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1991 Mark Meeting

Final Minutes

Seattle, Washington **February 19, 1991**

PRELIMINARY BUSINESS

The 1991 Mark Meeting was convened on February 19, 1991 at 9 AM at the National Marine Fisheries Service facilities at Sand Point in Seattle. Mark Committee members and other meeting participants introduced themselves at the start of the meeting. A list of attendees is provided is Attachment 1.

Two new committee members and one alternate representative were introduced and welcomed:

Pete Hassemer (IDFG) - replacing Tim Cochnaeur
Vic Palermo (CDFO) - replacing Margaret Birch
Don Bailey (CDFO) - alternate for Bryon Ludwig (BCFW)

Several members of the Pacific Salmon Commission's Data Sharing Committee were also in attendance and welcomed:

Marc Hamer (CDFO) - (co-chair)
John Clark (ADFG) - (co-chair)
Mike Matylewich (CRITFC)

Two new agenda items were approved for inclusion into the already packed agenda. The first item was a request by Lee Blankenship (WDF) to briefly review results of a WDF study on mortality of tagged verses untagged fish. The second agenda item concerned the informal proposal to adipose clip (no CWT) all chinook (and possibly coho) hatchery stocks in the upper Columbia Basin in order to differentiate hatchery fish from wild fish.

AGENDA ITEMS

1. Status of CWT Data Files and Reporting Problems

A. Conversion of Historical Data to PSC Format

Another year has past without achieving a complete conversion of all CWT historical data files (release, recovery, catch/sample) into PSC format. Therefore, each agency's progress to date was reviewed in some detail for the Mark Committee. This information is summarized in Tables 1-4 (updated through April 8, 1991)

1) **CWT Release Data**

Conversion of the CWT release data (Table 1) is the most complete, with only IDFG incomplete for years prior to 1988. IDFG has had problems with changes in staff but is now making excellent progress. Pete Hassemer (IDFG) projected that Idaho's entire release file would be converted into new format by the end of March.

2) **Recovery and Catch/Sample Data**

Progress in converting the remainder of the historical recovery and catch/sample data sets to PSC format (Tables 2-3) was modest during the past year. California was a notable exception, having completed the conversion of their 1978-1987 data sets. In addition, the NWIFC reported recoveries in PSC format for years 1978-1987. Data sets still remaining in old format include those for WDF (1977-83), NMFS (1977-86, 1988-1990), and QDNR (1983-90). Partial data sets for WDW and Metlakatla are also missing in new format but were not previously reported in old format. With respect to future time tables, Dick O'Connor (WDF) reported that Washington had expected to complete the entire conversion process by May, 1991. However, this plan was thwarted when staff member Susan Markey was re-assigned within the Department until June, 1991. He further explained that WDF has no flexibility for replacing the position on a short-term basis. Consequently all remaining conversion work will be delayed until July, 1991. The 1983 file will be processed first and should be available in July. The remaining years, 1982-1977, are to be completed sequentially by December, 1991.

WDW's steelhead recoveries in the mainstem Columbia River have been reported through ODFW. However, recoveries in Puget Sound, Columbia River tributaries, and lower Snake River remain un-reported. Charles Morrill (WDW) noted that work has been started to process these data. However, it will be some time before the data are available in PSC format.

Pete Hassemer reported that IDFG staff have made excellent progress and have most of Idaho's recovery data for 1977-1990 already in PSC format. Work is expected to be completed by July, 1991.

ADFG has three years of data (1977-1979) still in old format. Karen Crandall noted that she was hopeful that the conversion process could be completed before January, 1992. There are a number of problems with the old data and considerable work will be required to complete the task.

NMFS (AK) has the farthest to go in reporting their recoveries in new format, with only 1987 partially processed. Ron Heintz explained to the Mark Committee that the problems with reformatting and reporting the NMFS Alaska CWT data have resulted from an inability to gain support for assigning this project a high priority (see Attachments 2A, 2B). Other requirements for on-going field work and research have prevented the necessary time

TABLE 1. Status of Conversion to PSC Format

CWT Release Data

Year	Reporting Agency												
	CDFG	ODFW	WDF	WDW	IDFG	CDFO	ADFG	FWS	NMFS (AK)	NMFS (CR)	NWIFC	QDNR	METL
pre-1975	V	V	V			V	V	V	V				
1975	V	V	V			V	V	V	V	V			
1976	V	V	V		-	V	V	V	V	V	V	V	
1977	V	V	V	V	-	V	V	V	V	V	V	V	
1978	V	V	V	V	-	V	V	V	V	V	V	V	
1979	V	V	V	V	-	V	V	V	V	V	V	V	
1980	V	V	V	V	-	V	V	V	V	V	V	V	V
1981	V	V	V	V	-	V	V	V	V	V	V	V	V
1982	V	V	V	V	-	V	V	V	V	V	V	V	V
1983	V	V	V	V	-	V	V	V	V	V	V	V	V
1984	V	V	V	V	-	V	V	V	V	V	V	V	V
1985	V	V	V	V	-	V	V	V	V	V	V	V	V
1986	V	V	V	V	-	V	V	V	V	V	V	V	V
1987	V	V	V	V	-	V	V	V	V	V	V	V	V
1988	V	V	V	V	V	V	V	V	V	V	V	V	V
1989	V	V	V	V	V	V	V	V	V	V	V	V	V
1990	V	V	V	S	V	I	V	V	V	V	V	V	V

(S = In Mail; I = Mid Year Only; V = Validated)
(Dash = Let Them Speak To Issue)

CDFG	=	California Department of Fish and Game
ODFW	=	Oregon Department of Fish and Wildlife
WDF	=	Washington Department of Fisheries
WDW	=	Washington Department of Wildlife
IDFG	=	Idaho Department of Fish and Game
CDFO	=	Canada Department of Fisheries and Oceans
ADFG	=	Alaska Department of Fish and Game
FWS	=	U.S. Fish and Wildlife Service
NMFS(AK)	=	National Marine Fisheries Service - Alaska
NMFS(CR)	=	National Marine Fisheries Service - Columbia River
NWIFC	=	Northwest Indian Fisheries Commission
QDNR	=	Quinault Department of Natural Resources
METL	=	Metlakata Indian Community - Alaska

TABLE 2. Status of Conversion to PSC Format

CWT Recovery Data

Year	Reporting Agency											
	CDFG	ODFW	WDF	WDW	IDFG	CDFO	ADFG	FWS	NMFS (AK)	NWIFC	QDNR	METL
1975			-			V				S		
1976			-			V				S		
1977	-	V	-		-	V	-		-	S		
1978	V	V	-		-	V	-		-	S		
1979	V	V	-		-	V	-	V		S		
1980	V	V	-		-	V	V	V	-	S		
1981	V	V	-	I	-	V	V	V	-	S		
1982	V	V	-	I	-	V	V	V	-	S		I
1983	V	V	-	I	-	V	V	V	-	S	-	I
1984	V	V	V	I	-	V	V	V	-	S	-	I
1985	V	V	V	I	-	V	V	V	-	S	-	I
1986	V	V	V	I	-	V	V	V	-	S	-	I
1987	V	V	V	I	-	V	V	V	S	S	-	I
1988	I	V	V	I	-	V	V	V	-	S	-	I
1989	I	V	V	I	-	V	V	V	-	S	-	I
1990	I	I	I	-	-	I	I	-	-	-	-	I

(I = Incomplete but Validated Data Sets; V = Validated)
(S = Submitted; Dash = Not Yet Reported)

Incomplete Data Sets:

1) WDW's recoveries in the main stem Columbia River have been reported through ODFW. However, recoveries in Columbia River basin tributaries and Puget Sound are unreported.

2) Metlakatla (METL) has reported recoveries for its fisheries through ADFG. However, hatchery returns are unreported at this time.

TABLE 3. Status of Conversion to PSC Format
CWT Catch/Sample Data

Year	Reporting Agency											
	CDFG	ODFW	WDF	WDW	IDFG	CDFO	ADFG	FWS	NMFS (AK)	NWIFC	QDNR	METL
1975			-			V				S		
1976			-			V				S		
1977	-	V	-		-	V	-		-	S		
1978	V	V	-		-	V	-		-	S		
1979	V	V	-		-	V	-	V	-	S		
1980	V	V	-		-	V	V	V	-	S		
1981	V	V	-	I	-	V	V	V	-	S		
1982	V	V	-	I	-	V	V	V	-	S		I
1983	V	V	-	I	-	V	V	V	-	S	-	I
1984	V	V	V	I	-	V	V	V	-	S	-	I
1985	V	V	V	I	-	V	V	V	-	S	-	I
1986	V	V	V	I	-	V	V	V	-	S	-	I
1987	V	V	V	I	-	V	V	V	S	S	-	I
1988	V	V	V	I	-	V	V	V	-	S	-	I
1989	V	V	V	I	-	V	V	V	-	-	-	I
1990	I	I	I	-	-	-	I	-	-	-	-	I

(S = Submitted; I = Incomplete but Validated Data Sets; V = Validated)
(Dash = Not Yet Reported)

TABLE 4. Status of Conversion to PSC Format
Unmarked Hatchery Production Releases

Year	Reporting Agency											
	CDFG	ODFW	WDF	WDW	IDFG	CDFO	ADFG	FWS	NMFS[1] (AK)	NWIFC	QDNR	METL
1975	-	U	-	-	-	V	-	I	NA			
1976	-	U	-	-	-	V	-	I	NA	-	-	
1977	-	U	-	-	-	V	-	I	NA	-	-	
1978	-	U	-	-	-	V	-	I	NA	-	-	
1979	-	U	-	-	-	V	-	I	NA	-	-	
1980	-	U	-	-	-	V	-	I	NA	-	-	-
1981	-	U	-	-	-	V	-	I	NA	-	-	V
1982	-	V	-	-	-	V	-	I	NA	-	-	V
1983	-	V	-	-	-	V	-	I	NA	-	-	V
1984	-	V	-	-	-	V	-	I	NA	-	-	V
1985	-	V	-	-	-	V	-	I	NA	-	-	V
1986	-	V	-	-	-	V	-	I	NA	-	-	V
1987	-	V	-	-	-	V	-	I	NA	-	-	V
1988	-	V	-	-	-	V	-	I	NA	-	-	V
1989	-	I	-	-	-	V	-	I	V	V	V	V
1990	-	-			V					V	V	V

(U = Unavailable; I = Incomplete but validated Data Sets; V = Validated)
(NA = Not Applicable; Dash = Not Yet Reported; S = Submitted)

[1]Note: With the exception of 1989, all of NMFS-AK's hatchery production has been represented by CWT studies.

commitments to do the conversion work. However, an effort is being made to find funding to contract an outside programmer to develop the necessary software. In addition, NMFS (AK) has requested funding to employ a full time mark coordinator. The outcome of these efforts was uncertain.

Tag recovery and catch/sample data for the Quinault Indian Nation remain in old format for 1986-1990. However, considerable progress has been made in converting the data, with help provided by an outside contractor.

The Metlakatla Indian Community has reported all tag recoveries sampled in its fisheries for 1982-1990 through ADFG. Hatchery recoveries are missing, however, with no time table for completing the task. Part of the problem is a lack of software to process the data in-house.

3) Unmarked Hatchery Production Releases

Progress toward the goal of reporting unmarked hatchery production (Table 4) was minimal at best during 1990. Metlakatla Indian Community was the only new agency to join ODFW and CDFO in reporting all available years of unmarked production releases. In addition, IDFG, NWIFC and QDNR reported 1990 data. There appeared to be little enthusiasm for reporting historical unmarked production releases and continued progress is likely to remain very slow.

B. Completion of Data Conversion

Following the lengthy discussion of the status of each agency's data, attention was again focused on concerns that the conversion process be completed as quickly as possible. Ken Johnson (PSMFC) noted that it has caused a major problem for both the Mark Center and data users. Since agencies no longer report in both old and new format, it means that both the old format and new format data sets are incomplete. Consequently, it has become very difficult for the Mark Center to provide users with complete data for even normally simple data requests. This problem will not be resolved until the historical conversion is completed.

Johnson further noted that following the 1990 Mark Meeting, individualized letters had been forwarded to all agency directors in an effort to seek their assistance in accelerating the conversion of their agency's respective CWT data sets into PSC format. A similar letter was also forwarded to the PSC Data Sharing Committee seeking their assistance to encourage the agencies to expedite the data conversion.

