AN UPDATE ON THE IMPLICATIONS OF THE USE OF THE VENTRAL FIN CLIP AS A MASS MARK FOR COHO SALMON

Selective Fisheries Evaluation Committee

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1.0 INTRODUCTION

Conservation concerns for wild salmonids have driven exploration of alternate management strategies including selective harvest of mass marked hatchery stocks. The ventral fin clip has been proposed as a mass mark for Pacific salmonids on several occasions in the past fifteen years. The CDFO released ventral marked coho in 1985, in anticipation of the potential of increased angling effort associated with Expo 86. However, selective fishery regulations were not implemented. More recently, the PSMFC Subcommittee on Mass Marking (PSMFC 1992) identified two possible mass marks for selective fisheries; the ventral fin clip and the adipose fin clip. They noted that the use of the adipose fin clip as a mass mark was not feasible as long as the adipose fin clip was sequestered as the external indicator for the presence of CWTs. The Subcommittee also cautioned on the use of the ventral fin because of possible high and variable mortality.

The Ad-hoc Selective Fisheries Evaluation Committee (ASFEC) of the PSC recommended against the use of ventral clips, and endorsed the adipose fin clip as the selective mark of choice based on four criteria: 1) ease of application; 2) ease of recognition by an untrained observer; 3) low mark induced mortality; and 4) mark stability over the life of the fish. The ASFEC further recommended that there should be no external indicator for the presence of CWTs, and that CWT recovery employ newly developed electronic CWT detection technology (PSC 1995).

Shortly thereafter, WDFW and ODFW adipose-marked 1995 brood-year (BY) hatchery coho salmon from Grays Harbor south, and approximately one-third of the Puget Sound production for potential selective fisheries in 1998. Because of concerns for the need to ensure adequate coordination among affected managers in order to maintain the viability of the CWT system, the treaty tribes in Washington State sought and received a court injunction to halt further marking of Puget Sound coho salmon. The tribes and WDFW are developing a schedule to resolve and address technical and policy issues pertaining to mass marking and selective fisheries. By late 1996, CDFO was not able to commit to implement complete electronic sampling by 1998, for technical and financial reasons. However, in response to conservation concerns for southern B.C. coho salmon and the unresolved technical and policy concerns pertaining to the ability to maintain the viability of the CWT program if the adipose fin were to be used as the mass mark, CDFO is proceeding ventral fin clipping approximately five million 1995 BY coho salmon, for a possible selective fishery in 1998.

2.0 VENTRAL FIN CLIP INDUCED EFFECTS

Recent research on the ventral clip has focused on two areas: the additional mortality associated with the excision of the fin; and the regeneration of ventral fins following clipping. Recent investigations into mass marks and selective fisheries for Pacific salmonids was summarized in the ASFEC report (PSC 1995).

2.1 Mark-Induced Mortality

2.1.1 Investigations into Ventral Clip Induced Mortality

Mortality attributable to the ventral fin clip is highly variable and occasionally substantial. Table 1 summarizes ventral clip studies conducted on chinook and coho salmon. Values discussed in the text compare survival rates of the Ad-Vent-CWT releases to Ad-CWT (control) releases. Negative differential mortality means that the Ad-Vent-CWT groups had a lower survival rate than the Ad-CWT groups. This additional mortality is assumed to be due to the ventral clip.

For coho salmon released as yearlings, PSC (1995) reported differential mortality ranging from approximately -6 to -25%, and for salmonids in general, differential post-release mortality may be as high as -50%. PSMFC (1992) reported differential mortality attributable to the ventral clip ranging between 0 and -90%, however, they also indicated that some recent studies had been unable to demonstrate significant mortality as a result of ventral clips. Results of a study on chinook salmon released from Warm Springs Hatchery (USFWS) indicated that ventral clipped fish survived at a higher rate than adipose clipped fish. However, the conclusions are based upon a very small number of recoveries. Confounding marks, mark regeneration and problems with estimates of numbers released were cited as possible reasons for the observed variability in post-release mortality of ventral clipped fish.

Table 1. Summary of differential mortality attributed to treatment clipped releases in comparison to control releases. Negative differential mortality indicates that the treatment group had a lower survival rate than the control group.

						Differential Mortality of Treatment Group	
Program	Agency	Brood Year	Control	Treatment	n	Mean	Range
a) Ad-Vent-CWT vs Ad-CWT comparisons							
Expo Coho salmon	CDFO	1983	Ad-CWT	Ad-Vent-CWT	5	-16.8%	+4.0 to -43.6%
Puget Sound Coho	WDFW	1990-91	Ad-CWT	Ad-Vent-CWT	6	-13.9%	-6.0 to -24.9%
Chilliwack Coho	CDFO	1991	Ad-CWT	Ad-Vent-CWT	1	-58.4%	
Lower Geo. Str. Chin (0+)	CDFO	1987-91	Ad-CWT	Ad-Vent-CWT	3	-38.5%	-33.6 to -57.4%
b) Other comparisons							
Puget Sound Coho	WDFW	1991	Ad-CWT	Vent-CWT	3	-23.9%	-16.7 to -32.2%
			CWT	Ad-CWT	3	-2.4%	
Warm Springs Chin (1+)	USFWS	1987-89	Ad-CWT	Vent-CWT	3	+30.2%[1]	+97.5 to -5.7%[1]
Spring Creek Chin (0+)	WDFW	1992-93	CWT	Ad-Vent-CWT	2	-67.8%	-59.8 to -75.7%
	and	1992-93	CWT	Vent-CWT	2	-59.9%	-54.9 to -64.9%
	USFWS	1993	CWT	Ad-CWT	1	-4.9%	

