

**Impact of Mass Marking and  
Mark-Selective Fisheries on the  
Integrity and Future of the Coded  
Wire Tag Recovery Program:**

**REPORT OF THE EXPERT  
PANEL ON THE FUTURE OF THE  
CODED WIRE  
TAG RECOVERY PROGRAM  
FOR PACIFIC SALMON**

# Panel Members

## From within PSC “Family”

- John Clark, ADFG
- Gary Morishima, MORI-ko, WA
- Brian Riddell, DFO, BC
- Jim Scott, WDFW

## From “Outside” PSC Family

- Rick Deriso, IATTC, CA
- Carlos Garza, NMFS, CA
- David Hankin, HSU, CA (Chair)
- Carl Schwarz, SFU, BC

technical support from Marianna Alexandersdottir, NWIFC

# REPORT PREPARATION PROCESS

- CWT Workshop: 7-10 June , 2004
- Full Panel Meetings & Assignments– 18 October 2004; 14-15 January 2005; 13-14 May 2005
- Draft Report sent out to peer review – late June 2005
- All Peer Reviews Received – early September 2005; respond to peer reviews.
- Final Report – Released in mid-November 2005 ([consensus document](#))

# REPORT STRUCTURE

- Preface (2 pp)
  - Part I: Background Information (20 pp)
  - Part II: Executive Summary (18 pp):
    - Major Findings
    - Major Recommendations
    - Implementation Steps
  - Part III: Justifications and Rationale for Part II (94 pp)
  - Part IV: Technical Appendixes (70 pp)
- Note: Available at PSC web site

# What Concerns Prompted The EP Report?

- 1. Deterioration in the CWT system itself
  - reduced ocean fisheries lead to reduced ocean CWT recoveries which in turn lead to increased uncertainty in expanded ocean fishery CWT recoveries, especially at small time-area scales;

# Example: Substantial Reduction in Ocean Fishery Recoveries – Late 70s vs Late 90s

**Iron Gate Hatchery (Klamath R.) Fall Chinook:  
CWT 06-61-01, 1976 BY, Oct. release of 191,000 fish**

Expanded Recoveries at Age						Est. Age 4 Harvest Rate
Age 2		Age 3		Age 4		
Ocn	FW	Ocn	FW	Ocn	FW	
6	1526	3314	913	3151	602	0.80*

**Trinity River Hatchery (Klamath R.) Fall Chinook:  
CWT 06-61-05, 1977 BY, Oct release of 180,000 fish**

5	345	986	1491	856	610	0.58*
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**\*VERY serious conservation concern revealed by CWT recovery data.**

# Example: Substantial Reduction in Ocean Fishery Recoveries – Late 70s vs Late 90s

**Trinity River Hatchery (Klamath R.) Fall Chinook:  
CWTs 06-52-33 and 06-52-36, 1997 BY, June releases  
of 51,000 & 48,000 fish (experimental groups)**

<b>Expanded Recoveries at Age</b>						<b>Est. Age 4 Harvest Rate</b>
<b>Age 2</b>		<b>Age 3</b>		<b>Age 4</b>		
<b>Ocn</b>	<b>FW</b>	<b>Ocn</b>	<b>FW</b>	<b>Ocn</b>	<b>FW</b>	
0	29	29	351	10	114	0.081
0	67	67	444	11	68	0.139

# What Concerns Prompted The EP Report?

- 1. Deterioration in the CWT system itself (cont.)
  - Historic & current areas with inadequate or non-existent sampling: freshwater “stray” escapement; freshwater recreational catch; ocean recreational catch (BC); some new fisheries are hard to sample.
  - reduced cooperation and support for the CWT system due to budget cuts and mass marking-related issues – example: inconsistent use of “wanding” in fisheries where substantial numbers of MM fish are present (AK, BC).

# What Concerns Prompted The EP Report?

- 2. Potentially serious consequences of MM and MSF for analysis and interpretation of CWT recovery data, especially for estimation of non-catch mortalities in MSF.
  - Is the “DIT” (Double Index Tagging) approach a magic bullet or not? Does it really work for Chinook salmon? Can we use this approach to estimate non-catch mortalities in individual MSFs?