These letters did help some, as there was a surge in data processing soon there after. Unfortunately it wasn't enough to finish the task. Therefore, the question was posed to the Committee as to what steps should now be taken. The recommendation was made that follow up

letters be forwarded to the appropriate agencies. This was readily approved by the Mark Committee.

ACTION:

The Mark Coordinator was instructed to write follow-up letters to the appropriate agency directors and outline progress to date in completing the conversion of their agency's respective CWT data sets into PSC format. The letters are to be individualized and positive in tone, expressing appreciation for the progress to data, and noting the remaining years to be completed.

2. Status of RMPC Operations

A. Software Development

Jim Longwill (PSMFC) reviewed the Mark Center's progress over the past year and noted that there was both bad news and good news to report. The bad news was that due to severe performance limitations of the host computer and associated communication problems with the PICK operating system, the past year primarily involved re-programming efforts and event driven programming projects rather than major new software development and implementation as previously planned.

The good news, however, was that the Mark Center continued to be functional and PSC formatted data were available in either raw record or report form by tagcode. These reports are in the form of summary reports by year, month, and bi-weekly periods as well as detail reports which contain single-line output with coded locations. Location and PSC fishery code translations are available online from the database location and fishery tables as desired. Release data also continues to be available online in raw form.

The major changes implemented this past year are:

1) The "batch" processing system is now fully operational--by which reports may be directed to a host system file rather than to the screen. Users can logoff while a report is running and dial up later to list it to the screen. This can save tremendous phone time waiting for reports to finish.

2) A severe performance inefficiency in the reporting system was discovered a few months ago and was improved by an applications programming specialist. The performance was improved dramatically--but remains very slow by modern computing standards.

3) The screen menu handling portion of the reporting system has been overhauled recently. This effort has removed the line graphics and reverse video processing--which has served to improve both modem communications, and the speed of the menu system.

4) A new report, TR1, has been added which outputs individualized recovery records in zero filled fields. The species, brood year, date of recovery, agency, fishery, area, expansion value, and length (mm) are included on each output line.

The Mark Center is now awaiting the opportunity to move the database from the current PICK operating system onto the Ingres relational database manager. At that point, additional reports such as recovery reports by catch area and catch/sample reports will be offered. Downloading should also be much faster with file-transfer software available in the Ingres-UNIX environment (e.g. Kermit).

While awaiting this Ingres development, the PICK platform will be moved soon to the Sequent computer in hopes of gaining substantially greater performance and convenience over the next few months. This move should take place by May and will involve a slight change in the log-in procedure.

B. RMPC Funding Review

Johnson (PSMFC) reviewed the recent funding problems of the Mark Center. A funding proposal of $55,000 was approved for FY 1990 by the PSC Budget Committee (U.S. Section). Unfortunately, the line item was subsequently omitted during final budget work in Washington, D.C. This unexpected development left the Mark Center facing a critical shortfall for FY 1990 and necessitated an emergency request for contributions from the agencies. ADFG, NMFS (Col. River), ODFW, and USFWS each contributed $6,000. An addition $20,000 was authorized from PSMFC's funds. Together these funds permitted the Mark Center to continue operations in FY 1990, albeit under stringent conditions.

The U.S. Section Budget Committee again approved $62,000 in funding for the Mark Center for FY 1991. It was later learned that these funds were almost lost at the Washington, D.C. level as well. Senator Stevens (Alaska), however, stepped in and played a key role in adding the monies as a new line item in the budget. A shortfall, unfortunately, is again expected in FY 1991 because of the carry over effects of the FY 1990 budget, plus the fact that the USFWS will charge approximately 10% of the grant as a charge for administrating the "pass-thru" funding.

A funding request of $100,000 was submitted for FY 1992, with the substantial increase intended to eliminate the serious shortfall problems encountered in FY 1990 and 1991. However, the U.S. Section Budget Committee felt that the funding level was too low and increased it to $200,000 (June 5, 1990 meeting). This was done with the intent that the additional funds would be used to implement and maintain a regional catch data base for PSC purposes. Johnson further noted that this plan had not been formally approved by the PSC Data Sharing Committee and would be addressed on the following day.

Note : The Data Sharing Committee addressed this issue the next day (Feb. 20th) and endorsed the Mark Center on the logical U.S. site for maintaining a regional catch database. A supporting letter (March 1, 1991) from Joseph Pavel (U.S. Chair of the Working Group on Catch Data Exchange) also is attached (Attachment 3).

3. Report on PSC's Working Group on Data Standards

A. Activities in 1990

Marc Hamer (CDFO) and Ken Johnson (PSMFC) jointly reported on recent activities of the Working Group on Data Standards. Work on Format Version 2.0 continued during the early months of 1990. Upon invitation, nearly all members of the Work Group attended the 1990 Mark Meeting. At that meeting, the Mark Committee reviewed and then approved the use of binary "sequential tags" with the adipose finclip.

Given that development, members of the Work Group then caucused and agreed to add several additional data fields to Version 2.0 in order to accommodate data for sequential tags. The new fields were approved by the Data Sharing Committee the next day in their back-to-back meeting with the Mark Committee. Specifications for Format Version 2.0 were subsequently prepared and distributed for review and comments.

The Work Group met again on an informal basis on October 4, 1990 to address a number of data processing concerns that were not fully resolved by Version 2.0. However, after considerable discussion, the consensus was that alternative solutions could be applied without having to undergo another format revision. Accordingly, it was decided that Format Version 2.0 will remain unchanged for at least one year and most likely much longer than that.

Data Sharing Committee met the following day (October 5, 1990), and again voiced approval of Version 2.0 for use in exchange of CWT data between Canada and the United States.

B. Future Tasks

The Working Group on Data Standards will be working with the Working Group on Catch Data as the latter group establishes formats for a regional catch data base (U.S. Section) and for exchange with Canada. To the degree possible, standardization of coding, such as location sites, will be encouraged.

The question was then raised as to whether or not the 19 character PSC location code includes valuable information on latitude and longitude. Johnson answered that it did not but that the Mark Center was very interested in eventually adopting for in-house use the EPA river reach coding scheme that does have latitude and longitude. The EPA coding scheme is being widely adopted in the Columbia Basin now by a variety of agencies, including BPA and IDFG.

Charles Corrarino (ODFW) then addressed the issue and noted that Oregon's current coding scheme for locations has some inconsistencies that really should be corrected. He noted that ODFW was very interested in the EPA river reach coding scheme and hoped to be able to incorporate it fully into the current 19 character PSC location code format. Corrarino further emphasized that the goal should be to have standardized location codes on a regionwide basis, and urged other agencies to give serious consideration to possibly adopting the EPA coding scheme.

Dick O'Connor (WDF) recognized that the EPA location coding scheme does have a lot of potential and WDF had some interest in it as well. However, there is as yet no formal proposal to replace the current PSC location code scheme (i.e. each state/province now provides its own unique coding scheme within the 7-level, 19 character PSC location code format). He also noted that the current PSC scheme was designed only for data exchange and not for a relational, integrated database. As such, it works well and does have some advantages. Ron Olson (NWIFC) also cautioned that all aspects be fully evaluated before any attempt is made to convert to a regionwide location scheme such as the EPA river reach model.

4. Proposal to Discontinue Usage of Embedded "Replicate Tags" - Revisited

By way of review, the Working Group on Mark Recovery Statistics' proposal to discontinue further use of embedded "replicate" tags resulted in a very lively discussion during the 1990 Mark Meeting. The discussion ended with all Mark Committee members in agreement that these tags were not an estimator of variance for fishery contributions. However, tag coordinators for CDFO, BCFW, WDF and NMFS-Alaska were reluctant to discontinue usage because of possible usefulness in other areas. Therefore, it was agreed that embedded replicates could be used for at least one more year, with the understanding that justification for continuing their use would be required during the 1991 Mark Meeting.

Discussion during this year's Mark Meeting again proved to be very lively. John E. Clark (ADFG) started the discussion by briefly reviewing efforts of the Working Group on Mark Statistics to further examine the issue of "embedded replicates" during 1990. He focused on Jon Schnute's (CDFO) research and noted that Schnute has a revised paper in the works for publication. The basic findings of this research is that embedded replicates are not a estimator of variance.

Clark noted further that the Working Group concurred with Schnute's findings and believed that there was no additional information provided by embedded replicates that couldn't be generated by computer or by binomial theory, etc. Said another way, recoveries obtained for a tagcode released with three embedded replicates would be the same as that generated if one tagcode was released and the tagcode was then randomly selected from the recoveries in three groups. And if there was a difference found, Clark argued that it would be a difference that couldn't be related to anything (i.e. no hypothesis testing possible). Therefore, given this information and the fact that no one came forth with a good justification to use embedded replicates, the Working Group continues to recommend that the tags no longer be approved for use.

Vic Palermo (CDFO) disagreed with this premise and argued that there is indeed a meaningful difference. When tagcodes are collected, it represents an empirical experiment and something is being measured in that system. If the tags are embedded replicates, then one can get a measure of the variance of the system. However, it isn't necessarily the variance of the tag group. He then cited an example of measuring a single fish 50 times on a rolling boat. Obviously a mean and the variance can be calculated. However, the measurements represent only the variance of the system (i.e. measuring error)

since the fish didn't change length during the measurements. He further argued that embedded replicates are similar to the above example in that they can provide a measure of the "system noise", where the system is the actual tagging. As such, embedded replicates can provide useful information.

Clark countered by noting that embedded replicate were initially envisioned to give distribution between recoveries. Basically every 2nd, 3rd, 4th, etc. fish received a different replicate code. Yet when the recovery distribution is examined, there is no real difference between each of the replicates. All fish are the same in effect. Therefore, to look at the distribution, one need only randomly select from all recoveries. It is true that it would not be the same distribution as that gotten empirically. However, it could be randomly generated using the binomial theorem.

In response, Palermo noted that this is based on the assumption that the system is stable across years. However, the ocean systems are, in fact, not stable and vary significantly from year to year. Hence a long series of recoveries of replicates will give a history of the changes of the distribution. He further argued that the notion of randomly placed replicate tags that are exactly the same is what is needed to measure the noise in the system. The key here is that the paradigm and underlying assumptions are different than that used for classical statistical applications.

Keith Jefferts (NWMT) entered the discussion at this point and noted that his firm would be willing to discontinue making the tags if so instructed. However, he wished to make two observations. The first observation was that the essence of what the statisticians are saying is that "...this is a useless effort as we already know the answer." Yet he noted that he had on his book shelf a recently published monograph (see footnote) by K.P. Burnham et al (1987) about the statistical design of fisheries experiments that clearly encourages the use of techniques such as embedded replicates (see pages 240, 241) to explore things one doesn't understand.

Jeffert's final comment, he noted, was based on his previous years of experience as an experimental physicist: "The difference between theory and practice is that in theory there is no difference between theory and practice".

Don Bailey (CDFO) concurred with Jeffert's comments about the differences between practice and theory, and noted that unless there are some major problems, the usage of embedded replicates should be allowed to continue in order to better explore the "noise" in the system. If this method isn't valid, then another method is clearly needed!

Lee Blankenship (WDF) took the floor at this point and pointed out that the original reason that embedded replicates were adopted was to be able to have a coastwide method that could be used to get variance estimates. As additional information became available, however, it became apparent that embedded replicates provided a measure of pseudo-variance and thus couldn't be used as a true estimator for variance for fishery contribution studies. He further noted that embedded replicates have now been discredited to the point that he couldn't use the technique even if it still seemed adequate for his purposes. The basic reason for this is that analyses based on embedded replicates can't be published in peer-reviewed literature.

Burnham, K.P. et al. 1987. Design and analysis methods for fish survival experiments based on release and recapture. Monograph #5. American Fisheries Society. 437 pp.

Blankenship then emphasized that if embedded replicates are to be done away with, the Working Group on Mark Recovery Statistics needs to provide an alternative variance estimator that can be adopted and used coastwide. He expressed feelings of anger and frustration that the Working Group has not met this need while roundly condemning embedded replicates. This view appeared to be widely shared by other members of the Mark Committee.

The long discussion had to be curtailed in the interest of time and Johnson then summarized the key points. On the one hand, several members of the Mark Committee argued that embedded replicates provide an empirical measure of variability in the system. While unlikely to be a measure of variance of the tag groups, it was still seen as providing useful information. On the other hand, the Working Group on Mark Recovery Statistics was of the firm mind that no new information could be obtained from embedded replicates and that their use actually could lead to erroneous conclusions. In addition, it was pointed out that the tags have been so discredited now that results can't be published.

