Fisheries and Oceans Canada (DFO) Case Study of Quality Control Investigations for Coded-Wire Tag (CWT) Detection

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Introduction

Many actual data collection and sampling methods have logistical problems that make their actual performance in the field less than expected in the monitoring design phase. For example, sampling periods can be lost because high stream flows wash out weirs or stream visibility decreases and it is difficult to observe fish. These realities make it imperative that routine data collection procedures are tested and validated with respect to their assumptions and intended results to ensure that credible inferences can be made. The evaluation below outlines an example where we found it necessary to test the assumptions about electronic detection of coded-wire tags in salmon fishery monitoring programs to determine whether undetected tags in the fishery harvest might be occurring and resulting in a negative bias in estimates of marine survival and fishery exploitation rates.

CWT Detection Case Study

Electronic field detection of coded-wire tags (CWTs) became essential when fishery agencies began mass marking hatchery releases with adipose fin clips without the presence of a CWT (circa 1996). A missing adipose fin could no longer be used to indicate that a fish contained a CWT, an operating condition that had been in place since 1974 along the Pacific coast for chinook and coho salmon.

Although wands had been developed and implemented to electronically detect CWTs from samples of landed fish, the performance of wands was initially evaluated in controlled environments without blind study designs. In several areas, the detection accuracy was reported as follows:

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Early Chinook Wanding Studies

Study	Detection Rate
ADFG (1995)	98 %
NWIFC/USFWS (1999)	99 %
CDFO (1999)	96 %
WDFW (1999)	91 %

DFO developed standards, protocols and guidelines (SPG) for the wands including regional training programs involving real fish heads as well as the testing method recommended by the manufacturer (wooden blocks with CWTs). In the first year of standardized use across the Southern BC creel survey program, the Creel Survey Program Head was shocked at the very small number of heads collected by creel staff. The program head knew the range of values for 'no pins' observed in the previous years based on sampling heads from all adipose clipped chinook and coho, and could not believe that the mass marked fish contributed to all the 'no beep' measurements. After the wands had been in use for a couple of years, a QA/QC program using blind studies, as were practically possible, was used to evaluate accuracy of tag detection. Results can be summarized by the following figures:

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Gillnet Test Fishery (2003)

	'Beep'	'No Beep'	Total
Marked (AFC): 24% of CWTs missed			
Tagged	25	8	33
Not Tagged	9	2	11
Total	34	10	44
Unmarked: 55% of CWTs missed			
Tagged	9	11	20
Not Tagged	5	3,594	3,599
Total	14	3,605	3,619

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Gillnet Test Fishery (2004)

	'Beep'	'No Beep'	Total
Marked (AFC): 0% of CWTs missed			
Tagged	29	0	29
Not Tagged	5	2	7
Total	34	2	36
Unmarked: 76% of CWTs missed			
Tagged	8	25	33
Not Tagged	5	2,697	2,702
Total	13	2,722	2,735

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Troll Fishery – Head Attached (2006)

	'Beep'	'No Beep'	Total
Marked (AFC): 9% of CWTs missed			
Tagged	139	14	153
Not Tagged	8	48	56
Total	147	62	209
Unmarked: 19% of CWTs missed			
Tagged	35	8	43
Not Tagged	13	5,685	5,698
Total	48	5,693	5,741

Troll Fishery – Head Off (2006)

	'Beep'	'No Beep'	Total
Unknown Adipose Fin Status (2% of CWTs missed)			
Tagged	235	4	239
Not Tagged	11	7,406	7,417
Total	246	7,410	7,656

- Snouts were removed from bodies by trollers at sea

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Spawning Grounds – Head Attached (AFC only)

	'Beep'	'No Beep'	Total
2004: 15% of CWTs missed			
Tagged	303	52	355
Not Tagged	14	7	21
Total	317	59	376
2005: <1% of CWTs missed			
Tagged	235	1	236
Not Tagged	6	8	14
Total	241	9	250

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The results showed considerable variability in accuracy among sampling environments, people, equipment, and if the fin was clipped or not in the Canadian programs. When we estimated the amount of QA/QC necessary to maintain the accuracy that was originally communicated within the program's cost, DFO changed its policy on the use of wands for CWT sampling. Wands are now only used in unique circumstances (e.g., when a fish is too large to pass through a tube detector). Tube detectors are used in high volume fisheries based on independent trials as to their efficacy. Visual sampling is used in sport fisheries, native fisheries, and spawning grounds.

The Southern U.S. continues to use the wands and claims that accuracy is 100% for their sampling programs. It very well could be, however even with the best SPG, measurements can be biased. If there is no QA/QC involved, then the biases may be unknown and the inferences may be misleading. Are hatchery salmon survivals so much lower than wild salmon because of biased measurements? Are the exploitation rates in Southern U.S. fisheries using wands higher than estimated from the data? There are so many different types of inferences relying on CWT data that are well beyond the objectives of an individual project, e.g., ESA population viability analyses using past exploitation rate data, that the role of QA/QC seems like a fundamental component of any program that contributes to a broader set of goals.