

PACIFIC SALMON COMMISSION
SELECTIVE FISHERIES EVALUATION COMMITTEE

2003 REVIEW OF MASS MARKING AND
MARK SELECTIVE FISHERY PROPOSALS

REPORT SFEC (03)-2

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Selective Fishery Evaluation Committee

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Acronyms

AABM	Aggregate Abundance Based Management (1999 PSC chinook agreement)
ASFEC	Ad-Hoc Selective Fishery Evaluation Committee
CTC	Chinook Technical Committee
CoTC	Coho Technical Committee
CWT	Coded Wire Tag
CNR	Chinook Non-Retention
DIT	Double Index Tagging
ETD	Electronic Tag Detection
ISBM	Individual Stock Based Management (1999 PSC chinook agreement)
MM	Mass Marking
MOU	Memorandum of Understanding
MSF	Mark Selective Fishery
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
SFEC	Selective Fishery Evaluation Committee
SFEC-AWG	Selective Fishery Evaluation Committee Analytical Work Group
SFEC-RCWG	Selective Fishery Evaluation Committee Regional Coordination Work Group
<i>sfm</i>	Selective Fishery Release Mortality Rate

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EXECUTIVE SUMMARY

The Pacific Salmon Commission (PSC) established the Selective Fisheries Evaluation Committee (SFEC) in 1998 to evaluate potential impacts of Mass Marking (MM) and Mark-Selective Fisheries (MSFs) on the viability of the Coded Wire Tag (CWT) system. In October 2002, agencies that intended to engage in MM or MSFs were requested to provide specific information on a schedule that would permit the SFEC to give timely advice to the PSC. This report (a) summarizes the results of the review process of MM and MSF proposals received between November 2002 and January 2003, (b) identifies important policy issues and concerns, and (c) provides recommendations and advice.

1. MM and MSF Proposal Reviews.

- Proposals for many of the mass marking programs were not received. Other proposals were incomplete. This lack of information is a significant concern for maintaining the integrity of the CWT system, and limited the scope of this review. For the proposals that were received, no significant technical concerns were identified. Some overarching issues of concern that result from implementing mass marking emerged. These included the adequacy of the chinook double index tag (DIT) program, the adequacy of CWT sampling rates, and the need for additional data reporting requirements.
- Numerous concerns were raised relating to the adequacy of electronic CWT sampling programs, primarily in Canada. Agency attention and possible additional funding will be needed to maintain adequate sampling rates and meet new data reporting requirements.
- Agencies did not provide proposals for some MSFs they intended to conduct. The MSF proposals that were received were of varying quality. The coho salmon MSF proposals generally did not provide the technical information requested. Most of the chinook salmon MSF proposals were more complete. However, the SFEC was unable to complete the technical reviews of MSF proposals. The proposals that identified all the technical information requested by the templates also proposed modifications to the estimation methods previously described by the SFEC. Those modifications involved the use of additional assumptions that the SFEC was not able to evaluate on a statistical basis.

Although proposed MSFs would impact the CWT system (and Individual Stock Based Management (ISBM) and Aggregate Abundance Based Management (AABM) indices that are integral to chinook management regimes under the 1999 PSC Agreement), it was not possible to quantify the impacts or gauge them against other sources with similar impacts, for example chinook non-retention fisheries. However the impacts can be qualitatively described as carry over effects. Because a given cohort of chinook contains fish that mature at different ages, pre-terminal MSFs for chinook that encounter immature fish will have carry-over effects to similar pre-terminal MSFs in subsequent years. In terminal areas with multiple MSFs, e.g., Columbia River, there will be similar carry over effects.

- There may be an implementation issue for nonselective fisheries where anglers voluntarily release unmarked fish. The SFEC was unable to assess that impact.
- The SFEC did not assess multiple encounter issues discussed in SFEC (2002).

2. Proposal Review Process.

- The time frame outlined in the SFEC’s template was established to provide the PSC with the opportunity to comment prior to implementation of MM programs and MSFs each year. However, this time frame precedes the completion of the annual domestic fishery planning processes. This increases the difficulty of assessing impacts to the CWT system since the total regulation package is not yet known.
- In some instances, agencies did not submit proposals for MM programs and MSFs they intended to conduct. In other instances, agencies did not provide additional information or clarifications as requested by the SFEC. There is a general need to improve agency awareness of the PSC’s request to utilize proposal templates and provide timely information for SFEC review. Since there is no mechanism to force agencies to adhere to the MM and MSF protocols, compliance is voluntary and uneven.

3. Double Index Tag (DIT) System.

- The DIT program should be reviewed by the agencies, SFEC-Analytical Work Group (SFEC-AWG), Chinook Technical Committee (CTC), and Coho Technical Committee (CoTC), to determine if indicator stocks potentially encountered in MSFs are adequately represented by DIT groups. For stocks that are not represented, exploitation rates will need to be assessed using additional assumptions.
- MSF proposals that indicated an estimation method generally described a modification of the paired ratio method developed by the SFEC (2002). The proposed modification provides a method for estimating exploitation rates of unmarked fish without a need for DIT. However, the method is biased and the degree of bias is difficult to assess as it depends on the validity of assumptions regarding input parameters. This method would not make the DIT program unnecessary. DIT is required if one elects to use another estimation method such as a paired ratio modification using the unmarked to marked ratio from the escapement. Such a modification may be appropriate if there are expected to be large MSFs with large annual carry over effects. DIT data also provide the most precise monitoring indicators for MSF impacts.

4. Viability of CWT System

- The CWT system should undergo a substantial review to determine its current viability. This type of review can help provide a gauge against which to measure impacts from MM and MSF proposals.
- Because estimates of incidental unmarked mortalities are necessary for cohort and exploitation rate analysis, additional CWT data reporting requirements are needed, such as a description of fishery regulations and methods used to estimate “pseudo-CWT”

recoveries of unmarked fish in MSFs or in areas with visual sampling.

- Following the implementation of MM and MSFs, voluntary CWT recovery programs can no longer be relied upon to recover tags from the unmarked fish; direct fishery sampling programs will be required for all fisheries that significantly impact DIT groups.

5. Unresolved Issues

- The SFEC-AWG was unable to assign a relative level of concern to each MSF proposal. Several qualitative characteristics of proposals can influence the viability of the CWT system. These characteristics correspond to different degrees of concern, and cannot be easily measured or compared.
- Given the inability to quantify uncertainty using statistical measures, the SFEC explored alternative (i.e., non-statistical) methods of perspective that may be meaningful to the PSC and fishery managers. One alternative compared exploitation rates due to non-retention of all chinook in past coho fisheries to proposed exploitation rates of MSFs on unmarked chinook to give a perspective on the potential size of the impact. Both situations require indirect estimation of non-retention mortalities and both incur bias and impacts to the CWT system. However, the nature of the impacts is not identical as non-retention of all chinook impacts marked and unmarked fish alike whereas an MSF will have a differential impact between marked and unmarked groups. Debate arose regarding the utility of those comparisons.

6. Future Direction

- The process of requesting and evaluating all agency MM and MSF proposals should continue so that the SFEC can maintain an oversight and identify potential conflicts. However, given the difficulty of providing meaningful review in light of the timing of domestic fishery planning processes, the SFEC should focus its review of MSF proposals on providing advice to agencies to ensure that monitoring systems are designed to produce data and information required to evaluate MSF impacts post-facto.
- The SFEC should provide guidance to agencies and other PSC technical committees on post-season analysis methods for DIT data for coho and chinook indicator stocks to estimate age and fishery-specific exploitation rates for indicator stocks.

INTRODUCTION

The coded-wire-tag (CWT) is the only method the Parties of the Pacific Salmon Treaty (PST) have available for estimating and monitoring fishery impacts on individual stocks of coho and chinook salmon. For three decades, the CWT has provided a practical, efficient, and cost-effective means for stock specific assessment. In recognition of the importance of the CWT system to the Pacific Salmon Commission (PSC), a Memorandum of Understanding (MOU) was signed in 1985 by the Parties that obliged them to “maintain a coded-wire-tagging and recapture program designed to provide statistically reliable data for stock assessments and fishery evaluations”.

The database of release and recovery information contains data collected since the mid 1970’s and represents the historic record for monitoring changes in stock and fishery specific impacts. Two factors have made it possible to utilize the CWT for these purposes: (1) coordinated coastwide marking and sampling programs; and 2) development of CWT tagged “indicator” stocks used to evaluate fishery impacts on population aggregates.

The management efforts of the PSC for chinook and coho salmon have focused on bilateral efforts to conserve and manage wild fish. For the most part, these regimes have been built on information derived from analysis of CWT data from hatchery fish and the assumption that indicator stocks of hatchery fish undergo similar exploitation patterns as associated wild fish.