Recent studies by CDFO on coho salmon at Chilliwack Hatchery and fall chinook salmon at two Strait of Georgia hatcheries, and by USFWS and WDFW on fall chinook salmon at Spring

[1] Results questionable due to very low survivals and subsequent recoveries

Creek Fish Hatchery have provided additional information about the impacts of applying ventral fin marks. The Ad-Vent -CWT fall chinook salmon from the lower Strait of Georgia survived at rates from -33.6 to -57.4% lower than the Ad-CWT fish. Further studies on fall chinook salmon at Spring Creek comparing Vent-CWT to CWTs without finclips yielded estimates of additional mortality ranging from -54.9 to -64.9% (Table 1).

For comparison, the adipose fin is estimated to cause -2.4% additional mortality for coho salmon and -4.9% addition mortality for chinook salmon (Table 1: Ad-CWT vs CWT).

2.2 Mark Stability

Ventral fins are more prone than the adipose fin to regeneration after excision. Regeneration of a fin after clipping can be virtually complete (clip almost undetectable), partial, or almost undetectable (not regenerated to any significant degree). Interpretation of reported regeneration rates is confounded by the way regeneration has been assessed. Some studies evaluated clip quality categorically at the hatchery rack, while others only reported detection failure rates for known previously clipped fish.

2.2.1 Ventral Fin Regeneration Studies

Studies by WDFW on coho salmon in Puget sound hatcheries reported total regeneration of the excised ventral fin in 0.0-5.7% of returning spawners. In addition, at least 50% of the clipped ventral fin was regenerated in 4.8%-24.9% of the sampled fish (Table 2). Clip qualities were poorer in the first year of the study, indicating that as crews gained experience excising ventral fins, clip quality improved. The CDFO Expo coho salmon study reported complete regeneration of ventral fins occurred in 4.2% of clipped returns (range 0.0 to 5.2%) (Table 2). This study did not determine rates for partial regeneration.

Table 2 also summarizes recent ventral clip regeneration information derived from returns of 1991 BY coho salmon to Chilliwack Hatchery and 1992 and 1993 BY fall chinook salmon to Spring Creek Hatchery. No estimates of partial regeneration rates were recorded for the CDFO coho salmon studies. However, an estimated 7.9% of the returning ventral clip releases had no recognizable ventral mark or were missed by samplers (i.e. sampler error). Between 0.0 and 16.7% of the chinook salmon returns to Spring Creek Hatchery had fully regenerated ventral fins (mean 5.9%), and between 4.8 and 44.4% had regenerated at least 50% of the clipped fin (mean 24.5%). Clip quality was considerably poorer for 1992 BY recoveries than for 1993 BY recoveries, again indicating that marker experience may significantly influence longer term regeneration rates. Given the seasonal nature of marking programs, it is difficult to maintain a pool of experienced markers.

Table 2. Summary of observed regeneration rates of adipose and ventral clips, estimated in studies a) previously reported in PSC (1995) and Anon (1992); and b) completed since the release of PSC (1995).

Program	Agency	Brood Year	Fin	Fin Regeneration Mean	Fin Regeneration Range	Degree of Regeneration
a) Previously reported						
Expo Coho	CDFO	1983	Ventral	4.2%	0.0 to 5.2%	Complete[1]
Puget Sound Coho	WDFW[2]	1990	Ventral	3.9%	2.0 to 5.7%	Complete
			Ventral	22.7%	19.4 to 24.9%	Partial[3]
		1991	Ventral	2.4%	0.5 to 6.1%	Complete
			Ventral	12.8%	7.6 to 20.4%	Partial
			Adipose	0.3%	0.0 to 0.7%	Complete
			Adipose	4.2%	2.7 to 4.3%	Partial
b) Previously unreported						
Chilliwack Coho	CDFO	1991	Ventral	7.9%	[4]	Complete[1]
Spring Creek Chin (0+)	WDFW	1992	Ventral	10.3%	3.8 to 16.7%	Complete
			Ventral	37.6%	30.8 to 44.4%	Partial
			Adipose	0.0%		Complete
			Adipose	1.8%		Partial
		1993	Ventral	1.6%	0.0 to 3.2%	Complete
			Ventral	11.5%	4.8 to 18.1%	Partial
			Adipose	0.0%		Complete
			Adipose	3.5%		Partial

2.3 Additional Issues for the Conduct of Selective Fisheries

Fishers should have little difficulty recognizing either the adipose or ventral mark, assuming fin marks are complete. However, there are additional issues relating to use of the ventral fin mark in selective fisheries. Identification of the mark status is likely slower and the fish must be landed for examination. The inability to release unmarked fish quickly, with a minimum of handling, may increase the release mortality on unmarked stocks.