Given these conflicting positions, the Mark Committee was asked to take a stand on whether or not to ban further use of the tags. The ensuring discussion provided general agreement with the Working Group's recommendation that embedded replicates should not be used as a estimator of variance for fishery contribution studies. However, committee members were equally adamant that the verdict was still out on other possible uses of embedded replicants. As such, the Mark Committee was in full consensus that use of the tags should continue to be approved.

This decision, in effect, maintained the current "status quo". Therefore, the question was raised as the whether or not the Mark Committee wished to deal with the issue every year. No one had much enthusiasm for that prospect! Dick O'Connor (WDF) then proposed a compromise that embedded replicates could be used indefinitely. However, recovery agencies would have the option of no longer decoding the replicate portion of an embedded replicate code after 1995. This compromise was approved with full consensus of the Mark Committee.

ACTION:

The Mark Committee approved continued use of embedded replicate tags with no time constraints. However, after 1995, recovery agencies will have the option of no longer decoding the replicate portion of an embedded replicate tag code. The tags would be returned to the releasing agency for full decoding.

The Mark Committee also recognized the recommendation of the Working Group of Mark Recovery Statistics that embedded replicates are not a valid estimator of variance for fishery contribution, and agreed to pass this recommendation on to all tag users.

In addition, the Mark Committee requested a letter from the Working Group that gives reasons for their position on embedded replicates. The Mark Committee also strongly urges the Working Group to provide CWT users with an alternative standard method (or collection of methods) for determining variance in CWT studies.

5. Proposed Standardization of Formula for Estimation of CWT Recoveries

The Mark Committee discussed Gary Morishima's (QDNR) proposal that agencies establish a standardized formula to compute estimation factors for CWT recoveries (Attachment 4). While ADFG, CDFO, WDF, and ODFW use the same basic formula, minor differences exist in how, for example, lost tags or no tags are treated. These differences in procedures, in turn, were shown to lead to significant differences and potential biases (over-estimates in many cases) when compared against the results computed by a standardized equation which he favors.

The discussion focused on the proposed policy of a standardized procedure rather than try to debate whether or not Morishima's preferred formula was the correct one. A major reason for this approach was that the agencies had not fully evaluated Morishima's findings. In addition, some errors are known to exist in the summary report. CDFO, for example, subsequently found that some of its catch/sample records were in error (two fields were reversed in some cases) and have since corrected those data.

ACTION:

The Mark Committee fully endorsed the concept of establishing a standardized formula for computing the number of tags represented by a single CWT recovery. The Committee also recommended that standardized definitions be established for the various parameters in the estimation formulas.

It was also agreed that the Working Group on Mark Recovery Statistics was the appropriate group to take the lead (in conjunction with the Working Group on Data Standards) in standardizing both the estimation formula and the respective variables such as "unresolved discrepancies (status 7's). The Mark Coordinator was instructed to write to the Data Sharing Committee and inform them of the Mark Committee's support and recommendation for standardization.

6. Proposal to Add Otolith Marks to the Mark List

Lee Blankenships (WDF) and Don Bailey (CDFO) proposed that otolith marking projects be listed in the Mark List, starting in 1991. The first year's reporting of otolith marks would include marks put out for the past three years. The otolith marks would be in a separate section of the report. A proposed format for reporting was distributed (see Attachment 5).

Blankenship explained that a 2-4° shift in temperature for 48 hours, for example, produces a unique recognizable banding in the otolith. As such, it has great value as a mass-marking technique for stock identification. He further noted that since WDF, CDFO, and ADFG are now carrying out otolith marking projects, there is a need for regional coordination. Listing of the otolith marks in the Mark List would facilitate the necessary coordination. This proposal was approved.

ACTION:

The Mark Committee approved the listing of otolith marks in the Mark List, starting with the 1991 report. No restrictions were placed on the use of otolith marks, other than that they should be listed annually in the Mark List.

6A. Proposal to Remove Ad-Only Marks from the Mark List (New Agenda Item).

Following the decision to add otolith marks to the Mark List, Charles Morrill (WDW) questioned if it was necessary to also maintain all "Adipose-only" marks for steelhead releases in the Mark List. He noted that the volume of Adipose-only marks for identifying hatchery origin steelhead creates a tremendous amount of work for all involved. He also noted that the Adipose clip on most steelhead is not used on a "study" mark in most sampling and recovery areas. In addition, he argued that since the PSC database includes a release file for all hatchery production releases, there shouldn't be a need for duplicate reporting.

Ken Johnson (PSMFC) concurred that the large number of Adipose-only fin marks for steelhead do require a lot of work for both the tag coordinators and the Mark Center. He also noted that the bulk of the Mark List is now devoted to pages filled with Adipose only releases of steelhead. Given that few people seem to require this data in report form, Johnson also recommended that the Adipose-only marks for steelhead be eliminated from future Mark List editions. However, he cautioned against not reporting the information because there are a number of users each year that have need for information on releases of steelhead. Furthermore, the PSC database for "unmarked" (i.e. non-CWT associated) releases is far from complete. Therefore, he recommended that steelhead release data for Adipose only marks continue to be reported so that the data can be accessed by computer when requested. After some discussion, this recommendation was approved by the Committee.

ACTION:

The Mark Committee approved the deletion of "Adipose-only" steelhead releases from the Mark List. However, fin mark coordinators are still under obligation to report the release information in standard format to the Mark Center so that it can be added to the database and thus available if requested.

7. Regional Coordination of Otolith Marking Projects

On a related topic, Karen Crandall noted that ADFG was also getting involved in otolith marking projects. She expressed concern about the limited coordination that currently exists between programs within ADFG, and the obvious need for additional regional coordination with CDFO and WDF. Accordingly, she requested that some attention be given to the issue of regional coordination (beyond listing otolith marks in the Mark List). In brief, what was needed and what was the best way to accomplish it?

In response, Lee Blankenship (WDF) agreed that ADFG needs to get its various otolith marking programs under control in order to avoid future problems with conflicting marks. He also agreed that some regional coordination, albeit fairly informal, is needed between CDFO, WDF and ADFG. This includes coordination on how to set down otolith marks, and what to look for when sampling for marks.

In further discussion, WDF, CDFO, and ADFG agreed to hold an annual workshop in order to coordinate their respective otolith programs.

ACTION:

No action was required by the Mark Committee as WDF, CDFO, and ADFG agreed to meet annually to coordinate their respective otolith programs.

8. **PSC Survey Questionnaire of Hatchery Practices in CWT Studies**

Under the direction of the PSC Data Sharing Committee, Richard Comstock (USFWS) developed a fairly comprehensive survey questionnaire designed to catalog hatchery practices used by agencies in conducting CWT studies. The questionnaire was distributed to all tag coordinators to expedite, with a requested return date of October 2, 1990.

Karen Crandall (ADFG) had requested a discussion on the results of this questionnaire, including the problems it uncovered, and what the future objectives are. This agenda item, however, was tabled since Comstock was not able to be present to report on his findings. Ken Johnson noted, though, that Comstock would be present the following day and planned to give a preliminary report to the Data Sharing Committee.

Crandall again stressed that those who went to the considerable effort of filling out the questionnaire should receive a formal report. The Mark Committee concurred and felt that the report could help to improve hatchery practices by providing a comparison of different approaches used for a given procedure.

9. **Proposal to Expand Mid-Year Reporting to Include Tags Implanted**

Lee Blankenship (WDF) proposed that the Mid-Year Release Report be changed from reporting tags "released" to tags "implanted" to date. The reason for expanding the reporting is that often some fish get out earlier than planned and may thus be recovered. In addition, the tagged fish will be released in the near future in most cases. He noted further that the tag codes wouldn't be reported in the actual release file until the fish were actually released.

This proposal received a mixed reaction. Charlie Corrarino (ODFW) felt that there wouldn't be a problem if timeliness of reporting was improved. Neil Williscroft (CDFO) also commented that it would be a problem for those using the Mid-Year Release Report to predict which codes were actually released and which ones were implanted at the time of the report. On the plus side, Blankenship argued that it would speed up reporting. Crandall (ADFG) also said that Alaska has been doing this all along.

ACTION:

No action was taken. The Mark Committee concurred that if they wished, agencies could submit "implanted tags to date" along with released tagcodes for the Mid-Year Release Report. However, there was no obligation to do so.

10. Coordination of the Spokane Tribe's New Tagging Program

Tim Peone addressed the Mark Committee and explained that the Spokane Tribe has embarked on a cooperative long term tagging program with the Washington Dept. of Wildlife to evaluate kokanee production in the upper Columbia Basin. The tagged kokanee are to be stocked into Banks Lake and Lake Roosevelt, inland reservoirs created by Grande Coulee Dam. As some tagged kokanee are expected to escape downstream and could be recovered, Peone requested permission to use the adipose fin clip. Peone also requested that the Spokane Tribe be assigned its own agency code for the studies. Clarification was also sought concerning reporting procedures for tag releases and recovery data.

Committee members informed Peone that approval of the Mark Committee was not necessary if the Spokane Tribe wished to use tags without an adipose clip. The disadvantage is that there would be no downstream recoveries. However, if the adipose fin is removed, the Spokane Tribe must use coded wire tags.

It was agreed that coordination would be provided by Charles Morrill (WDW) since the Spokane Tribe program was a cooperative project with WDW. Accordingly all release and recovery data are to be forwarded to WDW for compilation and subsequent submission to the Mark Center.

The request for a new agency code was not approved because of a long standing reluctance to assign unique agency codes to small programs. However, since the project was cooperative with WDW, agency code 62 was approved for standard tags. It was also noted that in the future, a unique agency code could be assigned to the Columbia River Intertribal Fisheries Commission to be used by all tribes in the Columbia Basin. This would be similar to the Puget Sound area, where the Northwest Indian Fisheries Commission coordinates tagging activities of many different tribes.

ACTION:

The Spokane Tribe was given approval to adipose clip kokanee in the upper Columbia River provided that a coded wire tag is used. Coordination and reporting of data will be done through WDW because of the cooperative program with WDW. Agency code 62 was approved for use with standard length tags (Attachment 6).

11. Request to Use Blank Wire in Ad-Clipped Fish

Ron Olson (NWIFC) reported that the Skagit System Cooperative wished to be able to identify their releases of adipose-clipped steelhead from other adipose-clipped steelhead when sampling the in-river fisheries. Permission was therefore requested to be able to use blank wire to identify the particular release group.

This request generated considerable discussion about the practice of using blank wire in general. The Committee agreed, however, that since the adipose clip on steelhead was desequestered, users were free to use any type of tag with the adipose clip. This included unrestricted use of blank wire and "agency-only" wire.

The Committee rejected the use of blank wire or "agency-only" wire with the adipose clip in chinook, coho, sockeye, pink and chum salmon. Steelhead in the Columbia Basin must also carry a fully coded tag if the left ventral (LV) fin is clipped. The Mark Committee further stressed that the regional agreements are to be revised to clearly

specify that blank wire or "agency-only" wire is not approved for use with the adipose clip on salmon (or LV clip on Columbia River steelhead).

ACTION:

1) **The Mark Committee concurred that there are no restrictions on the use of either blank wire or "agency-only" wire in adipose clipped steelhead.**

2) **Blank wire and "agency-only" wire is not approved for use in adiposed clipped salmon or LV-marked steelhead in the Columbia Basin.**

3) **The Mark Coordinator was instructed to revise the regional agreements to clearly specify the above restrictions on the use of blank wire and "agency-only" coded wire tags.**

11A. Potential Uses of Tagging for "Benign" Recoveries (New Agenda Item)

While blank wire can't be used with the adipose clip on salmon, there are a number of other practical applications. Lee Blankenship (WDF) referred to these uses as tagging for "benign" recoveries and cited several examples where the tag is placed in different body locations. For example, a blank tag can be placed in the left cheek and recovered only at the terminal fisheries with the aid of a hand held tag detector. The benefits include fewer numbers of fish to examine, no need for an external fin mark, no need to kill the fish, and unique identification of the area of tag placement.

Blankenship offered three reasons to do tagging for benign recovery:

a) Tagging repeat spawners:

WDF, for example, is conducting a comparison of trucked versus non-trucked steelhead, when the tags are placed in either the left or right cheek. A wand tag detector is used to identify the study group without having to kill the fish.

b) Selective breeding studies:

As part of the Endangered Species Act process, WDF needs to identify every chinook fish out of Lyons Ferry Hatchery. It would be fairly expensive to do this using standard tags. In addition, there are a lot of strays recovered at Lyons Ferry. This next year, WDF intends to place a tag in the snout (with an Ad-clip) and a blank tag in the left cheek. When the fish return, those with an adipose clip will be checked for a tag in the left cheek to see if it is a Lyons Ferry fish or a stray from another hatchery.

c) Cost considerations:

It is often cheaper when only two codes are required (e.g.: left cheek-right cheek) to identify a particular study group. In addition, the cost of the blank wire is $10.00 per thousand compared to $40.00 for standard full code wire.

