Application of Coded-Wire Tags to Chinook Salmon at the Whitehorse Rapids Fish Hatchery, 1997

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Abstract

A total of 312,292 fry were adipose fin clipped and injected with full size binary coded-wire tags between May 26 and June 10, 1997 at the chinook salmon hatchery in Whitehorse, Yukon. Tricaine methanesulfonate (MS-222) or CO_2 was used to anaesthetise the fry prior to clipping and tagging. Feeding was suspended at least 24 hours prior to tagging. Fry were separated by tag-code according to release location and anaesthetic; a total of thirteen different codes were used. Tag retention was tested from one to eleven days after tagging and ranged from 99% to 100% (n=500 per tag group). Feeding was again suspended 24-48 hours prior to fry release. Releases occurred from June 1 to 11, 1997.

Introduction

Coded-wire tags (CWTs) are small, metal, coded tags that are injected into the nose cartilage of juvenile salmon. The first tags were developed in the 1960's and carried longitudinal coloured stripes. Binary-coded tags were introduced in 1971 and quickly replaced colour-coded tags because of improved readability and an increase in the number of available codes. The size of a standard CWT is approximately 0.25mm by 1.0mm. When tagged, the juvenile fish are given a secondary, external mark, specifically removal of the adipose fin, to allow visual identification (Johnson 1990; Maddigan 1998).

CWTs 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. 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 annually in the Yukon Territory since 1985, principally by Fisheries and Oceans Canada. Approximately 80% of all the fish tagged 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 the impact of the turbines on juvenile chinook salmon migrating downstream. Over the 1985 to 1996 period, the WRFH released a total of more than three million chinook salmon fry. Of these, about 1.8 million were labelled with CWTs and externally marked using adipose fin clips. Annually 34% to 100% of the hatchery release has been tagged. The tags were applied to young of the year fry (also known as age "sub 1" or "0 check" fry) in late May or early June, after a period of rearing[1]. Almost all of the fry have been released into the Yukon River system upstream of the hydroelectric facility.

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[1] In 1997, the fry were ponded (i.e. transferred from incubation trays to rearing troughs) between January 27 and February 10.

The goals of the WRFH chinook salmon CWT program are to: (1) obtain information on survival rates, exploitation rates, run timing, and distribution; (2) obtain information on differential survival rates resulting from different release strategies; and (3) permit identification of returning hatchery fish in order to adhere to WRFH broodstock collection guidelines.

The first goal can be termed stock assessment while the second falls into the experimental category. The third goal was outside these categories – it did not involve CWTs directly. Rather, it involved only the external mark (the adipose fin clip) that was made when CWTs were applied. The broodstock collection guidelines for the WRFH indicate that the use of hatchery fish as broodstock should be minimised.

The objective of the 1997 Upper Lakes Chinook Coded-Wire Tagging Project was to tag and mark all of the juvenile salmon reared at the WRFH that year.

Methods

Diversified Ova Tech Limited was contracted to conduct the tagging and fin clipping. Two taggers and five adipose fin clippers were employed. (Four adipose fin clippers were on duty at any one time). Operations commenced on May 26 and ceased on June 10, 1997.

Fry were injected with full-size binary-coded tags using two Northwest Marine Technology Inc. Mark IV tagging machines provided by Fisheries and Oceans Canada. A total of 13 different tag codes were used. Multiple codes were provided for each release stream in order to separate fry on the basis of what they were anaesthetised with during fin clipping and tagging, and the precise release location on a given stream (if there was more than one). However, all of the fish in the McClintock River and Judas Creek release groups were anaesthetised with MS-222 in spite of being marked with two different codes each. In the case of the McClintock River release group, this was a departure from the operational plan for the sake of expediency. In the case of the Judas Creek release group, there was greater interest in distinguishing between the precise release locations on the stream, than the anaesthetic used.

Fry weights ranged from 2.27 to 2.51 grams (Appendix 1).

Fry were sorted according to size and condition prior to CWT application. Undersized or deformed fry were not tagged. Feeding was suspended at least 24 hours before tagging but was resumed afterwards. It was again suspended 24-48 hours prior to release.

There were two methods used for anaesthetising fry for adipose fin clipping and tagging. The first involved gaseous CO_2; the second, tricaine methanesulfonate, commonly referred to as MS-222 or TMS.

Methodology for anaesthetising with CO_2 was as follows. A 10" micropore airstone connected via a flow meter to a CO_2 cylinder was installed in a tub containing 300 litres of hatchery water. This water was 6°C, and after passing through the hatchery aeration tower, was saturated with oxygen at 11.5 ppm. The water in the tub was charged for 20 minutes at 2.5 litres per min, and stirred vigorously several times to ensure thorough mixing. A tablespoon of baking soda was added as a buffer against decreased pH level. The airstone was used intermittently to maintain oxygen levels. Temperature also increased 2-3 degrees over time, however it was not felt to be enough to warrant cooling. A fresh tub of anaesthetic was prepared for each ½ day of tagging.

The target CO_2 concentration was 300-325 ppm. If concentrations exceeded 375 ppm, or if exposure time was excessive, symptoms such as "pop eye" and haemorrhaging around the gums, fins and anal area were observed. Initially, titration with sodium hydroxide solution was used to ensure that the target was achieved. The titration step was then omitted because variations in concentration were readily apparent through observance of fry behaviour, and consistent results were being obtained.

The anaesthetic solution was transferred to nine-litre capacity plastic basins for use at the fin clipping/ tagging tables. Approximately 45 fry were placed in each basin at a time; after about 15 minutes the CO_2 was depleted and the basin was refilled.