# What Concerns Prompted The EP Report?

- 3. Belief by some fisheries scientists that modern genetic methods could and would completely supplant the CWT system within a few years.
  - Recent PSC success in standardization of large coast-wide Chinook salmon microsatellite baseline;
  - Current development of SNPs;
  - In-season use of microsatellites to reduce harvest on weak stocks

# The coast-wide CWT tag recovery system – PSMFC with lead coordination role.

- Adipose fin originally “sequestered” and used to identify hatchery (or wild) fish possessing CWT;
- Ocean fishery catch sampling at  $\geq 20\%$  rates, snouts of AD-clipped fish collected;
- Hatcheries sampled at 100%;
- Attempts, varying in quality, made to estimate recoveries in FW fisheries, stray escapement, etc.

## Late 70's – Independent development of Cohort Analysis methods –

- IF estimates of catches and escapements from all areas are available, and natural survival rates are assumed known, then the full cohort history can be reconstructed and at least the following can be estimated:
  - Age-specific maturation probabilities;
  - Overall age-specific ocean and freshwater fishery harvest rates;
  - Exploitation rates at age in individual fisheries;
  - Survival rates from release to age 2

# PSC Chinook Technical Committee: 1991 memo to Directors of DFO & WDF

- *In response to proposals to use AD-clip removal to identify hatchery fish (for MM & MSF):*
- Parties to Pacific Salmon Treaty had agreed to maintain a statistically reliable CWT tag-recovery program;
- Removal of adipose fins from large numbers of untagged hatchery salmon would cause many problems, including:

# PSC Chinook Technical Committee: 1991 (prescient?) memo to Directors of DFO & WDF

- CWT recovery data could no longer be used to evaluate fishery impacts on wild stocks if selective fisheries were on AD-clipped fish;
- Unclipped fish would be subject to increased non-catch mortalities of unknown magnitude;
- Management procedures that rely on CWT analysis would have to be eliminated, revised or replaced.

# Mass Marking and Mark-Selective Fisheries

- In mass marking, ALL hatchery fish receive an adipose fin clip, but many (most) of these fish are released without CWTs:
- *2003 Interior Appropriations Bill: “The United States Fish and Wildlife Service shall, in carrying out its responsibilities to protect threatened and endangered species of salmon, implement a system of mass marking of salmonid stocks, intended for harvest, that are released from Federally operated or Federally financed hatcheries including but not limited to fish releases of coho, chinook, and steelhead species. Marked fish must have a visible mark that can be readily identified by commercial and recreational fishers.”*
- NOTE: Mass mark does not have to be AD-clip.

Mass Marking introduces new complications wrt sampling catches and escapements for CWT'd fish because now not all ad-clipped fish have CWT and it would be impractical to collect heads from all AD-clipped fish to search for non-existent CWTs.