Blankenship noted further that they had tagged 9 different body parts, including the base of the adipose fin, and found 100% success in detecting the location of the tags. As such, he argued that tagging with blank wire for benign recovery is a viable option to standard tagging procedures and doesn't add any noise to the system.

Keith Jefferts (NWMT) cautioned the Mark Committee against going to the local hardware store and buying #302 stainless steel wire because of the general quality of the wire. A roll of wire can be purchased for $20 per pound, and will provide roughly one million tags. However, Jefferts noted that even in dealing with a supplier of high grade wire, NWMT rejects one out of every three rolls of wire because of inferior magnetism properties. In addition, the wire must be cleaned.

Jefferts also recommended that at a minimum, agencies use "agency-only" wire instead of blank wire because of the added information carried on the tags. Agency-only tags are half price, while blank wire will be sold for 1/4 the price of standard tags. However, a minimum lot of 100,000 tags must be ordered, with a lead delivery time of 120 days.

ACTION:

No action was required. However, it was agreed that NWMT would report sales of "agency only" tags and blank wire tags to the appropriate agency tag coordinator.

11B. Proposed Use of the Adipose Clip (No CWT) in the Columbia Basin (New Agenda Item)

Lee Blankenship (WDF) commented that the recent focus on the declining salmon stocks in the Columbia Basin and the increasing threat of the Endangered Species Act have resulted in a renewed effort to find ways to protect and enhancement wild production of these stocks. Some policy makers have advanced the proposal to adipose clip all hatchery reared chinook (and possibly coho) in the upper Columbia Basin. The apparent objective is to easily differentiate hatchery reared stocks from wild/natural stocks. Live catch harvest methods could then be used so that wild fish can be released.

The Mark Committee received this news with considerable disbelief because of the potential impact such a marking program would have on the coastwide CWT recovery program. Concern was also expressed that it would also violate the U.S.-Canada Salmon Treaty which specially states that a statistically reliable CWT program will be maintained. Given that the proposal was still informal and few facts were available, the Mark Coordinator was directed to write to the appropriate policy makers and outline concerns of the Mark Committee.

ACTION:

The Mark Coordinator was instructed to send a letter to the appropriate policy makers outlining the serious concerns of the Mark Committee about the coastwide consequences of an adipose-only clip (no CWT) on all hatchery chinook and coho in the upper Columbia Basin. (Note: see Attachment 7 for the resultant letter).

12. Sequential Tags - Revisited

Sequential tags were approved for use with the adipose clip at the 1990 Mark Meeting, with the stipulation that all rules that apply to standard tags also apply to the new tags. This included the requirement that tag codes can be used only once. However, because of mis-communications, Northwest Marine Technology subsequently issued several tagcodes for which the effective tagcode was the same as previously released standard wire codes. Once the situation became known, NWMT quickly recalled the problem codes and issued new codes that were unique.

Given this background and the increased complexity of sequential tags, Committee members were asked if any new problems had surfaced with the new tags. No new problems or concerns were raised, however. Keith Jefferts (NWMT) also confirmed that steps had been taken to insure that new sequential codes will not duplicate any previously issued codes.

13. Update on 1990 High Seas CWT Recoveries

The following report was given by Ron Heintz (NMFS-AK):

From October 1989 to September 1990, observers on high seas fishing vessels recovered 138 coded wire tagged salmonids. In addition, 226 salmonids with adipose fins were processed. Data come predominately from the hake fishery located off the coast of Oregon and Washington. No new agencies or range extensions were observed this year. A snout from a coho salmon was examined by a Japanese observer in the squid driftnet fishery; it did not contain a CWT. The following table summarizes finalized tag recovery data for all of 1989.

CWT RECOVERIES BY FISHERY
(1989)

FISHERY	NUMBER OF CHINOOK TAGS	NUMBER OF COHO TAGS	NUMBER OF STEELHEAD TAGS
J.V. Hake	193	1	0
J.V. Bering Sea	1	0	0
Domestic GOA	1	0	1
Domestic Bering Sea	1	0	0
Research gillnet	0	0	17

Coverage in the domestic fisheries improved in 1990 with observers required 100% of the time on vessels exceeding 125' and 30% of the time on vessels exceeding 50'. This provides better than 80% coverage because the bulk of the catch is made by large vessels.

Japan, Korea and Taiwan continued fishing for squid with driftnets outside the EEZ with some observer coverage. Approximately 8% of the fishing activity was observed by North American and Asian observers. Many more salmon were observed this year, but the numbers have not been finalized. Taiwan and the

Republic of Korea have yet to share observer data. Estimates of bycatch are further hampered because sampling coverage may not represent the distribution of effort. Increased salmon bycatch is likely due to cooler sea surface temperatures along the northern boundary of the squid area.

14. Agency Reports on Tagging Plans for 1991

As requested, each of the tag coordinators provided a summary table of projected tagging plans for 1991 and actual tags released in 1990 for comparison. These tables are found in **Attachment 8** (provided to tag coordinators only). **Table 5** below provides an overview of all tagging.

Overall tagging levels projected for 1991 total 47.4 million fish. This represents a 3% increase over 1990 when 45.9 million fish were tagged. Most agencies projected modest or little change from 1990 levels. The most notable exception is the NMFS (Col. River) which plans to decrease tagging from 2.2 million in 1990 to 490,000 in 1991. Most of the decrease is attributed to the elimination of tagging fall chinook.

Table 5. Comparison of Agency Tagging Levels

Reporting Agency [1]		Tagging Levels ($X10^3$) 1990	Tagging Levels ($X10^3$) 1991
Alaska			
	ADFG (+PNP)	5,580	5,980
	Metlakatla	496	810
	NMFS-AK	245	400
British Columbia			
	CDFO	10,250	11,250
	CDFR	193	295
	BCFW	38	1
Washington			
	WDF	7,800	9,300
	WDW	310	410
	NWIFC	2,975	2,980
Idaho			
	IDFG	2,108	2,643
Oregon			
	ODFW	6,030	6,510
California			
	CDFG	3,350	1,850
Federal (Regional)			
NMFS	Col. Basin	2,221	490
USFW	Col. River	3,310	3,330
	Puget Sound Wash. Coast	740	940
	California	280	300
TOTALS:		45,926	47,489

1/ Tagging totals include those for private agencies, etc., which are coordinated by the reporting agency.

15. Advance in Marking Technology

A. Binary Tags - Northwest Marine Technology

Dr. Keith Jefferts reviewed several new products that are or soon will be available:

1	Wand Tag Detector:	This hand held tag detector is very sturdy, floats in water, and is powered by 9 volt batteries. It has a 2 cm tag detection range and works best for full length tags if placement is in the snout. It is also excellent for "benign" tag recoveries. Price = $4,000
2.	Hand Held CWT Injector:	This hand held tag injector will be in prototype production this spring. It can be used with or without a head mold. Probable price range: $1,500 - 2,000
3.	Visual Tag Injector:	This is a modified CWT hand held injector and designed to speed up the tagging process for visual implant tags. Probable price range: $1,500 - 2,000

B. Elemental Marks - Elemental Research, Inc.

Robert Brown (Elemental Research, Inc.) provided an update on progress on the use of Inductively Couples Plasma Mass Spectrometry (ICP-MS) for identifying hatchery stocks mass marked with either rare earth elements or strontium (see Attachment 9).

Research results to date demonstrate that the lanthanide elements are readily taken up through the water supply and subsequently deposited into the vertebral columns, otoliths, and scales of fish. Uptake and retention of elements increases as the concentration and duration of exposure increases. Retention is now known to be at least one year without being metabolized out of the system. While the sensitivity of ICP-MS varies for the different lanthanides, the conclusion is that the method works. As such it has great potential for mass marking hatchery stocks.

One problem encountered is that the initial low elemental loading in small fish is diluted as the fish grows. Research is therefore shifting from the standard ICP-MS procedures to electrothermal vaporization. Using this technique, a tiny sample is oblated and the vapor is then drawn into the machine for analysis. It has a sensitivity 1-2 orders higher than the ICP-MS procedure and can detect elements at concentrations as low as 5-1 x 10^{-12} ug/ml. The central portion of the scale is a promising target.

There remains considerable research to do before lanthanide elements can be used on a large scale to mass mark hatchery stocks. However, those involved in the research remain very optimistic that the technology can be further refined and that it will work as envisioned.

C. Pit Tags - Biomark, Inc.

This agenda item was deleted as Scott McCutcheon (formerly of NMFS-Col. R.) was not able to attend.

D. Comparison of Tagged versus Untagged Mortality (New Agenda Item)

Lee Blankenship (WDF) reported preliminary results of a study to compare the daily mortality of both CWT tagged and untagged populations of spring chinook being reared at Cowlitz Hatchery. The Cowlitz Hatchery was chosen since it has protective netting and mortalities are counted and removed daily.

Results of the study to date are summarized in Attachment 10. During the first seven months, approximately 1% of the population died. Of these, tagged fish showed a 27% higher mortality rate than untagged fish. Taking into account that only 1% of the entire population had died, the differential mortality of the tagged fish was only 0.3% after seven months. There was also some evidence that on-going mortality rates of tagged fish continued to be slightly higher, and particularly during a stress period of illness in the population.

16. Clarification of Idaho Tag Releases - Discussion Point

Pete Hassemer (IDFG) pointed out that the January reporting guideline for submitting finalized release data has created some confusion for users of Idaho's release data. Depending on the water conditions, some Idaho hatcheries release spring chinook in the fall, while other hatcheries continue to rear the same brood year until the following spring before releasing them.

Consequently, reporting finalized release data in January meant in the past that some tag codes were missing the spring release component of production when listed in the annual CWT Release Report. This in turn caused some data users to miss the spring component of a brood year release.

During the subsequent discussion, it was pointed out that the reporting should consist of one record or line of data for a given tag code, regardless of the time span of release. In addition, Johnson (PSMFC) noted that release data can be submitted at any time once it has been finalized. The January deadline serves as a focal point to get the given year's release report printed on a timely basis.

ACTION:

No action was required by the Mark Committee. IDFG reported that it intends to delay reporting tagcode releases until the entire group has been released. This will eliminate the confusion experience by users in the past for some spring chinook tag groups from Idaho released in both the fall and following spring.

17. High Incidence of Naturally Occurring Adipose "Clips"

Dennis Isaac (ODFW) led a discussion of the general incidence of naturally occurring adipose clips. He reported that ODFW staff had been observing from 30% to 70% "no tags" in returning adipose - clipped coho at the Bonneville/Oxbow/Cascade complex for the past 3-4 years. Higher than expected rates (25% - 30% range) have also been observed at a few other select Oregon hatcheries. He was confident that ODFW's tagging wasn't that poor and therefore wondered what other agencies had been observing with respect to "no tags" back at the hatchery.

Keith Jefferts (NWMT) observed that one samples the whole population for a naturally missing adipose mark against only a small fraction that actually had tags in them once. Therefore, if the tagging level is 5%, the fraction of naturally missing adipose marks must be multiplied by 20 before it is seen in the operations at the rack. Isaac agreed but commented that missing adipose fin rates of 60 -70% still seemed too high to be easily explained this way. Lee Blankenship (WDF) then noted that it might relate to a naturally occurring adipose mark rate of 10%. Jefferts agreed and said that a rate of 10% could give very high recovery rates if the tagged component of the population was very small. Isaac didn't rule out this explanation but still felt that the observed adipose only rates observed at the Bonneville/Oxbow/Cascade complex were too high to be normal.

Robert Smith (NMFS) asked whether these higher than expected rates were reflected in the pre-release sampling for tag loss. Isaac responded to the contrary and said that the observed tag loss rate ranges between 0% and 6% at three weeks. He explained further, that the fish sampled for tag loss are removed during the tagging and held in live boxes for three weeks before being checked for tag loss. The fish are then returned back with the rest of the population to be released the next spring. Given this, Smith noted that it wasn't actually a measure of pre-release missing adipose fins but only a 3 week measure of tag loss. Lee Blankenship countered by noting that 90% of tag loss is observed by three weeks. Isaac agreed with both observations and argued that additional loss of the adipose could be occurring in the succeeding months prior to release.