Conservation concerns for wild salmon have increased in recent years in both Canada and the United States. In addition, large investments have been made by both countries to support hatchery production of salmon. If investment in these hatchery programs is to continue then production from hatcheries must provide for economically and socially viable fisheries, while constraining impacts to levels appropriate for the conservation and rebuilding of wild salmon stocks.

These concerns have recently increased interest in exploring alternative management approaches that permit continued or increased harvest opportunities for hatchery fish, while also constraining impacts on wild stocks. One such approach is the implementation of selective fisheries that allow retention of marked fish while requiring release of unmarked fish.

The preferred method of marking fish so fishermen can easily recognize them in mark selective fisheries (MSFs) is to clip the adipose fin.¹ The term “mass marking” in this document refers to the clipping of the adipose fin of large numbers of hatchery fish, without application of a corresponding CWT. Due to unresolved analytical issues and technical difficulties, mass marking programs were initially restricted to coho. Canada and the United States currently mass mark millions of hatchery coho each year; the United States has also mass marked millions of chinook salmon in recent years. The purpose of the mass marking was to provide a means to visually identify hatchery fish, either to support and evaluate MSFs, monitor hatchery and wild

¹ The Ad-Hoc Selective Fishery Evaluation Committee of the PSC recommended that adipose fin clip be used as the mark of choice because: (a) marking mortality was believed to be minimal and relatively stable; and (b) marking methods and costs were known with reasonable certainty.

interactions, or both. Prior to the relatively recent interest in MSFs, the clipping of the adipose fin of salmon was reserved almost exclusively to indicate that a fish was implanted with a CWT. Reserving the adipose fin clip for this purpose allowed visual detection of a fish that was tagged and thus facilitated the sampling and recovery of the CWT.

However, in MSFs fish of the target species without an adipose fin (generally hatchery fish) are retained, while some or all fish of that species with adipose fins (generally wild fish) are released. Therefore, unless the mortality rate on the released fish is 100%, the assumption of equal exploitation rates of wild and hatchery fish is violated in MSFs. This differential mortality of marked and unmarked fish in MSFs prompted the PSC to establish an Ad-Hoc Selective Fishery Evaluation Committee in the mid 1980's and a permanent Selective Fishery Evaluation Committee in 1998.

The viability of the CWT system was defined by the PSC Ad-Hoc Selective Fishery Committee (ASFEC 1995), as one that:

- ***Provides the ability to use CWT data for assessment and management of wild stocks;***
- ***Is maintained such that the uncertainty in stock assessments and their applications does not unacceptably increase management risk; and***
- ***Provides the ability to estimate stock-specific exploitation rates by fishery and age.***

Recognizing that the recent MM and MSF impact the coast-wide CWT program, the PSC subsequently adopted the "Understanding of the PSC Concerning Mass Marking and Selective Fisheries" (Understanding, Appendix A). It describes the PSC policies and procedures required to implement the MOU and assist the Parties in fulfilling the obligations of the MOU and other related obligations under the PST.

In 1998, the PSC established a Selective Fishery Evaluation Committee (SFEC; PSC 1997/98 Thirteenth Annual Report, Appendix E). The purpose of the SFEC is to provide advice to the Commission regarding the potential impacts of MM and MSF on the viability of the CWT system. To facilitate this objective, the Understanding also prescribed a schedule for the annual submission of MM and MSF proposals by the appropriate Agencies of November 1 for the year prior to implementation. The intent was that the proposals would be provided annually to the SFEC in time to allow it to complete its analyses and report to the Commission at the PSC Annual Meeting. It was recognized that this timeline preceded the completion of the annual domestic fishery planning processes of the Parties. However, this schedule is required to allow for sufficient bilateral technical review and evaluation in time for the PSC to comment prior to implementation of the MM programs and MSF each year.

In February 2002, the Commission directed the SFEC to develop templates and protocols for agencies to use in submitting MM and MSF proposals. The purpose of this assignment was to ensure that the management agencies had a clear understanding of the information, data and timeframes needed for the SFEC to complete its analyses.

In October 2002, the SFEC completed the development of the proposal templates and distributed these to the Agencies. Proposals for MM and MSFs were subsequently prepared by the

Agencies and submitted to the PSC. The SFEC then reviewed these proposals from a technical perspective, to try to assess the potential impact on viability of the coast-wide CWT system. The SFEC assigned the responsibility to review MM proposal to the Regional Coordination Work Group (SFEC-RCWG) and MSF proposals to the Analytical Work Group (SFEC-AWG). This report summarizes the results of the proposal submission and review process, and the SFEC technical review of the MM and MSF proposals received by the PSC and the SFEC between November 2002 and January 2003. The report also identifies some important policy issues and concerns for the PSC that arise from the implementation of proposed MM and MSFs, and provides some recommendations and advice to the PSC.

SFEC-Regional Coordination Work Group Report

Introduction

The SFEC was charged with developing a standardized process for submitting and evaluating proposals for MM and MSFs. A template for MM proposals was developed and agencies were asked to provide their information to the SFEC in this format (Appendix B). The RCWG developed criteria (Appendix C) for reviewing the MM proposals. The SFEC timeline for submitting and reviewing proposals is listed in Appendix D. Proposals were reviewed, discussed, and evaluated by RCWG members in December 2002. This review identified additional information required for the SFEC to complete its evaluation. Subsequently, SFEC sent requests for additional information to the agencies. Final review and evaluation of the MM proposals was conducted at the January 2003 SFEC meeting. Not all mass marking proposals that were requested by SFEC were submitted by the agencies. The current status of the proposals is listed in Appendix E.

Summary of 2003 Review

Proposals were reviewed and rated for their impacts on the CWT system. The results are listed in Table 1. No ratings were assigned for programs that did not submit a proposal.

Table 1. Summary of review of 2003 mass-marking proposals.

Species	Area	Agency	Rating ¹	Number to be Mass Marked	Recommendations
Coho	Southern BC	CDFO	Some concerns	5,700,000	It is suggested that CDFO review its recreational fishery sampling program and take measures to increase CWT sampling rates to pre-mass-marking levels.
	Puget Sound	WDFW ²	No significant concerns	11,793,000	Anticipated fishery distribution and sampling rate information should be provided in a timely manner in the MM proposal.

Species	Area	Agency	Rating ¹	Number to be Mass Marked	Recommendations
		USFWS	No significant concerns	450,000	None
	Washington Coast	USFWS	No significant concerns	760,000	None
		WDFW	(not rated)	6,625,000	No proposal received
	Columbia River	USFWS	No significant concerns	2,485,000	None
		WDFW	(not rated)	14,714,000	Incomplete proposal
		ODFW	(not rated)	6,557,500	No proposal received
	Oregon Coast	ODFW	(not rated)	941,500	No proposal received
Spring Chinook	Puget Sound	WDFW ²	Some concerns	1,025,000	Anticipated fishery distribution and sampling rate information should be provided in future MM proposals. It is recommended that the SFEC-AWG and CTC ³ assess the scope and utility of the chinook DIT program.
		WDFW	(not rated)	4,688,900	Incomplete proposal
	Columbia River	USFWS	No significant concerns	6,870,000	It is recommended that Columbia River co-managers reach annual mass marking agreements.
		ODFW	(not rated)	11,400,000	Proposal not reviewed
	Oregon Coast	ODFW	(not rated)	2,751,000	Proposal not reviewed
Fall Chinook	Puget Sound	WDFW ²	Some concerns	33,980,000	Anticipated fishery distribution and sampling rate information should be provided in future MM proposals. It is recommended that the SFEC-AWG and CTC ³ assess the scope and utility of the chinook DIT program..
	Idaho	IDFG	(not rated)	500,000	No proposal received
Spring / Summer Chinook	Idaho	IDFG	(not rated)	8,800,000	No proposal received
Summer Chinook	Puget Sound	WDFW ²	Some concerns	1,450,000	Anticipated fishery distribution and sampling rate information should be provided in future MM proposals. It is recommended that the SFEC-AWG and CTC ³ assess the scope and utility of the chinook DIT program..

¹ Rating of Impacts to the CWT System

- **No Significant Concerns:** adequate DIT representation and electronic tag detection programs are in place for the known distribution of the mass marked stock
- **Some Concerns:** some technical concerns relating to DIT representation or sampling programs
- **Significant Concerns:** proposal likely to result in significant impacts to the viability to the CWT system. For example, electronic tag detection capability is inadequate or significant impacts to ability to meet sampling goals. .