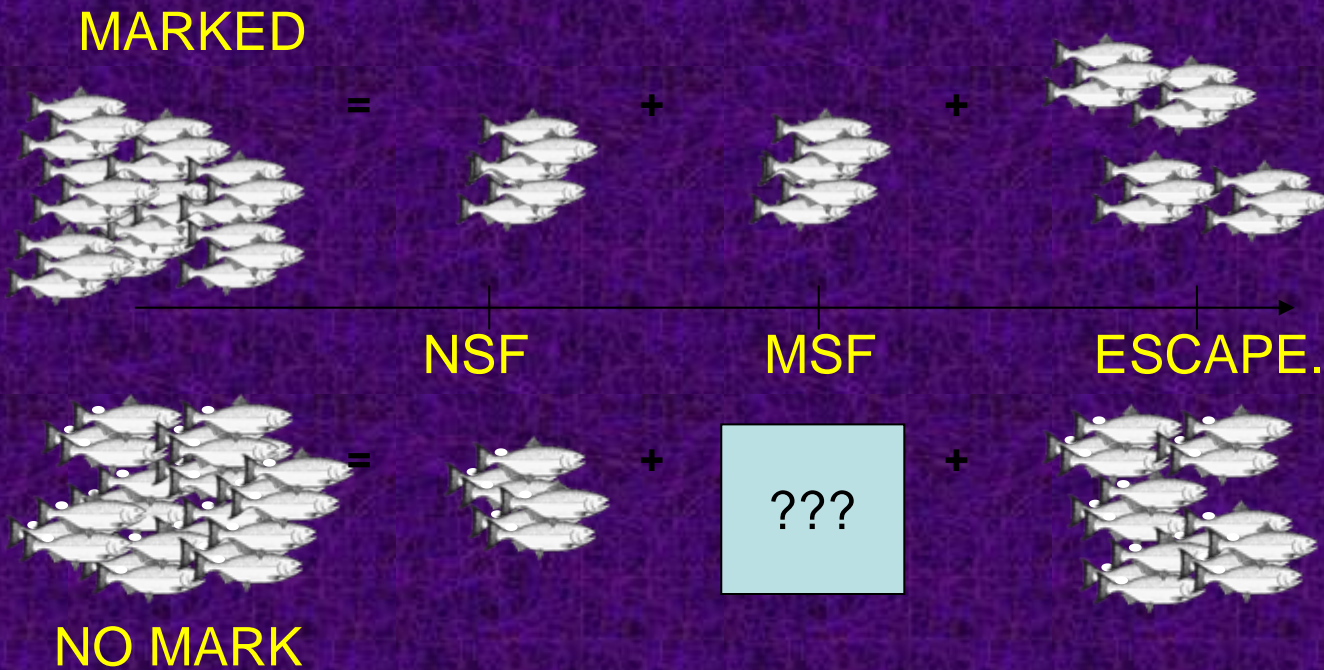
**Wand and tube CWT detectors**

# Complications from MM and MSF

- In mark-selective fisheries (MSF), only ad-clipped (known hatchery) fish may be retained, theoretically leading to reduced fishing mortality on weak (e.g., ESA-listed) natural stocks.
- BUT – there must also be some “non-catch” hook & release mortality on unmarked (natural) fish in MSF.
- Recovery patterns of CWT'd hatchery *indicator stocks* have routinely been used to infer exploitation rates experienced by associated natural stocks.
- With MSF, recovery patterns of marked hatchery fish are no longer the same as the associated unmarked natural stocks.

# DIT - Double Index Tagging: Two groups receive CWT, but only one group is AD-clipped.

## Observable and Unobservable Mortalities of DIT Groups



# MAJOR FINDINGS: Issues raised by Mark-Selective Fisheries

- 6. Mass Marking (MM) and Mark-Selective Fisheries (MSF) together pose serious threats to the integrity of the CWT system. The PSC has been alerted to these threats since at least 1991. In particular:
  - A. Recovery patterns of adipose-clipped fish no longer indicate recovery patterns for unmarked natural stocks;
  - B. Significant practical and statistical issues are raised by the need to find Ad+CWT fish when many MM fish are released with Ad clip only.

# MAJOR FINDINGS: Issues raised by Mark-Selective Fisheries

- 7. For coho and chinook salmon, it appears possible to estimate total non-catch mortalities at age in all MSFs from a full cohort analysis of paired DIT (double-index tagged) releases.

*However, we could not derive an unbiased method to allocate total non-catch mortalities over a set of MSFs.*

*Consequence: Unless only one MSF, can't tell "which one" may be causing non-catch morts.*

# MAJOR FINDINGS: Issues raised by Mark-Selective Fisheries

- 9. Concerns have been expressed regarding “reliability in practice” of electronic wandings of salmon for presence of CWTs, but all evidence brought to our attention suggests that wanding is reliable. *(except for half tags in Chinook – CDFG comments. Many half-tags used in CA.)*
- 10. Impacts of MSF will be variable & stock-specific. Management agencies have not yet developed a framework to address the increased uncertainties that would result from significant MSFs.

# MAJOR RECOMMENDATIONS: Coordinated Research

- 12. Design and conduct new experiments to evaluate use of alternative external marks for identification of fish bearing CWTs OR use a different Mass Mark.
  - External marks (e.g., ventral fin clips) appear to generally decrease survival from release to age 2, but (from the CWT analysis perspective) it is more important to know if there is a persistent survival effect past age 2.