Isaac continued by noting that careful observations during tagging seem to point towards "coldwater" disease as a possible contributing factor. Some of the characteristics of this disease include snout erosion, fin erosion and some mortalities. As an example, he cited a tagging project at Eagle Creek last year in which the coho were suffering from coldwater disease and had enough erosion of the adipose fin to cause confusion for the tagging crew. He further commented that while he was aware of information about nipping behavior, he had never seen evidence of it in coho to account for the observed fin damage. Given these observations, he proposed that the high incidence of natural adipose marks seen at certain hatcheries was closely correlated with the parallel problems of coldwater disease at those hatcheries.

Lee Blankenship reported also seeing the same pattern in Washington where certain hatcheries have what they refer to as "cold temp" disease. These same hatcheries also exhibit a higher than normal rate of natural adipose marks and it is accepted that this is a direct result of the cold temp disease.

The question was then posed as to what use the three week measurement of tag loss is if the total number of adipose only marked fish in the group isn't measured at the actual time of release. Lee Blankenship responded that it will tell you what the tag loss is for the group in question. For example, if the release group was 40,000 and tag loss was 4%, one can compute how many fish are eligible to be caught in the fisheries. He further emphasized that the number of "no tags" in the adult population was really immaterial as they represent noise in the system that is ignored.

Blankenship further cautioned against taking a tag loss sample at 3-4 weeks and then later resampling and recomputing tag loss. This latter practice results in erroneously high contribution rates. Keith Jefferts agreed and noted that when you see an adult back at the rack without a fin, you know that it either lost a tag or lost the fin. However, you don't know which it was. Hence one should never use adult returns to recalculate tag loss!

When asked what the incident of naturally occurring adipose marks was, Lee Blankenship and Don Bailey (CDFO) provided the following estimates:

Wild Stocks	0.05% WDF (all species) 0.06% CDFO
Hatchery	0.5% WDF

ACTION:

No action was required. However, given the apparent close correlation with coldwater disease and other possible causes for natural adipose fin loss, there was general consensus that "ad-only" recoveries are of little use in estimating contribution of a group to a fishery.

18. Fin Mark Allocation for 1991

This agenda item was deleted because the Mark Center staff was not able to process all of the fin mark data prior to the meeting. A list of 1991 mark requests will be forwarded to Committee members as soon as possible.

1991 Mark Meeting Attendees

February 19, 1991

*	Don Bailey	CDFO - Vancouver, B.C.
*	Lee Blankenship	WDF - Olympia, WA
	Howard Burge	USFWS - Ahsaka, ID
	John E. Clark	ADFG - Douglas, AK
*	Charlie Corrarino	ODFW - Portland, OR
*	Karen Crandall	ADFG - Juneau, AK
	Nancy Davis	FRI - University of WA
*	Richard Dixon	CDFG - Rancho Cordova, CA
	Robert Donnelly	FRI - University of WA
	Tim Fisher	BPA - Portland, OR
	Wayne Haight	PNPTC - Kingston, WA
	Marc Hamer	CDFO - Nanaimo, B.C.
*	Jerry Harmon	NMFS - Pomeroy,WA
	Peter Hassemer	IDFG - Boise, ID
*	Ron Heintz	NMFS - Auke Bay, AK
*	David Houseworth	MIC - Metlakatla, AK
*	Dennis Isaac	ODFW - Clackamas, OR
	Dr. Keith Jefferts	NWMT - Shaw Island, WA
*	Ken Johnson	PSMFC - Portland, OR
	Jan Kallshian	NWMT - Shaw Island, WA
	Tom Kane	USFWS - Olympia, WA
	Jim Longwill	PSMFC - Portland, OR
	Mike Matylewich	CRITFC - Portland, OR
	Stan Moberly	NWMT - Olympia, WA
*	Charles Morrill	WDW - Olympia, WA
	Kate Myers	FRI - University of WA
	Paul Novak	NWMT - North Platte, NE
	Dick O'Connor	WDF - Olympia, WA
*	Ron Olson	NWIFC - Olympia, WA
	Vic Palermo	CDFO - Vancouver, WA
	Miguel Pascual	FRI - University of WA
	Tim Peone	Spokane Tribe, WA
	Ken Phillipson	NWIFC - Olympia, WA
	Cynthia Pratt	WDF - Olympia, WA
	Melanie Romey	MIC - Metlakatla, AK
	Ralph B. Roseberg	USFWS - Ahsahka, ID
*	Robert Z. Smith	NMFS - Portland, OR
	Percy M. Washington	Gaia NW - Seattle, WA
	S. Neil Williscroft	CDFO - Vancouver, B.C.
*	David Zajac	USFWS - Olympia, WA

* Mark Committee Member or Designate

ATTACHMENT 2A

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE
AUKE BAY LABORATORY
P.O. Box 210155, AUKE BAY, AK 99821-0155
(907) 789-6000

24 hour RAPICOM (907) 789-6094

December 7, 1990

Mr. Guy N. Thornburgh
Executive Director
Pacific States Marine Fisheries Commission
2501 S.W. First Avenue, Suite 200
Portland, Oregon 97201

Dear Mr. Thornburgh:

This is a belated response to your request for help from Auke Bay Laboratory (ABL) in expediting the conversion of NMFS Alaska historical coded-wire tag (CWT) database into new Pacific Salmon Commission (PSC) requested formats. The new format apparently is now being used coastwide for data management and data exchanges by harvest managers. My understanding of this issue is that most NMFS Alaska CWT release and recovery data have been appropriately reported in the original PSMFC formats. These formats preceded development of the more recent detailed PSC format. Also, apparently all NMFS Alaska release data have been converted into the new formats and that the data sets needing conversion mostly involve recovery/catch sample information.

As you may know, our Laboratory is not a primary catch/sampling organization. The majority of the CWT recoveries we deal with are weir/stream recoveries that we do ourselves at two experimental stations, Little Port Walter and Auke Creek. Both of these are research programs, not production hatcheries, and do not play a major part in coastwide harvest management issues. I might add, however, that CWT recovery and internal data management efforts at these stations represent a significant commitment of our available research funds. Smaller numbers of CWT recoveries that we manage also come from research programs involving the experimental marine sampling of juvenile salmon, from work on wild salmonids in streams, and from high seas research recoveries and bycatch sampling by observers in domestic groundfish and foreign squid fisheries.

The original PSMFC catch/sample data formats, which we were able to report in a reasonably timely manner, were and still remain very adequate for our own research needs. It is the requirement for the expanded information deemed necessary by PSC and major

catch/sample analyses groups that has created a bottleneck for us both. I regretfully have to report we will not be able to meet your deadline for the requested conversions.

This Laboratory has been and remains a strong supporter of PSMFC coastwide CWT coordination activities. The conversion of historical NMFS Alaska catch/sample data into the new format, however, has forced new manpower/funding concerns on us that we are trying to resolve. In reality, this PSC and PSMFC request has changed what was formerly a part time CWT data management requirement into a full time responsibility. The Laboratory's current Tag Coordinator, Ron Heintz, has numerous other duties including his own major research commitments. We estimate that a full time competent and experienced computer programmer will be required for 6 to 9 months to make the conversions. We also suspect, depending on future PSC data requirements, there may be other longer range adjustments we will have to deal with. In short, we are faced with significant unscheduled expansion of effort at ABL in dealing with these catch/sample matters.

I have met with my Program Managers and we are exploring ways to resolve this problem. Central to the issue is how to justify and implement an expanded ABL CWT data system that exceeds our own research needs. Please, do not misunderstand my position; I am not questioning the basic need for the PSC requirements, rather I am trying to find how this laboratory can meet them. We have considered several options including internal reprogramming, transferring ABL CWT management from Enhancement Research to our U.S./Canada group which already has Treaty funds committed for harvest management stock identification purposes or an appeal to NMFS or PSC for separate funding support to meet this new need. I believe most of the regular CWT catch/sample programs on the coast have separate funds to address these issues. Meanwhile we will do all that we can to expedite the format conversion for Alaska NMFS catch/sample data and will continue implementation of the new PSC release data formats.

Sincerely,

George Snyder, Ph.D.
Laboratory Director

ATTACHMENT 2B

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE
AUKE BAY LABORATORY
P.O. Box 210155, AUKE BAY, AK 99821-0155
(907) 789-6000

24 hour RAPICOM (907) 789-6094

February 15, 1991

Mr. Ken Johnson
Regional Mark Coordinator
Pacific Marine Fisheries Commission
Metro Center, Suite 170
2000 SW First Avenue
Portland, Oregon 97201

Dear Ken:

I want to outline the efforts that we have made toward reformatting the NMFS Alaska CWT recovery data. As you know, our problems with reformatting and reporting have resulted from an inability to gain support for assigning this project a high priority. Essentially, requirements for field work and other ongoing research commitments have prevented the Program I work in from assigning the large uninterrupted block of time that will be required to reformat the data. As pointed out in Dr. Snyder's letter of last December 7, to Guy Thornburgh, the Auke Bay Laboratory is exploring several avenues to solve this problem. Until I receive further instruction from a higher level in NMFS, I am, presently, unable to completely fulfill my obligations as a Mark Coordinator.

The project I am assigned to has requested funds to employ a full time NMFS Mark Coordinator. These plans were well received after review by management at our laboratory and were forwarded as part of the regular budget process through the Alaska Fisheries Science Center and the Alaska Regional Office. This plan, if implemented, only represents a long term remedy and could not affect the current situation for 2 or 3 years. On the short term, however, we have recently reviewed the problem with Steve Pennoyer, NMFS Director of the Alaska Region. His response was supportive and demonstrated an understanding of the scope and importance of the problem. A possible solution to the immediate problem was briefly discussed with Pennoyer. This involved finding sufficient funds to contract an outside programmer for developing necessary programs to reformat existing NMFS CWT recovery data into the PSC mode. If this became a real possibility within the next few months, I believe we could complete all

the necessary conversions by the end of 1991. Pennoyer, however, did not indicate if or when such funds might become available for us to rectify the situation. Neither did he close the door on this possibility.

I am sorry for the delay and I hope that this note demonstrates that we have made some effort to provide the data you have requested. I hope that we can join with the rest of the participating agencies soon and finish the conversion of the coastwide database.

Sincerely,

Ronald A. Heintz
Mark Coordinator

ATTACHMENT 3

Northwest Indian Fisheries Commission

6730 Martin Way E., Olympia, WA 98506 Phone (206) 438-1180 FAX #456-3032 FTS #434-9476

March 1, 1991

Guy N. Thornburgh, Executive Director
Pacific States Marine Fisheries Commission
2501 SW 1st Ave., Suite 200
Portland, Oregon 97201

Dear Mr. Thornburgh:

The Catch Data Exchange Work Group of the Pacific Salmon Commission (PSC) Technical Committee on Data Sharing has been working on development of a catch and effort database. The scope of this project, as a bilateral assignment, is to develop a format for exchanging catch and effort data and to provide documentation as necessary to explain the data coding and sources. However, once this portion of the project has been completed, the U.S. has logistical hurdles unique from our Canadian counterparts, due to the many U.S. agencies that would be collecting and supplying data as part of this effort. The PSMFC is the appropriate agency to collate, validate, store, and distribute data from U.S. participants. This would be a task similar to the compilation and maintenance of coastwide CWT data, already performed by PSMFC.

We are not able to ascertain, at this time, what would be necessary from PSMFC in the way of hardware, software, and manpower to perform this task, but would like to advise you of our thoughts at this time in case the PSMFC is considering any modifications or upgrading of existing capabilities. It does make sense, given the experience PSMFC has with the CWT database and the coastwide scope of PSMFC, that they provide services for collating, validating, storing, updating, and distributing the data from U.S. agencies and from Canada as they make their data available. The members of the U.S. section of the Catch Data Exchange Work Group strongly encourage PSMFC to seek additional U.S./Canada Treaty resources to meet this obligation.

Sincerely,

Joseph Pavel

Joseph Pavel, NWIFC
Scott Johnson, ADFG
Will Daspit, PSMFC
Susan Markey, WDF
Gerald Lukas, ODFW

cc: U.S. Section, PSC Standing Committee on Finance and Administration
U.S. Section, PSC Technical Committee on Data Sharing

MEMORANDUM

TO: Data Sharing Committee

FR: Gary S. Morishima

RE: Formula for Estimation of CWT Recoveries

DATE: January 22, 1991

I am concerned over potential errors and inconsistencies in procedures used by agencies to estimate the number of tags represented by a single CWT recovery (Estimation Factor). Since estimated CWT recoveries are seminal to several types of analyses performed by the Coho and Chinook Technical Committees (e.g. chinook Exploitation Rate Analysis, the Chinook Model, coho stock assessments, coho stock composition estimates) problems with expansions could have serious repercussions.