² Includes mass marking programs at tribal facilities

³ Chinook Technical Committee

Issues and Concerns Raised by the Review of the Mass Marking Proposals

Process

- MM proposals were not received from all agencies for all anticipated MM activities (e.g. Oregon, Idaho, Washington). Some proposals were incomplete (Washington), which also limited the scope of the review. It was recognized that time constraints limited the process in 2002, and an official request from the SFEC was not sent to Idaho. The review process also suffered from unfilled agency staff vacancies on the RCWG in 2002 (ODFW and WDFW).
- The MM proposal template (Appendix B) did not request information on CWT sampling rates. This information is needed to assess the adequacy of regional sampling programs. This information was subsequently requested from agencies, with limited success. Future templates will include such a request for anticipated sampling rates.
- The MM Template includes a question asking if the proposal complies with other regional agreements on marking. The intent was to help identify potential conflicts with marking programs. This question highlighted the fact that there are unresolved inter-agency issues regarding the use of the adipose fin clip on chinook within the Columbia River basin.

DIT Program

- Ad+CWT groups (tagged and adipose fin clipped) no longer represent unmarked groups and cannot be used to directly estimate exploitation of wild or unmarked stocks in the presence of MSFs. The list of chinook and coho DIT pairs (Appendix F) should be reviewed by the SFEC-AWG, Chinook Technical Committee (CTC), and Coho Technical Committee (CoTC) to ensure that all stocks potentially encountered in proposed MSFs are adequately represented by DIT groups. For example, there are no DIT groups for chinook indicator stocks in the upper Columbia, Snake River, or Oregon Coast. Only one of potentially nine Canadian indicator stocks vulnerable to the proposed MSFs in Washington Area 5/6 has DIT groups and Electronic Tag Detection (ETD) sampling in the escapement. However, there are also uncertainties surrounding the utility of DIT groups.
- The cost of DIT tagging and associated ETD sampling in escapement and fisheries is high. Preliminary information is inconclusive that the DIT method will work in practice to achieve the goals and objectives of the 1999 PST Agreement. Post-season DIT data for coho and chinook indicator stocks should be analyzed by the SFEC to assess the method's efficacy to accurately measure fishery and age specific exploitation rates for indicator stock cohorts.

Electronic CWT Sampling

- An assessment of the cumulative impacts of all MM on sampling programs (e.g., increases in processing costs and sampling capabilities) was not possible due to missing and incomplete proposals. However, the proposed increased number of untagged, clipped recoveries in areas without ETD could result in both increased costs and reduced sampling rates due to increased sampling time needed for processing a large number of heads from fish without CWTs.

- The conversion to ETD has resulted in numerous impacts to agency sampling programs. Specifically, ETD has added more complexity to the sampling process, greater costs for equipment, the need for more data collection, and greater dependence on proper sampling technique. ETD is slower than visual sampling and the additional handling of fish is physically more demanding and a greater imposition on the harvester or processing facility (e.g., not all commercially caught fish placed on a table for processing require handling under a visual sampling scenario. They will all need to be handled under ETD). The impacts are offset to some degree because ETD equipment has proved to be very accurate at detecting tags when used properly (including “mouth-wandering” on chinook) and because the requirement of handling each fish may reduce the number of missed tags.
- The recommended “mouth-wandering” technique for chinook ETD is not being widely used because it results in excessive abrasion of the wands. Mouth wandering involves inserting the wand into the fish’s mouth to detect tags through the palate. This technique is used in conjunction with the standard wandering technique, where the wand is passed over the outside of the snout. Protective Sheaths that protect the wands are being developed, but are not currently available. Some tags will be missed if the mouth-wandering technique is not used on chinook. If the technique is used without sheaths, abrasion to wands will increase repair and replacement costs.
- The geographical range required for ETD for chinook needs further review to ensure that the lack of CWT-only (tagged and unmarked) recoveries in areas without ETD (e.g. Alaska, B.C. freshwater sport, coastal Oregon) will not compromise the analysis and estimation of exploitation rates for wild stocks.
- Mass marking requires a transition away from Voluntary Head Recovery in Canadian recreational fisheries to Direct CWT sampling programs since anglers are not expected to have wands. This change has resulted in a substantial decrease in sampling rates and recoveries of CWTs for coho, which has caused CWT expansion factors to increase 10 fold. At the same time, changes in Canadian harvest allocations, especially a reduction in commercial fisheries, have increased the importance of obtaining reliable recreational fishery CWT data. This transition has increased the uncertainty in the CWT system.
- There are continued concerns related to the cost of ETD equipment. Agencies may require additional equipment to sample chinook escapements, fisheries, and the increasing number of small, mobile buyers. Funds will also be needed to replace equipment as it ages. The life span of existing equipment is unknown.

General Concerns with Sampling Rates

- The review of MM proposals raised concerns regarding the adequacy of fishery CWT sampling rates. These are partially the result of downward trends in survival rates and reduced fishery harvest rates and are not solely related to mass marking. There is also an increasing trend away from centralized landing sites to small buyers or individual fisherman sales, both in Canada and Washington. This makes obtaining adequate, representative samples more difficult and costly and will likely require agencies to increase sampling efforts and may also require additional ETD equipment.

Data Management

- The distribution of tag recoveries from stocks depends on sampling methods (visual or electronic), sampling locations, sampling intensity, fishing patterns, and the ocean distribution of the stocks themselves. For some stocks, information on MSF impacts may not be available because of the lack of DIT representation. Some indicator stocks may not have DIT representation because of limited resources, limited hatchery production, small stock size concerns, or conservation concerns. For example, Washington rebuilding stocks (e.g., White River spring chinook, Stillaguamish summer chinook, and Dungeness spring chinook), which are tagged but not clipped (no DIT), will no longer be recovered in areas with MSF or in areas relying on visual sampling to recover tags. Data analysts must now be aware of the marking status of CWT groups and the regulatory history of fisheries in order to consider MSF impacts in stock assessments. This need to understand and interpret more complex data will also increase the potential for misinterpretation of recovery data.
- Not all agencies have successfully converted from PSC data exchange format 3.2 to the new format 4.0 designed to capture information on mass marking. This has impacted timeliness of reporting and also resulted in frequent data processing delays. There have also been data reporting errors regarding the identification of selective fisheries and the type of sampling. It is imperative that all agencies report information in the correct format and that every effort be used to minimize reporting errors.
- There is presently no system in place to share information needed to evaluate CWT recoveries affected by MSFs. A mechanism is required to review and report “pseudo-CWT” recoveries to regional databases.

Summary and Recommendations From SFEC-RCWG

No significant technical concerns were identified with any individual mass marking proposal received, but there are overarching issues of concern due to implementing mass marking.

Process

- The process of reviewing all agency proposals should be repeated in 2003 so that all MM programs anticipated by agencies are reviewed at least once by the SFEC. The template should be revised by the SFEC to incorporate information on catch sampling rates. All mass marking agencies should be notified and requested to use the mass-marking template for submitting proposals. Agencies will be asked to strictly adhere to the timeline. A complete set of proposals is necessary to assess the cumulative effects of these programs.
- The quality of the MM proposals varied greatly. Proposals were not received from all MM agencies for all proposed MM and others were incomplete. Timely and complete information is required to conduct this review and for agencies to coordinate and plan tagging and sampling programs. The SFEC will work to correct this for 2004 through better communications and more timely requests for information. However, this also requires that agencies make the appropriate technical staff available to provide the information and to

serve on the SFEC. Preserving the viability of the CWT program, to the extent possible, depends on this coordinated coastwide approach.

- The SFEC-RCWG intends to request, collate, and review CWT sampling rate information. This will allow an assessment of the adequacy of regional and coastwide sampling programs.

DIT Program

- The list of chinook and coho DIT pairs should be reviewed by the agencies, SFEC, CTC, and CoTC to ensure that stocks likely to be encountered in potential MSFs are adequately represented.
- Numerous questions remain regarding the utility and performance of the DIT program, the quality of the data being generated, and the analytical requirements for assessing MSFs. An analysis of the performance of DIT groups should be a high priority for the marking agencies and the SFEC.²

Electronic CWT Sampling

- Numerous concerns were raised by RCWG members regarding the adequacy of electronic CWT sampling programs, primarily in Canada.
- Agency attention and possible additional funding will be needed to adjust programs to maintain adequate sampling rates and meet new data reporting requirements. A review of sampling rates is planned by the RCWG this upcoming year.

Data Management

- Additional data reporting requirements were identified which need to be addressed by the PSC Data Sharing Committee. Priority data requirements include:
 - A database to record the regulatory history of fisheries. The SFEC understands that this request has been conveyed to the Data Standards Workgroup.
 - A mechanism should be established to review estimates of “pseudo-CWT” recoveries of unmarked fish in MSFs or areas with visual sampling and input them into regional CWT databases. Agencies should develop specific algorithms to estimate “pseudo-CWT” recoveries. The CTC and CoTC should review these algorithms.

² WDFW and Western Washington treaty tribes are in the process of preparing a report presenting results of a review of MSFs on coho DIT releases from Puget Sound and the Washington coast.