Procedures for using MS-222 were more straightforward. The anaesthetic solution was added directly to water in the nine-litre plastic basins. As with the CO_2, about 45 fry were placed in each basin at a time. The solution was changed frequently to prevent thermal shock.

Fry were generally immobilised after about one to three minutes, depending on the type and strength of the anaesthetic. After this occurred, fry were individually fin clipped and made accessible to a tagger for CWT application.

To check for tag implantation each fry was immediately passed through a quality control device (QCD) designed to automatically detect, separate, and enumerate tagged and untagged specimens. Untagged fry were held until the end of the day, at which time they were re-anaesthetised and run through the tagging procedure again.

A sample of 500 fry from each tag group was passed through the QCD from one to eleven days after tagging to check for CWT retention.

Table 1 presents tagging and release data for each tag group. Further details may be found in Appendix 1.

Results

CWT retention was 99% or greater for all tag groups (Appendix 1).

Tag Code	Start Date	Stop Date	Release Date
18-23-25	May 26	May 27	June 1
18-29-06	May 27	May 27	June 8
18-23-26	May 28	May 28	June 1
18-23-27	May 29	May 29	June 7
18-25-53	May 30	May 30	June 11
18-28-59	May 31	June 2	June 11
18-28-60	June 2	June 4	June 11
18-25-51	June 4	June 5	June 11
18-25-52	June 5	June 6	June 11
18-25-54	June 6	June 8[2]	June 11
18-25-55	June 8	June 9	June 11
18-29-05	June 10	June 10	June 11
18-29-07	June 10	June 10	June 11

Table 1. Tagging and release dates for WRFH fry, 1997.

The total number of fry tagged was 312,292. Ninety-six (0.03%) of these fry did not survive to release and an estimated 1,358 (0.4%) shed their tags prior to being released. The total release of adipose fin clipped fry was 312,196 fish, of which an estimated

310,838 contained CWTs. This constituted the total WRFH production of chinook salmon, less approximately 2,500 undersized or deformed fry that were deemed to be unsuitable for CWTs. These untagged fry were released into Scout Lake in July 1997 by the Department of Renewable Resources, Government of Yukon. Scout Lake is a small pothole lake near Whitehorse.

Fry releases occurred from June 1 to June 11. All release sites were upstream of the Whitehorse hydroelectric facility. The streams into which the fry were planted were Michie Creek (both downstream and upstream of Michie Lake), Byng Creek, McClintock River, Judas Creek, and Wolf Creek.

Discussion and Recommendations

Two different types of anaesthetic were used in order to provide a transition between the previous four years of tagging, when CO_2 was used, and future years, during which the use of MS-222 was anticipated. Differential tagging of the fry on the basis of anaesthetic was intended to facilitate detection of differential survival rates, in the event that an adequate sampling program adult or sub-adult sampling program is established.

It is recommended that a statistically defensible sampling regime, with clearly defined goals, be established in order to maximise the benefit gained from CWT application. If this does not occur, consideration should be given to applying an externally visible mark that does not require concurrent application of a CWT.

[2] No tagging was conducted on June 7.

Literature Cited

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Appendix 1. **Summary of releases of Whitehorse Rapids Fish Hatchery chinook salmon into the Yukon River system, 1997.**

Release Location	Release Date	Code	Anaes-thetic	Mort-alities	Weight (grams)	Tag Loss	Tag Loss Days	Released: Tagged & Clipped	Released: Clipped Only	Released: Total Clipped	Released: Total Unclipped	Released: Total
Wolf (a)	1-Jun-97	182325	MS-222	10	2.97	1%	2	14,850	150	15,000	0	15,000
Wolf (a)	1-Jun-97	182326	CO2	0	2.26	0%	4	20,334	0	20,334	0	20,334
Wolf (b)	8-Jun-97	182906	MS-222	0	2.77	0%	8	10,158	0	10,158	0	10,158
Michie (c)	11-Jun-97	182554	CO2	0	2.26	0%	3	25,242	0	25,242	0	25,242
Michie (c)	11-Jun-97	182555	MS-222	0	2.77	1%	3	24,995	253	25,248	0	25,248
Byng	11-Jun-97	182907	CO2	0	2.15	0%	1	10,029	0	10,029	0	10,029
Byng	11-Jun-97	182905	MS-222	0	2.56	0%	1	10,155	0	10,155	0	10,155
Michie (d)	11-Jun-97	182859	CO2	36	2.56	1%	3	49,657	502	50,159	0	50,159
Michie (d)	11-Jun-97	182860	MS-222	15	2.07	0%	3	50,130	0	50,130	0	50,130
Judas (e)	7-Jun-97	182327	MS-222	3	2.17	1%	3/7	19,951	202	20,153	0	20,153
Judas (f)	11-Jun-97	182553	MS-222	22	2.25	0%	11	25,146	0	25,146	0	25,146
McClintock (g)	11-Jun-97	182551	MS-222	5	2.07	0%	3	25,399	0	25,399	0	25,399
McClintock (g)	11-Jun-97	182552	MS-222	5	2.97	1%	3	24,792	251	25,043	0	25,043
TOTAL				96				310,838	1,358	312,196	0	312,196

Note: "Clipped" means that the adipose fin had been excised.

a = cadet camp
b = public campground
c = between Michie Lake and Fox Lake
d = outlet of Michie Lake
e = Alaska Highway crossing
f = near outlet of headwater lake
g = upstream of waterfall