I propose that a standard procedure for computing estimation factors be developed and employed. The PSC format for data exchange is intended to standardize reporting of recoveries in catch sample strata. I can see no reason why a standardized formula cannot be used. Indeed, the absence of a standardized procedure (i.e. blindly accepting the "company line") could produce misleading and erroneous results, particularly when a CWT group is impacted by more than a single jurisdiction and changes in exploitation patterns over time are of principal interest. I would appreciate your comments and opinions on this matter.

A proposed procedure for estimation of CWT recoveries is provided for your consideration and review. An example is provided to illustrate the differences between the proposed procedure and the estimation procedures currently used by CDFO, ADF&G, WDF, and ODFW.

Specific data elements used in the CWT estimation formulas are reported by gear, time, and species strata in the catch-sample record format used for PSC CWT data exchange. The recovery status codes and associated meanings within the PSC format are listed below:

Status Code	Meaning
1	Valid CWT code
2	No tag found in head
3	Tag extracted, but lost before decoding
4	Tag extracted, but could not be read
7	Tag extracted, but unresolvable discrepancy encountered
8	Ad clipped fish identified, but head not processed

PROPOSED CWT ESTIMATION FACTOR

I propose that estimation factors be computed according to the following procedure:

STEP 1: ***Adjust for heads not processed (status 8 recoveries).*** Had the Status 8 recoveries been processed, they would have been placed in any of the other status classifications. An adjustment factor can be estimated by simple proration as:

eq (1)

$$AF_8 = \frac{ST_8}{\sum_{j=1,2,3,4,7} ST_j}$$

where: AF_8 = *Adjustment Factor resulting from distribution of status 8 recoveries*

ST_j = *# of status j recoveries reported in Catch-Sample record*

STEP 2: ***Adjust for tags lost before decoding (status 3 recoveries).*** Had the adjusted status 3 recoveries been decoded, they would have been classified as status 1, 4, or 7. A second adjustment factor can be estimated by simple proration as:

eq (2)

$$AF_3 = \frac{(1 + AF_8) * ST_3}{\sum_{j=1,4,7} ST_j}$$

where: AF_3 = *Adjustment Factor resulting from proration of status 3 recoveries*

AF_8 = *Adjustment Factor resulting from proration of status 8 recoveries*

ST_j = *Number of status j recoveries reported in Catch Sample record*

The combined adjustment factor to compensate for Status 8 and Status 3 recoveries is:

eq (3)

$$\frac{C}{S} * (1 + AF_8 + AF_3)$$

This formulation is premised on my understanding of definitions of status codes as provided in the PSC format for data exchange. If agencies do not use standardized definitions for these status codes, problems with inconsistency would be further exacerbated.

ADJUSTMENT FOR NO-TAGS

Another area where a potential adjustment to observed CWT recoveries may be warranted concerns the distribution of status 2 (no tags) codes. In some circumstances, it may be possible to distribute status 2 codes among tag groups by incorporating data on tag retention rates reported in the release file. The CWT release records contain information regarding individual tag groups, including the number of fish with tags and the number of fish that were observed to shed tags. There is no consistent standard for sample sizes and the length of time used to evaluate tag retention. However, there may be circumstances (particularly when sampling of terminal areas is involved) where procedures used to estimate tag retention rates are reasonably consistent. In such instances, the status 2 recoveries could be allocated among status 1 recoveries through simple proration as:

$$AF_{j2} = \frac{ENP_j * ST_3 * (1 + AF_8)}{\sum_{k=1}^{n} ENP_k}$$

eq (4)

where: AF_{j2} = *Adjustment to status 1 recoveries for tag code j resulting from distribution of status 2 recoveries*

$$ENP_j = \frac{\text{\# Fish in tag group } j \text{ reported with no-tags}}{\text{\# Tagged fish in tag group } j}$$

AF_8 = *Adjustment resulting from Step 1*

When all three types of adjustments are made, the estimation factor would become:

$$AF_{jT} = \frac{C}{S} * (1 + AF_8 + AF_3 + AF_{j2})$$

eq (5)

where: AF_{jT} = *Total Adjustment Factor for tag code j*

other parameters as previously defined

COMPARISON WITH ESTIMATION FORMULAS USED BY AGENCIES

A description of estimation factors employed by state agencies for commercial fisheries is provided in Data Sharing Technical Committee Report TCDS(89)-1 (I am not privy to the estimation formulas used by other agencies). The representation of these formulas in terms of data items reported in PSC catch sample records format 1.2 was obtained though personal communication (WDF- Dick O'Connor; ADF&G - Karen Crandall; ODFW - Charlie Corrarino). The following discussion concerns estimation factors for commercial fisheries only. Procedures used by reporting agencies to estimate recoveries by sport fisheries are not fully documented in TCDS(89)-1.

CANADIAN DEPARTMENT OF FISHERIES AND OCEANS (CDFO)

The factor used by CDFO to adjust for lost tags or unprocessed heads was reported on page 35 of Kuhn [1] and in slightly different form on page 88 of TCDS(89)-1[2]. The formula used to compute the estimated recoveries, as presented in TCDS(89)-1 (corrected for typographical errors) is:

eq (6)

$$EST = \frac{C}{S} * \left(1 + \frac{LP}{KN} + \frac{ND * (KN + LP)}{KN * (KN + LP + NP)}\right)$$

where: EST - *Estimated Recoveries*

C - *Total catch (or escapement)*

S - *# of fish sampled for ad clips*

KN - *# Status* 1

LP - *# Status* 3 *or* 4

NP - *# Status* 2

ND - *# Status* 7 *or* 8

The second term in the parenthetical expression represents an adjustment for lost and unreadable tags; the third term represents an adjustment for recoveries with no data.

COMMENTS ON CDFO CWT EXPANSION FORMULA

1. No distinction is made between status 7 and status 8 codes. These codes are fundamentally different since status 7 indicates an unresolved discrepancy while status 8 indicates that no attempt was made to process a head from an ad-clipped fish. Status 8 codes should be distributed among the status 1, 2, 3, 4, and 7 recoveries.

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1 Kuhn, B.R. (1988). The MRP-Reporter Program: A Data Extraction and Reporting Tool For the Mark-Recovery Database, Canadian Technical Report of Fisheries and Aquatic Sciences No. 1625.

2 Pacific Salmon Commission, Joint Technical Committee on Data Sharing, Joint Working Group on Mark Recovery Databases, March 8, 1989.

2. No distinction is made between status 3 and status 4 codes. These codes differ in that status 3 indicates that a tag was found, but lost prior to decoding while status 4 indicates that a tag could not be read. Status 3 recoveries should be distributed among the status 1, 4, and 7 recoveries after adjustment for status 8 codes.

3. Results of the CDFO expansion formula are identical to those generated by equation (3) if there are no Status 7 and Status 4 codes in a recovery strata.

ALASKAN DEPARTMENT OF FISH AND GAME (ADF&G) AND WASHINGTON DEPARTMENT OF FISHERIES (WDF)

The formula used by both these agencies to compute estimated recoveries when adjusting for lost tags and unprocessed heads is:

$$EST = \frac{N}{N2} * \frac{M1}{M2} * \frac{A1}{A2}$$

where: EST = *Estimated Recoveries*

N = *Total catch (or escapement)*

$N2$ = *# of fish sampled for ad clips*

eq (7)

$M1$ = *# Tags detected*
= *Status* 1 + *Status* 3 + *Status* 4+*Status* 7)

$M2$ = *# Tags successfully decoded*
= (*Status* 1+*Status* 7)

$A1$ = *# Fish with ad clips*
= (*Status* 1+*Status* 2+*Status* 3+*Status* 4+*Status* 7+*Status* 8)

$A2$ = *# Ad clips read at lab*
= (*Status* 1+*Status* 2+*Status* 4+*Status* 7)

The second term in the parenthetical expression represents an adjustment for unreadable tags; the third term represents an adjustment for lost heads.

COMMENTS ON ADF&G & WDF CWT ESTIMATION FACTOR

1. When all tags are successfully decoded, the estimation factor is identical to equation (3). From simple algebra,

$$\frac{A1}{A2} = \frac{Status\ 1 + Status\ 2 + Status\ 3 + Status\ 4 + Status\ 7 + Status\ 8}{Status\ 1 + Status\ 2 + Status\ 3 + Status\ 4 + Status\ 7}$$

eq (8)

$$= 1 + \frac{Status\ 8}{Status\ 1 + Status\ 2 + Status\ 3 + Status\ 4 + Status\ 7}$$

$$= 1 + AF_8$$

2. As with the CDFO formula, this formula does not distinguish between status 3 and status 4 codes. These codes differ in that status 3 indicates that a tag was found, but lost prior to decoding while status 4 indicates that a tag could not be read. Status 3 recoveries should be distributed among the status 1, 4, and 7 recoveries after adjustment for status 8 codes. When there are no status 4 recoveries, then the ADF&G and WDF formula is identical to equation (3).

OREGON DEPARTMENT OF FISH AND WILDLIFE (ODFW)

ODFW computes estimated recoveries when adjusting for lost tags and unprocessed heads through the following procedure:

1. Estimate the number of ad-clipped fish in the stratum.

$$NAD = \frac{C}{S} * NADS$$

where: NAD = *Estimated # of ad-clipped fish caught in stratum*

eq (9)

C = *Catch*

S = *Sample*

$NADS$ = *# of ad-clipped fish in sample*

$= Status\ 1 + Status\ 2 + Status\ 3 + Status\ 4 + Status\ 7 + Status\ 8$

2. Estimate the number of coded-wire tags in the stratum.

$$ECWT = NAD * \frac{NSCWT}{NSP}$$

where: $ECWT$ = *Estimated # of CWTs in stratum*

eq (10) $NSCWT$ = *# snouts processed that contained a CWT*

= *Status* 1 + *Status* 3 +*Status* 4 + *Status* 7

NSP = *# of snouts processsed*

= *Status* 1 + *Status* 2 + *Status* 3 + *Status* 4 + *Status* 7

3. Estimate the number of coded-wire-tagged fish represented by one observed recovery.

$$EF = \frac{ECWT}{NCWTP}$$

eq (11) where: EF = *Estimated # of CWT fish represented by* 1 *observed recovery*

$NCWTP$ = *# of CWTs processed and decoded*

= *Status* 1

COMMENTS ON ODFW CWT ESTIMATION FACTOR

1. This procedure makes no distinction between status 3, status 4 or status 7 recoveries, i.e. a status 1 recovery is adjusted for lost tags, unreadable tags, and unresolved discrepancies.

2. This formula is identical results to equation (3) only when there are no status 3, status 4, or status 7 recoveries in a stratum.

EXAMPLE

The following example illustrates the differences between the proposed procedure described by equation (3) and agency formulas for computing estimated recoveries. The number of recoveries in the various strata are not intended to reflect values that might be encountered in actuality, but are selected merely for purposes of demonstration.

Status 1	Status 2	Status 3	Status 4	Status 7	Status 8
120	50	20	10	3	100

Using the proposed estimation formulas:

STEP 1: Adjust for heads not processed.

$$AF_8 = \frac{100}{(120+50+20+10+3)}$$

$$= .493$$

Status 1	Status 2	Status 3	Status 4	Status 7	Status 8
120	50	20	10	3	100
Distribution of Status 8					
59.2	24.6	9.9	4.9	1.5	
After Distribution of Status 8					
179.1	74.6	29.9	14.9	4.5	

STEP 2: Adjust for tags lost before decoding.

$$AF_3 = \frac{(1 + .493) * 20}{(120+10+3)}$$

$$AF_3 = .224$$

Status 1	Status 2	Status 3	Status 4	Status 7	Status 8
179.1	74.6	29.9	14.9	4.5	
Distribution of Status 3					
26.9	NA		2.2	0.7	
After Distribution of Status 3					
206.0	74.6		17.1	5.2	

The estimation factor using the proposed procedure is thus:

$$\frac{C}{S} * (1 + .493 + .224) = \frac{C}{S} * 1.717$$

Using the CDFO formula, the estimation factor is:

$$EST = \frac{C}{S} * \left(1 + \frac{(20+10)}{120} + \frac{(3+100) * (120 + (20+10))}{120 * (120 + (20+10) + 50)}\right)$$

$$= \frac{C}{S} * 1.8938$$

Using the ADF&G and WDF formulas, the estimation factor is:

$$EST = \frac{C}{S} * \frac{120+20+10+3}{120+3} * \frac{120+50+20+10+3+100}{120+50+20+10+3}$$

$$= \frac{C}{S} * 1.8567$$

Using the ODFW formula, the estimation factor is:

$$EST = \frac{C}{S} * (120+50+20+10+3+100) * \frac{120+20+10+3}{120+50+20+10+3} * \frac{1}{120}$$

$$= \frac{C}{S} * 1.9031$$

The estimated number of recoveries computed through the agency formulas is compared below with the estimation factor computed using equation (3). Agency formulas appear to over-estimate recoveries by from 8% to nearly 11%.