SFEC-Analytical Work Group REPORT

Introduction

The SFEC was instructed to develop and distribute templates for MM and MSF proposals and to evaluate the potential impacts of them on the viability of the CWT program. In October 2002, MSF proposal templates (Appendix G) were finalized. The templates requested MSF proponents to provide projected unmarked mortalities in MSF by tag code for stocks of PSC concern as well as the statistical method proposed for estimating the mortalities (and properties of the estimators) once data were available. Requests for proposals, along with the templates, were sent to agencies with the PSC required November 1, 2002 deadline for submissions. As of the February 2003 PSC Annual Meeting, eight MSFs proposals were received and their quality varied considerably. Some proponents provided considerable information, while others provided very little information other than a general notice that a MSF might occur at a particular time and location. Initial screening criteria were developed by the SFEC to evaluate MSF proposals for completeness. The current status of the proposals received was listed in Appendix E.

MSF Impacts on the CWT System

By its nature, a MSF cannot be sampled for stock- and age-specific mortalities of unmarked fish, yet those incidental mortalities must be considered in developing responsible fishery management plans and estimation is required to fulfill the objectives of the 1999 PST Agreement. As there are no direct methods of measuring incidental unmarked mortality, estimations must be made based on more assumptions and inference, adding uncertainty to the estimates of total fishery-related mortalities. MSFs have the potential to add uncertainty to current estimates of stock- and age-specific exploitation rates and that uncertainty may not be statistically quantifiable. Even if degrees of uncertainty could be guesstimated, it has yet to be determined how much increase in uncertainty the CWT system can absorb before there is cause for concern.

The AWG was unable come to consensus on whether the additional uncertainty introduced by the proposed MSFs was cause of technical concern. It was acknowledged that the MSF's would cause an impact, but the workgroup was unable to determine how much of an impact would be of concern because of differences in the purpose of the CWT release groups and perspectives on the degree of increased uncertainty that could be tolerated for fishery and resource management.

However, the AWG identified several qualitative evaluation criteria (Figure 1) that could lead to concern for the viability of the CWT system. Figure 1 shows qualitatively how the concern level varies within each criterion. The concern level for each criterion was not quantified, but rather was given on a qualitative scale. Although the scale is relative within a criterion, it has not been rated across criteria. For example, within the criteria "Across Year Carry-over Effects" there is greater concern with pre-terminal MSF's on chinook than with terminal MSF's on chinook since impacts on immature fish are expected to carry over to subsequent years. Within the criteria "Predicted Simple Exploitation Rates," there is more concern with MSF's expected to have higher rates. However, a small preterminal MSF on chinook could cause lesser impacts than a large terminal MSF on chinook. Without a quantitative system of ranking across criteria, one

cannot objectively determine the break even point when a small preterminal MSF would have the same impact as a larger terminal MSF. The AWG has not created such a quantitative system and therefore, was unable to rank proposals against each other. Rather, they provided a descriptive comparison of the eight proposals against the criteria categories (Figure 2). Figure 2 does not rate the proposals in terms of overall concern, but simply illustrates features of each proposal that may cause concerns.

Incremental increase in uncertainty in the CWT program

The questions asked of the SFEC are, "what is the incremental increase in uncertainty in the CWT program due to mark-selective fisheries" and "is this increase significant." These questions are not easy to answer. The second question (i.e., is the impact significant) cannot be answered without specifying a context for assessing significance and establishing an acceptable level of risk. CWT data are used for many purposes, including the estimate of stock and age specific exploitation rates by PSC fishery, cohort analyses, and developing abundance forecasts. The impact of MSFs is likely to be small when considering some of these purposes, e.g., estimating survival rates of hatchery fish – which can be accomplished by solely considering the marked and tagged fish. For other purposes, such as assessing exploitation rates on wild stocks (subject to very restrictive constraints such as those associated with ESA jeopardy standards), the impact may be more substantial.

Even with a framework established and a defined acceptable level of risk, the first question, incremental increase in uncertainty, is difficult to answer. Uncertainty is typically addressed using two measures: bias (a systematic tendency to over or underestimate) and precision (variability due to sampling error). While the precision of unmarked mortality estimates is easily addressed, the effect of potential biases is difficult to determine. Bias in estimation of exploitation rates due to a MSF will result from two sources: the estimate of the ratio of unmarked to marked fish in the fishery (λ) and the estimate of the selective fishery release mortality rate (sfm). The larger the number of fish encountered, the greater the bias in absolute terms. However, these biases cannot be estimated directly and therefore, one is limited to looking at hypothetical situations, as in the WDFW proposals for chinook in Area 5/6 and in the Skykomish River. Conceptually, this type of analysis results in a picture like that portrayed in Figure 3.

The solid curve in Figure 3 represents the uncertainty in unmarked mortality estimates made from direct samples of landed catch in a small non-selective fishery. As long as sampling is random, these estimates are likely to be unbiased. However, for small fisheries and low sampling rates, few tags are likely to be recovered in the fishery, and therefore estimates are likely to be fairly imprecise as indicated by the width of the solid curve. Now consider a MSF that results in the same number of unmarked mortalities as the non-selective fishery. The dotted curves in Figure 3 represent the uncertainty in mortality rates in the MSF when estimated by the Paired Ratio estimator (as in the proposals for area 5/6 and the Skykomish River). The estimates will be more precise (narrower curve) than if the unmarked mortalities in the MSF could be directly sampled. This counter intuitive result stems from the fact that the estimates are made using observations of landed marked fish, which are observed at a much higher rate (i.e., there will be many more marked mortalities in the MSF than unmarked mortalities). However, due to

the bias in λ and in the *sfm* (biases that cannot be estimated or observed), it will be impossible to know where the distribution is centered.

If the λ in the fishery is the same as that assumed (i.e., λ is equal to the λ at release) and if the assumed *sfm* is correct, then the distribution of possible estimates would be centered at the true value. However, it is impossible to know if these parameters are biased. So, all one can do is look at hypothetical situations regarding the degree of bias present in the estimates (e.g., due to using an incorrect *sfm*). Depending on the assumed bias, the distribution of the estimates will shift to the left or right (represented by the “?” in Figure 3). In the case of the assumed λ in the fishery is equal to the λ at release, one can infer the likely direction of bias (estimates will be too small since λ can be expected to increase with each new MSF impacting the brood, shifting the distribution of the estimates to the left). However, the potential bias due to *sfm* could shift the distribution in either direction.

Is the Impact Detectable?

One way to gauge the impact of a proposed MSF is to determine if it will result in a detectable difference in return rates of marked and unmarked CWT fish comprising the DIT pair for an individual stock subject to the MSF. Return rates are defined here as the proportion of CWT juveniles released that survived to escapement. To aid in this discussion it is useful to keep in mind three different return rates: the expected ($E[p] = \tau$), the realized (p), and the estimated (\hat{p}). The expected return rate is based on deterministic modeling. Realized return rates are those that actually occur and differ from expected return rates because of the stochastic nature of survival events associated with fishing and natural mortality sources. Under assumptions of independence, the realized return rate is approximately normally distributed with mean τ and variance $\tau(1-\tau)/R$ where R was the number of CWT fish surviving the fishery. Estimated return rates are based on sampling the escapement with a sampling rate of s , and are approximately normally distributed with mean τs , and variance $\tau s(1-\tau s)/R$.

One definition of detectable impact is whether or not a hypothesis test of no impact is rejected for the realized return rates. If there was no MSF, there is a certain probability that by chance alone the realized return rate would result in a rejected null hypothesis of no impact (in other words, an impact that was not there would be ‘detected’; i.e., a ‘false signal’). The null hypothesis would be rejected if the realized return rate showed a significantly larger proportion of unmarked than of marked fish in the CWT DIT pair in the escapement. A binomial process could describe the variance in the realized return rate. With a MSF, the chances of the realized return rate resulting in rejection of the null hypothesis of a larger proportion of unmarked than marked fish should increase. This increase could be projected using the projections of marked and unmarked mortalities in the proposals. This impact could be estimated by

$$p_U = \frac{\text{number of unmarked DIT fish at the hatchery rack}}{\text{number of unmarked DIT fish released}} = \frac{E^U}{R^U} \text{ and}$$

$$p_M = \frac{\text{number of marked DIT fish at the hatchery rack}}{\text{number of marked DIT fish released}} = \frac{E^M}{R^M}.$$

Assuming that the number of fish that return to the escapement can be represented by a binomial distribution, the variance in the return rates will be given by:

$$V(p_U) = \frac{\tau_U(1-\tau_U)}{R^U} \text{ and } V(p_M) = \frac{\tau_M(1-\tau_M)}{R^M},$$

where p_U and p_M are the respective expected return rates of tagged unmarked and marked fish and R^U and R^M are the respective number of tagged unmarked and marked fish released from a given DIT group. The expected return rates p_U and p_M will depend on expected marine survival rates as well as expected fishery exploitation rates (in both mark-selective and non-selective fisheries).

