Appendix 2. Detection of Coded-Wire Tags in Chinook Salmon with the "Wand" Detector

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Introduction

The Washington Department of Fish and Wildlife (WDFW) and the Oregon Department of Fish and Wildlife (ODFW) recently distributed a proposal regarding mass marking and selective fisheries for both coho and chinook salmon in 1999 (WDFW-ODFW, November 9, 1998). The proposed marking involves the use of the adipose fin clip for both species. This fin mark is now used to indicate mass marked hatchery coho salmon in Oregon, Washington and British Columbia, but the adipose mark is still reserved to indicate the presence of a coded-wire tag (CWT) in chinook salmon. Initiation of this proposal would necessitate that the chinook CWT sampling and recovery system be converted to electronic detection. The detection capability of CWT electronic sampling equipment, however, has not been extensively tested on chinook. Of particular concern is the capability of the hand held "wand" for detecting tags in larger chinook. Complicating the issue are the various types and lengths of wire being used. The "new wire" now being used for manufacturing tags has a stronger magnetic moment (i.e. higher detectability) than the "old wire" which is still present in some of the fish that are returning. The use of length-and-a-half tags, which have an even stronger magnetic moment, are now used in coho to ensure their detection with electronic equipment. It has recently been suggested that these longer tags could also be used in chinook. However, because many stocks of chinook are tagged as small fingerlings, some agencies believe that this longer tag would be too long for many of their stocks. The manufacturer of the wand, Northwest Marine Technology (NMT), guarantees a detection depth of 20 mm for single length tags (1.1 mm) and 30 mm for length-and-a-half tags (1.5 mm). Because of the large size of chinook heads, especially in the older age classes (i.e. age 4 and 5), it seems likely that a significant percentage of coded-wire tags would reside at a depth greater than 30 mm, where even length-and-a-half tags would not be detected. The purpose of this study was to measure the CWT detection rate of wands used on hatchery returns of chinook salmon tagged with standard length CWTs. A secondary purpose was to examine variability in the detection capability between wands.

Methods

Detection Rates: Wand detectors were tested in the fall of 1998 on adipose marked chinook returning to four hatcheries: 1) Nisqually Hatchery at Clear Creek, 2) Kalama Creek Hatchery, 3) Grovers Creek Hatchery, and 4) Makah National Fish Hatchery. Nisqually Hatchery at Clear Creek and Kalama Creek Hatchery are both operated by the Nisqually Tribe, and are located on the lower Nisqually River in south Puget Sound. Grovers Creek Hatchery is operated by the Suquamish Tribe and is located at the mouth of Grovers Creek, a stream on the Kitsap Peninsula that flows into mid-Puget Sound. Makah National Fish Hatchery (NFH) is operated by the U.S. Fish and Wildlife Service (USFWS) and is located on the Sooes River, which flows into the Pacific Ocean on the extreme north coast of Washington. All of the facilities have a history of tagging juvenile chinook and sampling adult returns for CWTs. All of the expected returning tag groups were originally tagged with standard length wire. Age 5 fish were tagged with "old wire", and age 2 – 4 fish were tagged with "new wire".

Sampling with the wand was conducted by Northwest Indian Fisheries Commission (NWIFC) or USFWS employees, using standardized detection methods established for this equipment. Only adipose marked chinook were used in this sampling. At the tribal hatcheries, the wand sampling only occurred on two days at each site, and only on groups of fish that were available at the time of sampling. Therefore, the sampling was non-random and the sampled fish do not reflect the size and age structure of those runs. Jacks were included in the sampling at two of the hatcheries. At Makah NFH, all marked adult chinook were sampled. After attempting detection with the wand, standard CWT sampling procedures were followed; each adipose marked fish was measured for fork length and the snouts were removed and placed in individual bags. The wand detection information was recorded on the individual head labels, which accompanied each snout. Recovery of CWTs was completed at the WDFW CWT laboratory (for the tribal hatcheries) or the Lacey USFWS dissection laboratory (for Makah NFH) using standard CWT recovery procedures.

Detection Depth Variability Between Wands: The variability in detection depth between six recently purchased wands was examined in a controlled laboratory test. One of the wands was used for the sampling at the Makah NFH. The methods used were similar to a previous wand test conducted by WDFW (Thompson and Blankenship, 1996). For this test a 1.5 mm tag was obtained from an adult coho snout. This tag was known to be from the latest type of wire, and cut from an NMT Mark IV tag injector. The tag was taped to a piece of plywood and a glass plate (15 cm x 30 cm x 3 mm thick) was placed over the tag. Plastic strips, approximately 1 mm thick, were placed on the sides of the glass to elevate it above the tag. The glass was raised in 1 mm increments (measurement were approximate) until the wand could no longer detect the tag consistently. The wand was used with the side of the wand tip placed on the glass. The wand was moved back and forth in both parallel and perpendicular strokes to the tag.