Proposed Procedure (Equation (3)):

(C/S) * 1.717 * 120 = (C/S) * 206.0

CDFO Formula:

(C/S) * 1.894 * 120 = (C/S) * 227.3

CDFO/Proposed = 1.103

ADF&G and WDF Formula:

(C/S) * 1.857 * 120 = (C/S) * 222.8

ADF&G/Proposed = 1.082

ODFW Formula:

(C/S) * 1.903 * 120 = (C/S) * 228.4

ODFW/Proposed: = 1.108

MAGNITUDE OF POTENTIAL PROBLEMS

As indicated in the discussion, under certain circumstances, the various formulas employed by agencies yield results identical to those produced by equation (3). To assess potential differences using real-world data, I compared the estimation factors reported in the PSC catch sample files with those resulting from the use of equation (3). Only instances where an agency computed an estimation factor for a commercial fishery based on random sampling of the catch (Sample Type 1) were examined. Results are summarized below by agency and degree of difference between the agency and proposed expansion formulas.

CWT Estimation Factors Used by Agencies In Relation to Proposed Estimation Factor.
Source data: Pacific States Marine Fisheries Commission; Catch/Sample Records in PSC Format.

Category	Definition
I	Agency factor less that 50% of that computed by equation (3)
II	Agency factor greater than or equal to 50% and less than 90% of that computed by equation (3)
III	Agency factor greater than or equal to 90% and less than 100% of that computed by equation (3).
IV	Agency factor = factor computed by equation (3)
V	Agency factor greater than 100% and less than 110% of that computed by equation (3)
VI	Agency factor greater than or equal to 110% and less than 150% of that computed by equation (3)
VII	Agency factor greater than or equal to 150% of that computed by equation (3).

Alaska Department of Fish & Game

	Year										80-89	
Category	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	TOTAL	PCT
I	0	0	0	0	1	0	0	0	0	0	1	0.0%
II	0	0	0	0	0	0	0	0	0	0	0	0.0%
III	0	0	0	0	0	0	0	0	0	0	0	0.0%
IV	118	130	184	216	300	299	230	242	245	309	2273	97.3%
V	3	6	3	10	5	5	7	8	3	3	53	2.3%
VI	0	1	1	1	2	0	1	0	0	0	6	0.3%
VII	0	1	0	0	1	0	2	0	0	0	4	0.2%
TOTAL	121	138	188	227	309	304	240	250	248	312	2337	

Canadian Department of Fisheries & Oceans

Category	Year '75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	75-89 TOTAL	PCT
I	0	0	0	0	0	0	0	2	3	1	4	4	3	0	0	17	0.2%
II	0	0	0	0	1	1	0	1	2	0	1	2	3	0	0	11	0.1%
III	1	1	2	6	4	9	5	5	11	8	13	11	15	1	0	92	1.2%
IV	397	430	446	357	366	494	444	452	431	470	531	505	440	390	399	6552	82.6%
V	23	37	36	112	71	27	31	67	59	65	69	58	58	78	58	849	10.7%
VI	3	4	6	9	21	15	7	20	23	15	24	12	15	34	28	236	3.0%
VII	10	4	4	10	17	21	14	13	12	12	17	3	9	13	20	179	2.3%
TOTAL	434	476	494	494	480	567	501	560	541	571	659	595	543	516	505	7936	

Washington Department of Fisheries

Category	Year '84	'85	'86	'87	'88	'89	84-89 TOTAL	PCT
I	44	174	201	171	153	137	880	13.8%
II	70	84	66	66	89	67	442	6.9%
III	121	149	14	7	16	8	315	4.9%
IV	546	610	706	951	966	690	4469	69.9%
V	5	4	9	11	10	9	48	0.8%
VI	23	2	24	2	16	13	80	1.3%
VII	39	11	56	7	21	22	156	2.4%
TOTAL	848	1034	1076	1215	1271	946	6390	

Oregon Department of Fish & Wildlife

Category	Year '77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	77-89 TOTAL	PCT
I	2	1	1	2	7	6	3	3	7	3	1	4	1	41	1.0%
II	5	0	13	8	20	28	23	22	15	21	7	13	2	177	4.4%
III	3	4	5	13	30	27	28	25	16	44	10	31	7	243	6.1%
IV	120	163	129	104	165	209	227	226	231	195	166	269	202	2406	60.0%
V	21	19	30	23	37	27	24	11	28	38	17	64	36	375	9.3%
VI	28	56	53	59	43	36	22	10	13	35	3	36	37	431	10.7%
VII	35	64	49	54	29	15	17	9	16	23	8	6	14	339	8.4%
TOTAL	214	307	280	263	331	348	344	306	326	359	212	423	299	4012	

California Department of Fish & Game

Category	Year '78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	78-89 TOTAL	PCT
I	7	13	12	6	12	12	11	12	6	4	8	13	116	5.7%
II	12	14	4	13	12	4	5	3	3	4	32	7	113	5.6%
III	4	12	9	6	10	8	12	6	4	4	49	11	135	6.7%
IV	127	101	107	139	143	121	115	92	131	131	51	104	1362	67.3%
V	6	4	8	5	7	6	4	5	4	3	1	7	60	3.0%
VI	11	11	17	8	13	15	10	8	11	8	7	12	131	6.5%
VII	14	18	13	9	12	3	7	11	4	1	5	10	107	5.3%
TOTAL	181	173	170	186	209	169	164	137	163	155	153	164	2024	

GENERAL CONCLUSIONS

1. There are significant and substantial differences between agencies in the formulas used to compute estimated recoveries based on catch-sample data.

2. These differences result from disparate treatments of various status code recoveries. Some of the inconsistency may be due to dissimilarities in definitions of status codes as provided in the PSC format for data exchange. However, if standardized definitions for status codes are not used, problems with inconsistent interpretation of catch sample data would be more serious. Under such circumstances, it would not be possible to utilize the data contained in the catch sample records to standardize estimation factors necessary to complete CWT-based analyses.

3. Over all years with available catch/sample records reported in the PSC format for data exchange, the percentage of commercial fishery recovery strata for which agency formulas produce results identical to those generated by equation (3) ranges from a low of 60% for ODFW to 97% for ADF&G.

4. The estimates reported by ADF&G, CDFO, and ODFW factors appear to be biased high, that is, they seem to more frequently indicate more recoveries than would be computed using equation (3).

5. The extent to which these inconsistencies may affect analyses using CWT recovery data will be dependent upon the time/area/fishery strata involved with particular tag codes. However, the potential for serious problems clearly exists.

PROPOSED SYSTEM FOR DESCRIBING OTOLITH MARK FOR INCLUSION IN PSMFC MARK LIST.

DEFINITIONS

1. Pr or Po : PRE or POST hatching marks (on embryos or alevins). Identifies the otolith region(s) where the mark will be found.

2. (# - #): CENTIGRADE TEMPERATURE UNIT RANGE (degrees C x days) further locates the mark on the otolith.

3. C or V: Constant or Variable describes ambient thermal regime under which fish typically incubate.

4. A + or - describes whether incubation water temperatures were raised or lowered during any particular part of te marking cycle.

5. HOURS(h) or DAYS(d) describe the duration of the imposed thermal events.

6. REPITITIONS(#), describes the number of times the thermal manipulation is performed.

EXAMPLES

1. Pr,430-525,C,4h-,44h+,7

This describes an otolith mark on a pre-hatch embryo, induced between 750 and 950 accumulated temperature units, under a constant ambient temperature regime, by lowering the temperature for 4 hours then raising it again for 44 hours. This cycle was repeated 7 times.

2. Po,650-1000,V,2d+,4d-,5

This describes an otolth mark on a post-hatch alevin, induced between 100 and 1600 accumulated temperature units, under a variable temperature regime, by raising the water temperature for 2d and returning to cool ambient for 4 days. The cycle was repeated 5 times.

3. Pr,380-460,C,4h-,44h+,2
Pr,460-500,C,2h-,24h+,2
Pr,500-560,C,8h-,16h+,2
Po,650-1000,C,1d-,2d+,5

This decsribes a cycle in which the marking scheme changed somewhat through the marking period. Three different cycles were used to produce six marks. Additionally, these fish were marked with a post-hatch or alevin mark. A repeating and reasonably consistent pattern is advised, but deviations may be unavoidable.

OTOLITH MARK REPORT

Date Submitted

Submittor

MARK DESCRIPTION

SPECIES

BROOD YEAR

RELEASE DATE

RELEASE SIZE

RELEASE NUMBER

RELEASE SITE

OBJECTIVES OF STUDY,
NATURE OF EXPERIMENT, STOCKS USED
OR OTHER INFORMATION

AGENCY CODE

PACIFIC STATES MARINE FISHERIES COMMISSION
2501 S.W. FIRST AVENUE, SUITE 200, PORTLAND, OREGON 97201
PHONE (503) 326-7025 FAX (503) 326-7033

February 27, 1991

EXECUTIVE DIRECTOR
GUY N. THORNBURGH

Mr. Tim Peone, Manager
Spokane Tribal Hatchery
P.O. Box 100
Wellpinit, WA 99040

Dear Tim,

I wish to thank you for coming to the Mark Meeting last week in order to coordinate your agency's new CWT marking program for kokanee releases into Lake Roosevelt and Banks Lake. You were effective in outlining your program for the benefit of the Mark Committee.

To summarize the action taken on your request, the Mark Committee approved the release of adipose-clipped kokanee provided that the fish also carry a coded wire tag in the snout. You also have the option of releasing fish marked with a CWT without having to remove the adipose clip. However, without the adipose clip as an external flag, those fish will not be sampled downstream for the presence of a CWT. The key here is that if the adipose fin is removed, the fish must also carry a CWT before it can be released.

With respect to reporting, Charles Morrill (WDW) will serve as your liaison with the Mark Center. You will need to forward your mid-year release data to him in early July and final release data by mid-January. He will then combine your release data with that for WDW and forward it to the Mark Center for processing. This arrangement is similar to that used for a number of other smaller scaled marking programs, and should work well given your cooperative program with WDW.

You also requested that the Spokane Tribe be assigned a new agency code. This request was not approved because of a long standing reluctance to assign unique codes for smaller scaled programs. However, since you will be coordinating your program through WDW, you may purchase agency 62 tags from Northwest Marine Technology, Inc.

Please give me a call if you have any questions. The minutes of the Mark Meeting should be available in about three weeks.

Sincerely,

Ken Johnson
Regional Mark Committee

cc: Charles Morrill (WDW)
David Zajac (USFWS)
Jan Kallshian (Northwest Marine Technology, Inc., Shaw Island, WA 98286)

ATTACHMENT 7

PACIFIC STATES MARINE FISHERIES COMMISSION

2501 S.W. FIRST AVENUE, SUITE 200, PORTLAND, OREGON 97201
PHONE (503) 326-7025 FAX (503) 326-7033

EXECUTIVE DIRECTOR
GUY N. THORNBURGH

April 2, 1991

Mr. James Goller
Chairman
Northwest Power Planning Council
Statehouse Mail
450 West State
Boise, Idaho 83720

Dear Mr. Goller:

The Committee on Anadromous Fish Marking and Tagging (i.e. the "Mark Committee") has followed events of the Northwest Salmon Summit with considerable interest. The Mark Committee is comprised of tagging and fin marking coordinators representing all federal, state, Indian, and private entities on the west coast, including Canada Department of Fisheries and Oceans, and British Columbia Fish and Wildlife. The Mark Committee has served for several decades as the vehicle for establishing and maintaining regional agreements in fin marking and coded wire tagging.