Given values for p_M , R^U , and R^M one can ask “what value of p_U would result in a 95% probability that tagged unmarked fish will return at a higher rate than tagged marked fish from the same DIT group?” The value of p_U can be determined by solving for this parameter in the equation below with $Z_{0.05} = 1.645$:

$$\frac{p_U - p_M}{\sqrt{\frac{p_U(1-p_U)}{R^U} + \frac{p_M(1-p_M)}{R^M}}} \geq 1.645.$$

The release sizes are known and by replacing p_M with the projected proportions of marked fish one can solve for the critical p_U . This critical value would then be the proportion of unmarked fish one would need to see in the escapement to detect significantly different return rates. One could not definitively conclude that the differential return rates were due to the MSF because this is not a completely controlled experiment and other unassessed sources of differential mortality may contribute to the differences in return rates. Unassessed sources contributing to differential return rates may include differences in marine survival, marine distribution, and exploitation rates due to random process error or voluntary selective fishing practices in fisheries sampled as though they were non-selective fisheries. The projected proportions of p_U in the proposals could then be compared to that critical value.

*EXAMPLE: Detectable Impact to George Adams
Chinook Stock in the Proposed Area 5/6 MSF*

The SFEC-AWG chose the Area 5/6 MSF proposal because the projected impacts to the George Adams stock were small and it was unclear if the fishery would produce detectable differences in return rates. Assuming a release of 200,000 marked and unmarked CWT'd fish and a return rate to escapement of 0.005, solving the above equation yields a p_U of 0.00537 which translates into a critical value of 75 more unmarked than marked fish in escapement summed over all return ages. What this means is that if the observed difference between unmarked and marked CWT fish of the DIT pair in the escapement was less than 75 fish, the impact due to the mark-selective fishery

would not be detectable with 95% confidence. To put this into a perspective, we calculated the expected difference in return number would have occurred for brood year 1985 George Adams Chinook, assuming the Area 5/6 sport fishery had been selective from 1987 through 1990. Brood year 1985 was chosen because of good survival of the brood and because the actual catch in the Area 5/6 sport fishery in the late 1980s was substantial (estimated catch averaged 49K³ from 1987-1990). A forward simulation model was used to make this calculation treating the Area 5/6 fishery as if it had been mark-selective each year from 1987-1990. The forward projection resulted in an expected difference of 23 fish between the marked and unmarked categories, which was less than the 75 fish deemed needed for a detectable effect.

How Does the Impact Compare with Other Impacts to the CWT System?

Whenever indirect estimation must be substituted for direct observation, caution is advised since additional assumptions, often difficult to verify, must be made. When assumptions must be substituted for data, the question becomes less statistical and more modeling in nature. Estimation of the change in uncertainty requires a comparison between statistical uncertainty of one method and an unknown modeling bias of the other, making the change difficult to assess in terms of practical concern. Another way to provide technical guidance is to put the projected impacts of MSFs into perspective with measures more commonly used by the PSC.

There are many different assumption-based methods to estimate incidental mortalities in non-MSFs and most of these use similar assumptions and have similar limitations as those used for MSFs (e.g., the inability to generate verifiable stock and age-specific exploitation rate estimates for cohorts and to validate assumptions regarding various incidental mortality rates and other fishery parameters). MSFs are in some ways similar to species-specific nonretention fisheries and fisheries that require the release of sub-legal fish in that they assume an *sfm*. However, MSFs differ in that they cause significant differential mortality between marked and unmarked fish. Consequently, for stocks subject to MSFs cohort analyses must be performed separately for marked and unmarked components.

In chinook nonretention (CNR) fisheries, encounters may be estimated using information from CWT recoveries in fisheries operated as retention fisheries in the same area at other times or through other methods, including direct observation (onboard observers or logbooks). Release mortality rates are then applied to estimated encounters to estimate total incidental mortalities. Those estimates can yield stock- and age-specific exploitation rates that may give a perspective when considering the projected incidental mortalities of the proposed MSFs. Although a CNR is expected to impact both marked and unmarked DIT components equally, there are similarities when considering impacts on exploitation rates. Like a CNR fishery, total unmarked mortalities for the MSF are estimated using information from another source to estimate encounters and then applying a release mortality rate to those encounters. A comparison of the predicted incidental mortality of the proposed MSF in Area 5/6 to the calculated CNR mortalities of previous catch years is one way to quantify a perspective.

Another perspective is to compare the impacts to the CWT system from other sources that may lead to different estimates of incidental mortalities. For example, unreported catch is a source of

³ Based on WDFW published sport catch estimates.

bias to exploitation rate analysis, but it is difficult to compare because without measures of unreported catch.

EXAMPLE: Comparison of Exploitation Rates of George Adams Chinook Non-retention (CNR) Mortalities in a Coho Fishery for a 1993 Chinook Brood Year and the Projected 2003 Unmarked Chinook Incidental Mortalities in the Proposed Area 5/6 MSF

Age	1993 BY Legal CNR	2003 Chinook MSF (values from MSF-2002-12-WDFW)
3	0.03%	0.9%
4	0.10%	0.9%

The CNR exploitation rates were generated using the annual CTC cohort analysis – brood year method. They represent the number of legal incidental mortalities by age (0.3 age 3 and 1.3 age 4) divided by the estimated ocean standing stock of 2-year olds ($1871 \cdot 0.6 = 1123$). The projections from the proposed Area 5/6 chinook MSF are based on a 3-month fishery (July – September).

Summary and Recommendations From SFEC-AWG

Process

- Eight MSF proposals were received with varying amounts of information.
- Agencies did not provide MSF proposals for some fisheries that they planned to conduct.
- MSF proposal templates will be revised to help expedite the review process.

MSF Proposal Reviews

- The impacts of proposed MSFs on the viability of the CWT system were difficult to assess because
 - One key area of debate within the SFEC-AWG was the challenge of assigning a relative level of concern to each MSF proposal. Several qualitative characteristics of the proposed MSFs can influence the viability of the CWT system. However, these characteristics correspond to different degrees of concern, which could not be measured statistically and easily compared.
 - We need a defined metric to assess the significance of the impacts of proposed MSFs on the viability of the CWT system.
 - We need a specified risk tolerance level to assess the significance of the impacts of proposed MSFs on the viability of the CWT system.
 - Characterizing the additional uncertainty incurred to the CWT system is difficult. Most of the uncertainty is due to the reliance on assumed parameter values (release mortality rates and assumptions regarding the number of released fish per retained fish) and generally not to sampling rates.
 - Specifics of MSFs were not available because domestic preseason planning processes had not been completed to provide information on the location or magnitude of MSFs.

- Although none of the proposals described plans to use the ‘total methods’ (SFEC 2002) for estimating the number of unmarked mortalities, the SFEC notes that the total methods would be ineffective at differentiating pre-terminal catch between the US and Canada and therefore could not be used to estimate ISBM indices as required by the 1999 agreement.
- Several of the proposals described methods for estimating unmarked mortalities by DIT group, age and fishery using a modification of the Paired Ratio method (SFEC 2002). The modification was in the source of the unmarked to marked ratio, i.e., using the release λ rather than a paired non-selective fishery.
- Given the difficulties in quantifying uncertainty using statistical measures, the SFEC needs to explore alternative (i.e., non-statistical) ways of describing uncertainties that are meaningful to the PSC and fishery managers. Such methods might include:
 - Examining if significant differences in return rates (juvenile release to escapement) of marked and unmarked fish within a DIT group may occur from the proposed MSF, as we did for the Area 5/6 sport fishery.
 - Qualifying these additional uncertainties due to MSF in the context of other sources of uncertainty in the CWT system. For example, by comparison with estimated impacts of Chinook non-retention fisheries
- The SFEC advises that implementation of MSF’s proceed with caution. For example, an implementation schedule could be based on a sequence of MSF’s from simple and small to complex and large where larger more complex fisheries are not implemented until the practical issues identified in smaller simpler ones are resolved. However, an implementation schedule based on successful conduct of a fishery does not acknowledge that MSFs are being proposed coastwide in an uncoordinated manner. It should at least be recognized that the current approach to implementation does not fully account for potential risks.
- Technical definitions of impacts need to be constructed and models need to be developed that objectively quantify the risks of those impacts. The modelled risks could then provide a means to compare proposals with different risk categories (e.g. small preterminal vs. large terminal). In addition, an evaluation of the current status of the CWT system with respect to those risks should also be conducted to provide a yardstick against which to measure the modelled impacts.