Results

A total of 319 marked hatchery chinook were sampled for CWTs with hand held wands. Dissection and recovery in the laboratory determined that 258 of the marked fish carried tags. Only one fish resulted in a "false positive", where a tag was indicated by the wand but was not actually present. Tag code information revealed the following age composition of the tagged fish: 34 of age 5; 87 of age 4; 75 of age 3; and 62 of age 2.

The results of the hatchery field tests are displayed in Table 1. As indicated, the wands were successful in detecting CWTs in 256 out of 258 tagged chinook (99.2%). Not surprisingly, the two tags that were missed were in larger fish. Additionally, neither missed tag was in the desired fatty area of the center of the snout. The fish from Kalama Creek was 4 years old and 91 cm in length. Although an exact depth measurement was not possible for the missed tag, the tag was located in fatty tissue behind one of the eyes. The fish from Makah NFH was 5 years old, 96.5 cm in length, and the tag was of the older style wire. The tag was found at a depth of 50 mm from the dorsal surface, just above the roof of the mouth. In the lab this tag was also missed by a Portable Field Sampling Detector (FSD) but was detected when the snout was passed through a "4 inch Tubular" detector (model TD 400 "cannon").

The results of the laboratory test for detection variability between equipment are shown in Table 2. Greater detection depth was found for all equipment when the wand was used in a parallel orientation to the tag. This maximum detection depth of the wands ranged from 38 to 44 mm.

However, variability in detection depth was only found when the wands were used in the parallel orientation. All equipment had a uniform detection depth of 37 mm when tested in the perpendicular orientation.

Table 1. Results of CWT Detections with the Hand Held Wand in 1998 Chinook Hatchery Returns.

Hatchery	Brood Year (age)	CWT Type	Mean Fork Length (cm)	# CWTs in Sample	# CWTs Missed with Wand	% CWTs Detected
Clear Creek	1994 (4)	1.1 mm, new wire	73.4	7	0	
	1995 (3)	1.1 mm, new wire	64.6	27	0	
	1996 (2)	1.1 mm, new wire	50.1	58	0	
				92	0	100.0
Kalama Creek	1993 (5)	1.1 mm, old wire	88.0	4	0	
	1994 (4)	1.1 mm, new wire	78.7	44	1	
	1995 (3)	1.1 mm, new wire	71.0	4	0	
	1996 (2)	1.1 mm, new wire	59.2	4	0	
				56	1	98.2
Grovers Creek	1993 (5)	1.1 mm, old wire	79.0	2	0	
	1994 (4)	1.1 mm, new wire	70.5	6	0	
	1995 (3)	1.1 mm, new wire	69.4	10	0	
				18	0	100.0
Makah NFH	1993 (5)	1.1 mm, old wire	87.3	28	1	
	1994 (4)	1.1 mm, new wire	87.7	30	0	
	1995 (3)	1.1 mm, new wire	74.1	34	0	
				92	1	98.9
			Totals =	258	2	99.2 [a]

[a] Unweighted mean for all fish sampled

Table 2. Detection distance of a 1.5 length coded-wire tag using six wand detectors and different stroke orientations.

Wand #	Parallel Orientation (mm)	Perpendicular Orientation (mm)
10277	38	37
10404 [a]	41	37
10423	44	37
10485	38	37
10573	44	37
10577	39	37
Mean distance =	40.7	37
Std. deviation =	2.8	0.0

[a] Wand used for sampling at Makah NFH

Discussion

The results of this limited field test indicate that the wand has the potential for detecting standard length, "new wire", coded-wire tags in adult chinook. However, because of the study design and the relatively low numbers of fish involved, we urge caution in the interpretation of these results. The intent of this testing was to measure the detection rate of a piece of equipment. As described in the methodology, only adipose marked fish were sampled. Although the samplers were instructed to use standard sampling techniques, the samplers knew that the fish being sampled had a high possibility of possessing a tag. These detection rates may not be indicative of the rates that would be achieved by a technician sampling groups of unmarked fish with a low percentage of tags. We therefore recommend testing of the wand in actual fishery situations to evaluate the detection rate achieved by samplers in the field. Only 121 of the total fish sampled were in the 4 and 5 year old age classes. These larger fish have the greatest potential for the wand missing tags. We therefore recommend that additional testing be conducted on large fish to see if these results can be repeated.

If wands are to be deemed an acceptable tool for detecting CWTs in chinook, their minimum detection depth will need to exceed the 20 mm depth guaranteed by the manufacturer. The results of our field tests indicate that the wands used may have detected standard length tags at depths much greater than 20 mm. It is unknown how the detection depth measured in the laboratory tests compares with detection depth in a salmon snout. However, the laboratory tests with a 1.5 mm tag resulted in a detection depth of 37 mm, for all of the wands, in the weakest orientation (perpendicular). Further testing is recommended to determine a minimum acceptable CWT detection depth for wand use on chinook. It would then be useful to have a standardized method for measuring individual wands, to ensure some uniformity in the detection capability of the equipment used by samplers.

References

Thompson, D. A. and Blankenship, H. L. 1996. Evaluation of Wand Coded Wire detector