% tag retention) = 37,781 released adiposed clipped with tag retained, 771 adipoesed clipped lost tag + 2,632 small untaggable fry adipose clipped not tagged = Total release 41,184																		
Agency Tags -18	2006	2	H P	W	Yukon River	Mainstem YKR	29-May-07	FF	Adipose	35,609	356	705	2 1.0		C	35,609		2.87	
COMMENTS	Tagged 35,674 - 65 mortalities = 35,609 x 1.0 % tag loss (99% tag retention) = 35,253 released adiposed clipped with tagged retained, 356 adiposed clipped tag not retained = Total released 35,609																		
Agency Tags -18	2006	2	H P	W	Yukon River	Michie Creek	08-Jun-07	FF	Adipose	50,639	506	819	2 1.0		C	50,590		3.22	
COMMENTS	Tagged 50,639 - 49 mortalities = 50,590 x 1.0 % tag loss (99% tag retention) = 50,084 adiposed clipped with tag retained, 506 adipose clipped with tag not retained= Total released 50,590																		
Agency Tags -18	2006	2	H P	W	Yukon River	M'Clintock R	08-Jun-07	FF	Adipose	38,823	388	634	2 1.0		C	38,771		3.22	
COMMENTS	Tagged 38,823 - 52 mortalities = 38,771 x 1.0 % tag loss (99% tag retention) = 38,383 adiposed clipped with tag retained, 388 adipose clipped with tag not retained= 38,771																		