REFERENCES

ASFEC 1995. *Selective Fishery Evaluation*. Report of the Ad-hoc Selective Fishery Evaluation Committee, Pacific Salmon Commission, June 9, 1995.

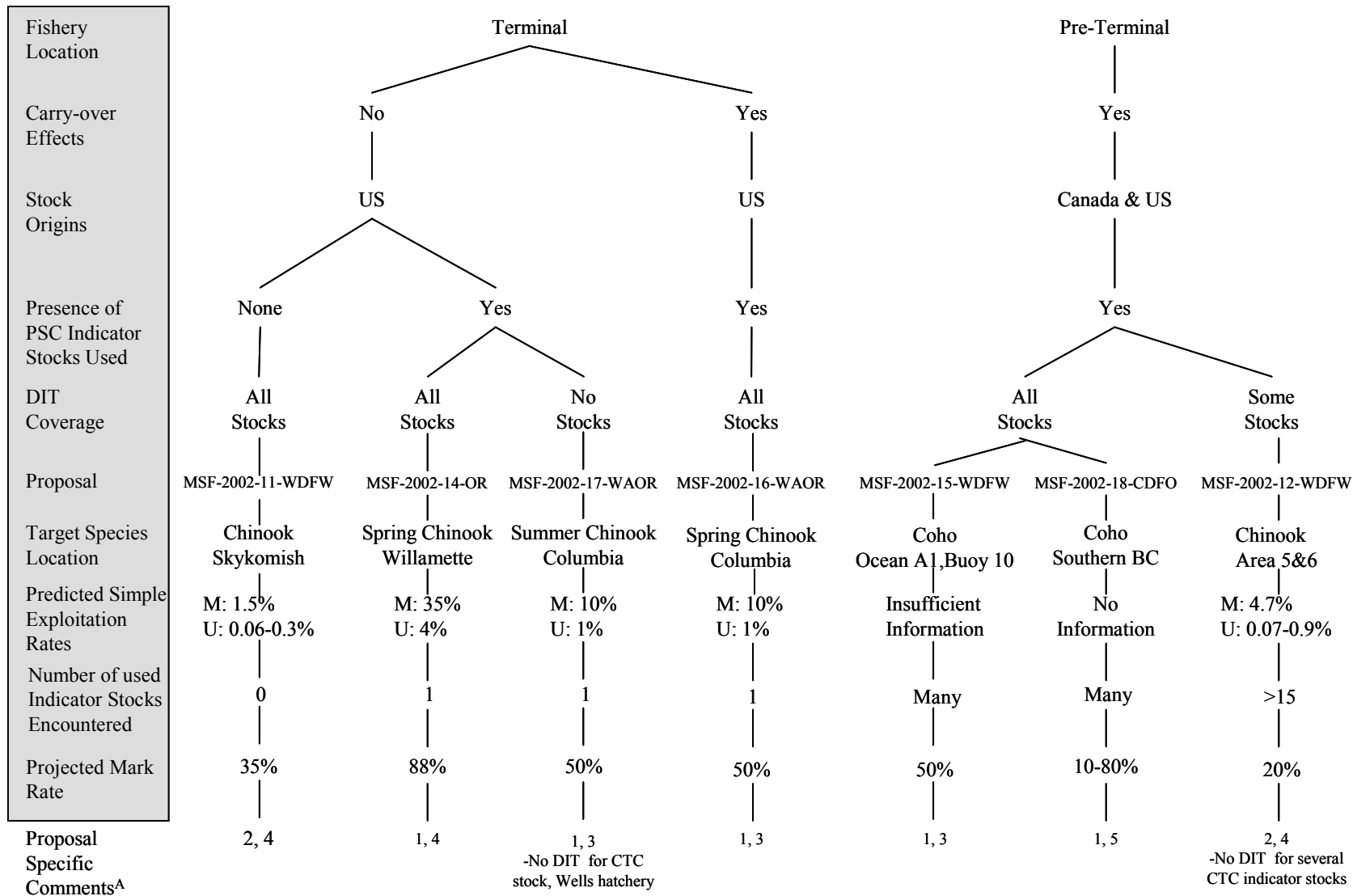
SFEC 2002. *Investigations of Methods to Estimate Mortalities of Unmarked Salmon in Mark-Selective Fisheries through the use of Double Index Tag Groups*. Report of the Pacific Salmon Commission, TCSFEC(02)-1, February, 2002.

Figure 1. Qualitative criteria for evaluating mark-selective fishery effects on the viability of the CWT system.

Evaluation Criteria	Increasing Level of Concern →		
	Single Mark-Selective Fishery	Multiple Mark-Selective Fisheries On Same Stock	
Within Year Carry-over Effects	Coho	Chinook Terminal Fishery	Chinook Pre-Terminal Fishery
Across Year Carry-over Effects	US or Canada Only	Canada and US	
Stock Origins	None	Few	Many
Presence of PSC Indicator Stocks	All Stocks	Some Stocks	No Stocks
DIT Coverage	Low Rates	High Rates / Insufficient Information	No Information
Predicted Simple Exploitation Rates	High Sampling Rate	Low Sampling Rate	
Sampling Program	Uncertainty Measures Provided	Uncertainty Measures Not Provided	
Information Content of Proposal	Stock-Specific Impacts Provided	General Impact Rates Provided Stock-Specific Impacts Inferred	General Impact Rates Provided Stock-Specific Impacts Not Inferred No Stock Impacts Provided

**Relative Importance Of Criteria
(Not Indicated By Order)**

Figure 2. Summary of mark-selective fisheries proposed.



A 1=uncertainty measures not provided
 2=uncertainty measures provided
 3=general impact rates provided, but no stock-specific impacts provided

4=stock-specific impacts inferred
 5=no stock impacts provided

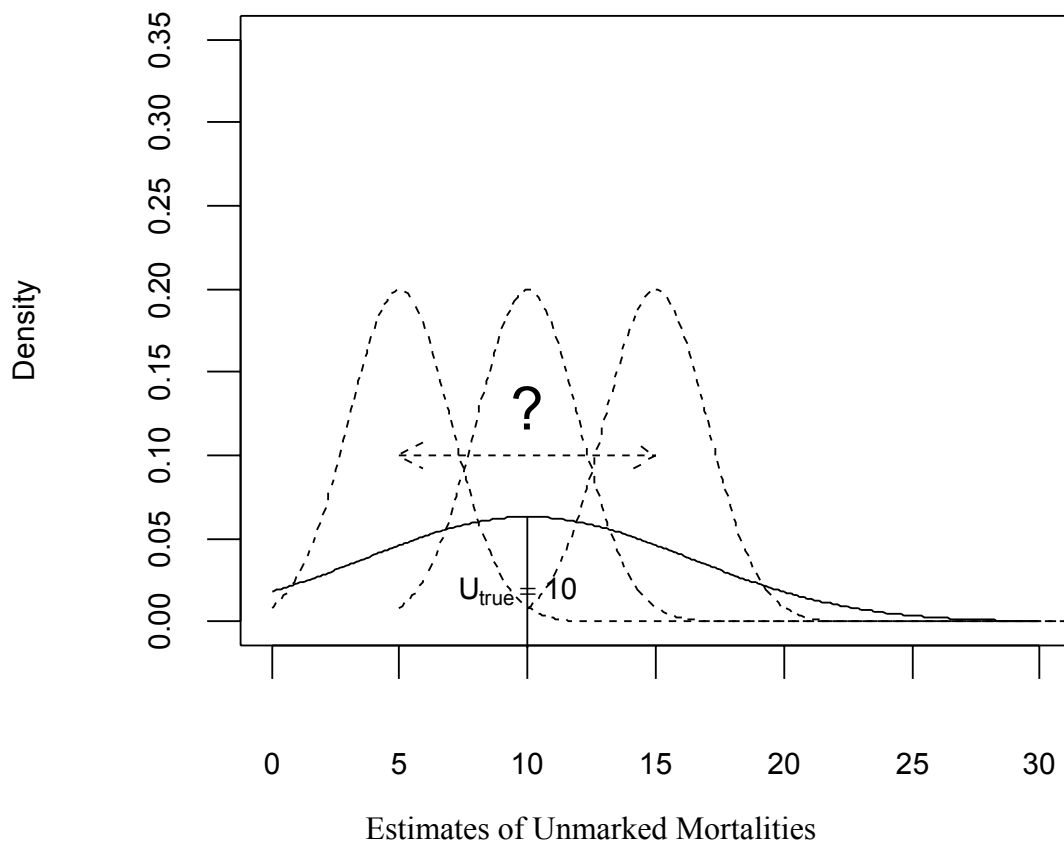


Figure 3. Comparison of estimates of unmarked mortalities in MSFs using the Paired Ratio method (dotted curves) relative to estimates of a comparably sized (in terms of unmarked mortalities) non-selective fishery where unmarked fish can be directly sampled (solid curve). “Density” refers to a probability density function.