Given the strong association among fishers between the adipose fin clip and hatchery fish, there may be confusion, especially at first, about the criteria for retaining. Species identification problems and different management regimes for coho salmon and chinook salmon may exacerbate the confusion. Inappropriate retention of Ad-CWT coho salmon will violate the assumptions of the CWT program.

In addition, fin regeneration may significantly affect the apparent availability of ventral marked fish for selective harvest. As previously noted in PSC (1995), partially regenerated fins may be discernible to trained observers, but would be difficult for fishers to recognize, and thus fish available for selective harvest would be released.

[1] Clip not detected by trained observers
[2] Hatchery rack recoveries only
[3] Fin at least 50% regenerated
[4] Only one hatchery; no mean across facilities

3.0 POTENTIAL IMPACTS ON THE CWT PROGRAM AS A RESULT OF USING VENTRAL FIN CLIPS AS A MASS MARK.

The CWT program is central to the management of chinook and coho salmon. The viability of the CWT system was defined by ASFEC (PSC 1995) as:

1. The ability to use CWT data for assessment and management of wild salmon stocks;
2. the ability to maintain the program such that the uncertainty in our assessments and their applications does not unacceptably increase management risk; and
3. the ability to estimate stock-specific exploitation rates by fishery and age.

A number of basic assumptions underlie the CWT program. They are:

1. CWT'd fish exhibit the same marine survival, catch distribution and migration behaviour as untagged fish from the same release group;
2. wild fish in a given area exhibit the same characteristics as wild-indicator hatchery stocks (Ad-CWT) in that area; and
3. the stock composition of the landed catch is the same as that in non-landed harvest mortalities (sub-legal fish and other releases).

If the ventral fin clip is used as a mass mark to identify hatchery salmon for the purposes of a selective fishery, and the adipose fin continues to be the external indicator for the presence of CWTs, fish with four mark types would be encountered: unmarked; Ad-CWT; ventral clipped; and Ad-Vent-CWT. Table 3 describes the retention status of the various mark types in selective (using the ventral mark as the selective mark) and non-selective fisheries.

Table 3. Mark types encountered by fishers under ventral clip-based selective fishery regime, using the adipose clip as the CWT identifier.

Mark Type	Represents	Retention Status	
		Non-Selective	Selective
No mark	unmarked fish e.g. wild	retained	released
Ad-CWT	CWT representation of unmarked fish	retained	released
Ventral clip	hatchery fish for selective harvest	retained	retained
Ad-Vent-CWT	CWT representation of hatchery fish for selective harvest	retained	retained

Assessment of selective fishery impacts would be based on comparisons between survival and exploitation rates of Ad-CWT and Ad-Vent-CWT releases. This is the double index tagging (DIT) described by ASFEC (PSC 1995). With selective fisheries, accounting for mortality on unmarked populations requires:

- no differential retention between marked and unmarked fish in non-selective fisheries,
- a means to estimate the mortality on unmarked fish in selective fisheries, and
- equal capability to recover marked and unmarked fish in the escapement.

The following impacts to the viability of the CWT program may be encountered:

1. The ASFEC (PSC 1995) report states that selective fisheries using the recommended mark and detection methods (adipose clip and electronic detection) would impair the viability of the CWT program, losing management information currently in use. The magnitude of any effect would be dependent upon the exploitation rate on a stock in the selective fisheries.

2. The use of a ventral clip further increases the information loss due to the significant and variable additional mark mortality. The uncertainty in estimates of marine survival and exploitation rates would increase as a result of variable mortality associated with the ventral fin clip. Therefore, there would be a reduced ability to evaluate the impacts of the selective fishery on unmarked stocks. It will be impossible to separate hook and release mortality on non-ventral clipped groups from mark induced mortality and mark recognition error.

3. The Ad-CWT fish would no longer be representative of unmarked fish if inappropriate retention of Ad-CWT fish occurred in the selective fishery. To further complicate matters, WDFW and ODFW are using the adipose-clip as the mass mark for their proposed selective fisheries. If significant numbers of Canadian fish are encountered in these fisheries, the Ad-CWT releases could no longer be assumed to be representative of unmarked and wild fish. This would be a problem whether or not Canadian fish were ventral clipped or not.

4. The variability in fin regeneration rates will lead to different rates of mark recognition error among stocks, which will result in unnatural variability in the exploitation rate estimates among stocks.

4.0 SUMMARY

Ventral fin clipped releases are subject to significant and variable additional mortality when compared to unclipped or adipose clipped CWT fish. Variability in mark mortality and fin regeneration may have significant impacts on the viability of the CWT system. The additional mortality and regeneration of fins also reduces the number of hatchery fish available for selective harvest.

The possibility of multiple selective fishery regimes employing different mass marks and sampling and recovery programs further emphasizes the need for coordination between all affected agencies.

REFERENCES

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