Appendix A. Understanding of the Pacific Salmon Commission Concerning Mass Marking and Selective Fisheries.

Policy Statement

The Pacific Salmon Treaty's Memorandum of Understanding (MOU) obliges the Parties to, among other things, "maintain a coded-wire-tag and recapture program designed to provide statistically reliable data for stock assessment and fishery evaluation." The Pacific Salmon Commission (PSC) recognizes that the selective fisheries for marked hatchery coho and chinook salmon can impact the coastwide coded-wire-tag (CWT) program. For the sole purpose of fulfilling this MOU obligation, the PSC has established the following policies and procedures. This policy does not preclude the PSC from evaluating the impacts of, and making recommendations concerning, mass marking or selective fishery plans as they effect the negotiation and establishment of Treaty annex provisions.

- It shall be the policy of the PSC to review proposals for mass marking and selective fisheries to determine consistency with the Parties' commitment to the MOU provisions regarding the reliability of data needed for management of salmon fisheries within the jurisdiction and management area of the Treaty, including whether they impose substantial cost increases for agencies to conduct required data collecting programs.
- The PSC shall establish a Selective Fishery Evaluation Committee (SFEC) to conduct the technical review and evaluation of proposed mass marking and selective fishery programs, and provide recommendations to the PSC as to the potential impacts of such proposals on the coastwide CWT program. To facilitate the SFEC review, domestic managers shall submit proposals for mass marking and preliminary selective fisheries plans by November 1 of the year prior to implementation. Final selective fishery plans should be submitted to the PSC when they are available.
- The PSC shall review, by the annual February PSC meeting, the SFEC evaluations of proposals for mass marking and selective fisheries that have been determined to be inconsistent with the Parties' commitment to the MOU provisions regarding the ability of the coastwide CWT program to produce statistically reliable, cost effective data for management of the salmon fisheries and the assessment of the stocks.
- In the event that the SFEC determines that a proposal does not meet the requirements of the coastwide CWT program, the PSC shall request the proposing agency or entity to provide additional information or plans as to how they could modify the proposal to meet the concerns of the PSC. The PSC will withhold approval of any agency proposal that is inconsistent with the Parties' commitment to the MOU provisions regarding the viability of the coastwide CWT program.
- After the occurrence of a selective fishery and when the data are available, the PSC shall review the management agency report on the actual conduct of the fishery with respect to its impact on the CWT program, and recommend changes and improvements.

Appendix B. Mass Marking Proposal Template

Mass Marking Proposal ID #
Date Received

ADIPOSE FIN MASS MARKING PROPOSAL

Contact information

Proposing Agency:	
Contact Person:	
Mailing Address:	
Phone Number:	
Fax:	
Email:	

Is the proposal:

new	<input type="checkbox"/>
substantially changed	<input type="checkbox"/>
or a continuation of a previous proposal	<input type="checkbox"/>

Proposed Marking and Tagging

1. Purpose of mass marking:
 - a. Provide a brief description of the goals and objectives of the proposal (e.g. to obtain more information on hatchery straying to wild spawning grounds, to increase fishing opportunities, or to identify hatchery/wild compositions in fisheries).
 - b. If the proposal is not a new proposal, list the Mass Marking Proposal ID number(s) (assigned by the PSC Executive Secretary) corresponding to the previous proposal. In addition, describe any significant differences from previous proposals (i.e., additions or deletions of mass marked stocks or Double Index Tagged – DIT - groups).
 - c. Identify potential mark-selective fisheries targeting the proposed mass marked stocks that your agency might pursue in the future.
2. Provide the information for proposed mass marking and DIT indicated in the attached format.

3. List any known reviews of the mass marking proposal that have been conducted (e.g., by the Mark Committee) and the outcome of those reviews. List any marking programs/agreements that this proposal may conflict with and briefly describe the possible conflict.

4. List any issues of concern previously identified by the SFEC related to this mass marking proposal and describe how those concerns have been addressed.

Fishery Distribution and CWT Sampling

5. Provide estimates of the anticipated number of marked fish that will be encountered using the Table below.

Fishery/Region	Anticipated number of marked fish that will be encountered	Electronic sampling currently in place Y/N?

Describe the source/data and methods used to make the estimates. Provide other information, as available, on the distribution, run timing and migration routes of the stocks proposed for marking and/or tagging.

PROPOSED MARKING AND TAGGING

2. List all proposed mass marking and tagging plans including the following information. Identify all DIT groups with an asterisk (*, along with the proposed number of fish in each pair of DIT releases).

Appendix C. Criteria for evaluating mass marking proposals.

PROPOSED MARKING AND TAGGING

- 1) *Has the purpose of the mass-marking proposal been adequately described? If increasing fishing opportunities is an objective of the mass-marking proposal, have future potential mark-selective fisheries been identified?*
- 2) *DIT coverage*
 - a) *Does the proposal contain a list of relevant DIT groups previously identified by the SFEC for that agency?*
 - b) *Are there additional groups that should be DITed, if there is an associated MSF?*
- 3) *Does the proposed marking comply with the other regional agreements on marking (from PSMFC Mark Committee and agency mark coordinators)?*
- 4) *Technical Issues*
 - a) *Have previously identified issues with this marking been resolved?*
 - b) *Do the proposed changes raise any new issues?*

FISHERY DISTRIBUTION AND CWT SAMPLING

- 5) *Fisheries*
 - a) *Is the information provided on distribution of the marked stocks, and their occurrence in fisheries, adequately described?*
 - b) *Is electronic sampling adequate in all these fisheries?*
 - c) *If not, identify the impacts on the current assessment methods or programs and methods to eliminate or mitigate for those impacts.*

SUMMARY

Summarize concerns related to the mass-marking proposal and its effect on the viability of the CWT system.

RECOMMENDATIONS

What additional information is required to evaluate the mass-marking proposal.

Provide recommendations for program modifications that might avoid, or mitigate for negative impacts on the viability of the CWT system.

Appendix D. Status of 2003 mass-marking proposals.

Description	Proposal Received	SFEC Proposal Number	Letter Sent *	Revisions Received
Makah Coho - USFWS	10/29/02	MM-2002-01	12/05/02	12/09/02
Quilcene Coho - USFWS	10/29/02	MM-2002-02	12/05/02	12/09/02
Quinalt Coho - USFWS	10/29/02	MM-2002-03	12/05/02	12/09/02
Eagle Creek Coho - USFWS	11/25/02	MM-2002-04	12/05/02	12/09/02
Willard Coho - USFWS	11/25/02	MM-2002-05	12/05/02	12/09/02
Southern BC Coho - CDFO	11/01/02	MM-2002-06	12/05/02	12/02
Puget Sound Coho - WDFW	12/03/02	MM-2002-07	12/05/02	12/20/02
Puget Sound Chinook - WDFW	12/03/02	MM-2002-08	12/05/02	12/20/02
Carson Spring Chinook - USFWS	11/25/02	MM-2002-09	12/05/02	12/09/02
Little White Spring Chinook - USFWS	11/25/02	MM-2002-10	12/05/02	12/09/02
Dworshak & Kooskia Spring Chinook - USFWS	12/02/02	MM-2002-11	12/05/02	12/09/02
Tillamook Spring Chinook - ODFW	02/03	MM-2002-12	Proposal not reviewed	
Willamette Spring Chinook - ODFW	02/03	MM-2002-13	Proposal not reviewed	
Leavenworth Spring Chinook - USFWS	02/03	MM-2002-14	Proposal not reviewed	
Entiat Spring Chinook - USFWS	02/03	MM-2002-15	Proposal not reviewed	
Columbia River Coho - WDFW	Incomplete			
Columbia River Chinook - WDFW	Incomplete			
Washington Coastal Coho - WDFW	No proposal			
Idaho Fall Chinook - IDFG	No proposal			
Idaho Spring/Summer Chinook - IDFG	No proposal			
Oregon Coho - ODFW	No proposal			
Oregon Spring Chinook - ODFW	Incomplete			

* Initial review letter sent to proponents.

Appendix E. Status of MSF proposals received.

SFEC Proposal Number	Selective Fishery Description	Proposal Received in	Initial Review Letter Sent in	Additional Information Received in
MSF-2002-14-OR	Recreational Spring Chinook in Willamette River	November	December	December
MSF-2002-16-WAOR	Recreational Spring Chinook in Columbia River	November	December	December
MSF-2002-16-WAOR	Commercial Spring Chinook in Columbia River	November	December	December
MSF-2002-17-WAOR	Recreational Summer Chinook in Columbia River	November	December	December
MSF-2002-11-WDFW	Recreational Chinook in Skykomish River	November	December	December
MSF-2002-12-WDFW	Recreational Chinook in Statistical Areas 5 & 6	November	December	December
MSF-2002-15-WDFW	Recreational Coho Washington Ocean	November	December	none received
MSF-2002-18-CDFO	Recreational Coho Southern British Columbia	January	February	none received

Appendix F. Chinook exploitation rate indicator stocks identified with DIT pairs.

Region	Natural/Unmarked Stock Representation	DIT Stock	Hatchery
British Columbia	Fraser Lates	Chilliwack	Chilliwack
	Fraser summer-run age 0.3	Lower Shuswap	Shuswap
Puget Sound	Nooksack River spring	Nooksack spring fingerlings	WDFW Kendall Creek
	Skagit River springs	Skagit spring yearlings	WDFW Marblemount
	White River springs	(none)	
	North Puget Soundsummer/fall	Skykomish summer fingerlings	WDFW Wallace River
	North Puget Sound fall	Samish fall fingerlings	WDFW Samish
	Mid Puget Sound fall	Green R. & Grovers Cr. fall fingerlings	WDFW Soos Cr. & Suquamish Grovers Cr.
	South Puget Sound fall	Nisqually fall fingerlings	Nisqually Hatchery at Clear Creek
	Hood Canal fall	George Adams fall fingerlings	WDFW George Adams
	Strait of Juan de Fuca	(none)	
	Washington Coast	Washington coastal falls	(none)
Columbia River	Lower Columbia spring	Lewis R. spring yearlings	WDFW Lewis River
	Willamette River spring	Clackamas spring yearlings	ODFW Clackamas River
	Willamette River spring	McKenzie spring yearlings	ODFW McKenzie River
	Upper Columbia spring/summer	(none)	
	Snake River spring/summer	(none)	
Oregon Coast		(none)	

- 1998 brood only

Appendix G. Template for mark-selective fishery proposals.

Mark-Selective Fishery Proposal ID #
Date Received

DRAFT TEMPLATE FOR MARK-SELECTIVE FISHERY PROPOSALS

Contact information

Proposing Agency:	
Contact Person:	
Mailing Address:	
Phone Number:	
Fax:	
Email:	

Is the proposal:

new	<input type="checkbox"/>
substantially changed	<input type="checkbox"/>
or a continuation of a previous proposal	<input type="checkbox"/>

Purpose/management objective

Describe the management objective of the proposed mark-selective fishery.

Description of the proposed mark-selective fishery

1. Location of the fishery:
2. Year and month(s) when the fishery is proposed to occur:
3. Target species/stocks:
4. Gear to be used:
5. Other regulation details (e.g., size restrictions, bag limits):
6. Describe enforcement and education programs that will be associated with the proposed mark-selective fishery.

Projected impacts BY the fishery

7. Identify CWT stocks likely to be encountered in this fishery, whether those stocks are Double Index Tagged (DIT), and describe method used to identify those stocks.

Table 1. DIT representation of impacted CWT stocks.

CWT	Is there a DIT indicator	If yes, what were the numbers of
-----	--------------------------	----------------------------------

Stock	stock?	fish released by CWT code?
-------	--------	----------------------------

8. Provide a preliminary projection of stock-specific unmarked mortalities in the proposed mark-selective fishery. Include:
 - a. List all assumptions.
 - b. List data elements and specific parameter values used to create these projections.
 - c. Describe the equation/algorithms used to project mortalities.
9. Provide the projected mark rate of the target species in the selective fishery and the basis for that projection.
10. Identify any known or likely impacts to other jurisdictions (e.g. increased marking/sampling costs).

In-season management

11. Describe, as applicable, plans to sample/monitor the fishery for the following information: (1) CWT recoveries, (2) estimates of retained catch by species and by marked and unmarked components, and (3) mark rate for target species encountered.
12. How will the fishery be managed in-season (e.g., how will the fishery be managed if the mark rate is lower/higher than expected, if anticipated encounters or catch is exceeded, or if stock composition is different from expected preseason)?

Estimation of impacts Post-season

13. Describe the method that will be used in the post-season to estimate impacts on the CWT system of the proposed mark-selective fishery. Include:
 - a. List all assumptions.
 - b. List data elements and specific supplied parameter values used to create estimates (e.g. for methods described in SFEC 2002⁴, compare against data list in Table 7 on pages 31 and 32 and in Table 9 on pages 34 and 35).
 - c. Describe the equation/algorithms that will be used to estimate mortalities and impacts to the CWT system.
14. Describe the following statistical properties of the estimator for unmarked mortalities in the mark-selective fishery.
 - a. What is the projected bias (or range of biases) due to assumption violations for the estimators of unmarked mortalities in the mark-selective fishery? Describe the method used to determine the projected bias of the estimates.
 - b. What is the projected imprecision of the unmarked mortality estimates in the mark-selective fishery? Describe the method used to determine the

⁴ SFEC(2002). Investigation of methods to estimate mortalities of unmarked salmon in mark-selective fisheries through the use of double index tag groups. Technical report to the PSC, TCSFEC(02)-1.

expected precision of the estimates.

Access to data and Results

15. Describe how the data and results from this selective fishery will be reported or how this information can be easily and effectively accessed (e.g. all data and results will be made available in electronic format accessible via the PSMFC internet web site).

Evaluation of the management objective

16. Describe how the achievement of the management objective will be assessed?

TimeLine

17. When will the post-fishery data analysis be completed?
18. When will the assessment of whether or not the management objectives were achieved be completed?
19. When will the results be reported to the PSC?

Appendix H. Initial screening criteria used to evaluate MSF proposals for completeness.

ITEM		SCREENING
Contact Information		<i>Complete?</i>
Type of Proposal		<i>Properly identified?</i>
Management Objective		<i>Clearly & sufficiently stated?</i>
DESCRIPTION of MSF		
1	Location	<i>Complete?</i>
2	Time Frame	<i>Complete?</i>
3	Target Species	<i>Complete?</i>
4	Gear	<i>Complete?</i>
5	Regulation Details	<i>Complete?</i>
6	Education/Enforcement	<i>Complete?</i>
PROJECTED IMPACTS		
7a.	CWT Stocks	<i>Stocks completely identified? DIT and non-DIT groups distinguished? Clarity of methodology description?</i>
7b.	PSC Indicator Stocks	<i>Are any of the stocks identified in (7) PSC indicator stocks?</i>
8	Projection of stock-specific unmarked mortalities:	<i>Are all stocks likely to be impacted by the MSF identified?</i>
a.	List all assumptions.	<i>Complete?</i>
b.	List data elements and specific parameter values used to create these projections	<i>Support for specific parameter values provided (particularly, if different from standard values used in planning or PSC analyses)? Indication of uncertainty surrounding choice of parameter values?</i>
c.	Describe the equation/algorithms used to project mortalities.	<i>Are elements missing that would bias evaluation (e.g., drop off, unmarked retention error, multiple encounters)?</i> <i>Methods described for stocks without DIT?</i>
9	Projected Mark Rate	<i>Provided? Reasonable methodology for estimation?</i>
10	Impacts to other jurisdictions	<i>Identified? Costs provided?</i>
INSEASON MANAGEMENT		
11	Sampling plans	<i>Adequate to obtain useful estimates of mortalities of marked and unmarked fish by stock and age for MSF?</i>
12	Inseason adjustments	<i>Adequately described?</i>
POST-SEASON ESTIMATION		
13	Impacts on CWT system:	<i>Are impacts in all CWT groups included?</i>
a.	List all assumptions.	<i>Complete?</i>

	b.	List data elements and specific parameter values used to create these projections	<i>Support for specific parameter values supported (particularly, if different from standard values used in planning or PSC analyses)?</i>
	c.	Describe the equation/algorithms used to project mortalities.	<i>Are the equations/algorithms adequately described?</i>
14		Statistical Properties of Estimates of unmarked mortalities:	<i>Provided for all CWT groups likely to be impacted by the MSF?</i>
	a.	Bias.	<i>Are elements missing that would bias evaluation (e.g., drop off, unmarked retention error, multiple encounters)? Reasonable? Methodology adequately described?</i>
	b.	Imprecision	<i>Reasonable? Methodology adequately described?</i>
ACCESS TO DATA & RESULTS			
15		Reporting	<i>Adequately described?</i>
EVALUATION OF MGT OBJECTIVE			
16		Description of methodology	<i>Appropriate for management objective stated in proposal?</i>
TIMELINE			
17		Post Season Analysis	<i>Will information be completed in time for consideration of future proposals?</i>
18		Management Objective	<i>Will information be completed in time for consideration of future proposals?</i>
19		Results Reported to PSC	<i>Will information be provided in a timely manner to meet requirements of PSC TCs?</i>