We understand there has been some informal discussion of a proposal to adipose fin clip all hatchery reared chinook in the upper Columbia River basin. The apparent objective of such a program appears to be to visibly differentiate hatchery fish from wild/natural fish. Unfortunately, such a program would also have far-reaching consequences for all tagging agencies coastwide.

Foremost among the regional agreements on fish marking is that the adipose fin clip on all salmon species is reserved exclusively as a flag for the presence of a coded wire tag (CWT). While there are some minor exceptions involving multiple fin marks for chum, sockeye and pink salmon, current regional agreements require that all chinook and coho salmon be tagged if the adipose fin is clipped. This agreement for chinook and coho has been in place since the early 1970's and is adhered to by all tagging agencies. Steelhead are a major exception, with the adipose fin de-sequestered and now used as a flag to indicate hatchery fish in the Columbia River basin. This latter usage has not been a major problem for sampling since there is no coastwide ocean sampling program for steelhead.

The proposal to adipose clip all hatchery chinook production in the upper Columbia River basin was discussed at some length during the recent "Mark Meeting" (February 19, 1991; Seattle). While fully recognizing the need to protect and enhance wild production in the upper Columbia River basin, the overriding concern of the Mark Committee was that the proposed use of the

adipose clip without a CWT could jeopardize the massive coastwide coded wire tag program. To give some sense of scale, over 50 agencies annually release approximately 42 million juvenile salmon and steelhead marked with the adipose clip and a coded wire tag. Of these, approximately 70% are chinook and 25% are coho. Annual costs for tagging, sampling, tag recovery, and data processing are in excess of 10 million dollars.

It must be emphasized that the CWT is much more than a research tool. It is the basic information unit for salmon management and evaluation. The information obtained from CWT recoveries is used as the basis for stock assessment, harvest management, hatchery evaluation, and U.S. - Canada negotiations regarding stock interceptions. With respect to the latter, the U.S./Canada Salmon Treaty's Memorandum of Understanding specifies that "The Parties agree to maintain a coded-wire tagging and recapture program designed to provide statistically reliable data for stock assessments and fishery evaluations."

Tag recovery agencies sample at least 20% of the catch to obtain statistically reliable data on tag recoveries. Each adipose marked salmon sampled is measured and the head then removed for later tag recovery. Since a sampler can not be certain if an adiposed clipped fish is tagged, all adiposed clipped fish would have to be examined and have the snout removed for later processing.

If all upper Columbia River hatchery chinook were to be adipose clipped, an additional 15-20 million fish could be released with the mark. This would add a tremendous work load to the coastwide sampling program. The net effect would be greatly reduced efficiency in sampling for tagged fish, and greatly increased manpower requirements to handle the extra flood of adipose marked fish. This would be particularly true for sampling programs in the lower Columbia River.

A similar impact can be expected in the agencies' recovery labs. Tag recovery personnel spend far more time verifying the absence of a tag in a sample than where one exists. Tag recovery costs will increase dramatically if large numbers of adiposed clipped but untagged heads are sampled.

Lastly, the statistical analyses in use since the mid 1970's would likely be affected for areas in which large numbers of adipose only fish are encountered in the catch. The "Mark Rate" is one useful statistic that would be lost in such situations. Samplers would also have to resort to subsampling in many cases. Subsampling adds a new second level of variability to the sampling and estimation process, and in effect, increases the chance of errors in any decision process. In addition, some analyses require a theshold level of tag recoveries that must be attained. As a result, subsampling can eliminate tagcodes as valid for analyses because of the dilution effect.

In summary, the Mark Committee recognizes the complex biological, political and social problems associated with the potential listing of certain Columbia River salmonid stocks as endangered species. However, the entire Pacific Northwest salmon and steelhead populations become united and mixed in a single universe in the ocean. The Mark Committee therefore requests that before any fish marking actions sponsored by the Northwest Power Planning Council are put into practice, the Council would seek an opportunity to discuss the potential coastwide impacts and develop a workable solution. The Mark Committee stands ready to work with the Council in this regard.

Sincerely,

J. Kenneth Johnson

J. Kenneth Johnson, Ph.D.
Regional Mark Coordinator
Regional Mark Processing Center

cc: Rollie Schmitten, NMFS
Charles Walters, NMFS
Merrit Tuttle, NMFS
Jack Donaldson, CBFWA
Ian Todd, PSC
Joseph Blum, WDF
Pat Chamut, CDFO
Rick Applegate, NPPC
John Palensky, BPA
Al Wright, PNUCC
Mark Committee
Technical Committee on Data Sharing, PSC

PROJECTED 1991 STATE OF ALASKA & PNP PROGRAM
CODED WIRE TAG RELEASES BY REGION AND SPECIES
(in millions)

REGION	RELEASE YEAR	CHINOOK	CHUM	COHO	PINK	SOCKEYE	STEELHEAD	TOTAL
SOUTHEAST	1990	1.20	0.75	0.74	0.19	0.21	0.01	3.10
	1991	1.22	0.77	0.76	0.30	0.23	0.03	3.31
SOUTHCENTRAL	1990	0.22	0.31	0.39	1.27	0.27	0.02	2.48
	1991	0.25	0.33	0.43	1.34	0.30	0.02	2.67
TOTAL	1990	1.42	1.06	1.13	1.46	0.48	0.03	5.58
	1991	1.47	1.10	1.19	1.64	0.53	0.05	5.98

ATTACHMENT 8

2/17/91

TAMGAS CREEK HATCHERY

FY 90 C.W.T. RELEASES

Species	Broodyear	Number Tagged
Chinook	1988	111,800
Coho	1988	336,500
Chum	1989	47,500
	Totals>>>	495,800

FY-91 MARKING PROGRAM

Species	Broodyear	Marked	Unmarked	Total	Percent Marked
Chinook	1989	100,000	572,000	672,000	14.8
Chinook (0)	1990	100,000	500,000	600,000	16.7
Coho (RP)	1989	150,000	1,150,000	1,300,000	11.5
Coho (ARP)	1989	200,000	1,900,000	2,100,000	9.5
Coho (TL)	1990	200,000	2,300,000	2,500,000	8.0
Chum	1990	60,000	1,440,000	1,500,000	4.0
	Totals>>>	810,000	7,862,000	8,672,000	9.3

BRITISH COLUMBIA: CWT TAG RELEASES (MILLIONS)

		CHINOOK	COHO	STEELHEAD	CHUM	SOCKEYE	TOTAL
CDFO	1990	7.23	2.16	-	.69	.16	10.25
PLANNED	1991	8.10	2.90	-	.53	.20	11.73
CDFR	1990	.002	.181	-	-	.06	.193
PLANNED	1991	.157	.14	-	-	.06	.295
BCFW	1990	-	-	.38	-	-	.38
PLANNED	1991	-	-	.01	-	-	.01
TOTAL	1990	7.25	2.35	.38	-	.22	10.89
PLANNED	1991	8.15	3.04	.01	-	.26	11.99

WDF CODED WIRE TAG RELEASES FOR 1990 AND 1991*
BY REGION AND SPECIES IN MILLIONS

Region	Year	Chinook	Coho	Total
Columbia River	1990	3.0	0.7	3.7
	1991	4.6	0.7	5.3
Coastal	1990	0.5	0.7	1.2
	1991	0.4	0.7	1.1
Puget Sound	1990	2.0	0.9	2.9
	1991	2.1	0.8	2.9
TOTAL	1990	5.5	2.3	7.8
	1991	7.1	2.2	9.3

*Projected releases

WDF Feb. 1991

Table 1. Washington Department of Wildlife's 1991 and projected 1992 Releases of Steelhead with Coded-Wire Tags by Region

Region	Year 1991	1992
Columbia Basin	310000	410000
Western WA.	0	0
Total:	310000	410000

Table 2. Washington Department of Wildlife's 1991 and projected 1992 Releases of Steelhead with Coded-Wire Tags by Site

Area	Year 1991	1992	Status
Columbia Basin			
Similkameen & Wells	70000	30000	Funded(BOR/BPA)
Wenatchee(East Bank Hatchery Evaluation)		50000	Tentative
Ringold Evaluation		120000	Tentative
Yakima/Klickitat-NWPPC	240000	240000	Funded(USFWS/BPA)
Lower Snake Comp. Plan	20000	20000	Funded(PP&L)
Big White Salmon		30000	Planned
Washougal		20000	Planned
Cowlitz			
Subtotal:	330000	510000	
Western WA.			
Boldt Case Area and/or Independent Drainages to use coded-wire tags.	: No current plans		
Total:	330000	510000	

PROJECTED 1991 ODFW CODED
WIRE TAG RELEASES BY REGION
AND SPECIES (millions)
12-Feb-91

Region	Status	Year	Chinook	Coho	Steelhead	Total
Columbia R.	Tagged	1990	2.95	0.90	0.39	4.24
	Requested	1991	3.60	0.91	0.33	4.84
Coastal R.	Tagged	1990	1.10	0.69	0.00	1.79
	Requested	1991	1.01	0.66	0.00	1.67
TOTAL	Tagged	1990	4.05	1.59	0.39	6.03
	Requested	1991	4.61	1.57	0.33	6.51

Northwest Indian Fisheries Commission

6730 Martin Way E., Olympia, WA 98506 Phone (206) 438-1180 FAX #456-3032 FTS #434-9476

PROJECTED 1991 TRIBAL CODED WIRE TAG RELEASES
FOR WESTERN WASHINGTON

	Chinook	Coho	Steelhead	Total
1990:	2,200,000	600,000	175,000	2,975,000
1991:	2,200,000	630,000	150,000	2,980,000

IDAHO DEPARTMENT OF FISH AND GAME
Tagging Plans for 1991 Outmigration

Species	Hatchery	Number CWT	Number PIT Tag
A Steelhead	Hagerman	107,100	1,000
	Magic Valley	68,500	1,600
	Niagra Springs	207,200	1,000
	Total A Steelhead	382,800	3,600
B Steelhead	Hagerman	71,100	500
	Magic Valley	136,500	1,500
	Dworshak	147,000	3,000
	Total B Steelhead	354,600	5,000
Spring Chinook	Crooked River	66,200[a]	800
	Powell	64,900[a]	800
	Red River	64,700[a]	800
	Sawtooth	362,900[b]	13,400
	Dworshak	700,100	600
	Rapid River	322,000	
	Total Spring Chinook	1,580,800	16,400
Summer Chinook	McCall	325,000	400
	Total Summer Chinook	325,000	400

[a] New releases in 1991.
[b] 1991 release is approximately 60,000 greater than 1990 release.

PROJECTED 1991 USFWS CODED WIRE TAG RELEASES

by

REGION AND SPECIES (millions)

Region	Year	Chinook	Coho	Steelhead	Total
Columbia River	1990	2.92	0.09	0.30	3.31
	1991	2.95	0.05	0.33	3.33
Puget Sound/WA Coast	1990	0.45	0.22	0.07	0.74
	1991	0.70	0.15	0.09	0.94
California	1990	0.25	-	0.03	0.28
	1991	0.30	-	-	0.30
Total	1990	3.62	0.31	0.40	4.33
	1991	3.95	0.20	0.42	4.57

PROJECTED 1991 CDFG CWT RELEASES (x 1000)
BY REGION AND SPECIES

Region		Chinook	Coho	Total
Klamath R Basin	1990	?	?	?
	1991	750	100	850
Central Valley	1990	?	?	?
	1991	1,000	0	1,000
Totals	1990	?	?	3,350
	1991	1,750	100	1,850

PROJECTED 1991 NMFS ALASKA CODED WIRE TAG RELEASES BY SPECIES

SPECIES	N
Chinook	300,000
Sockeye	100,000
Total	400,000

PROJECTED 1991 NMFS CODED WIRE TAG RELEASES COLUMBIA RIVER

	Spring Chinook	Fall Chinook	Sockeye	Steelhead	Total
1990	170,000	1,890,000	89,000	72,000	2,221,000
1991	325,000	0	93,000	72,000	490,000

PROGRESS OF LANTHANIDE MASS MARKING STUDY

Introduction

Tagging programs allow the collection of important information which can be used to evaluate the overall success of hatchery-production salmon. The development of a tagging method which could greatly increase the numbers marked and, at the same time, eliminate handling, would be a great asset to fisheries management.

Chemical Markers offer such an alternative to the labour-intensive mechanical tagging. These markers would enable hatchery staff to identify entire groups of fry for release. The lanthanides appear to be suitable for this purpose since they demonstrate the characteristics of good elemental markers. With this method marked fish are identified by analysis of bony tissues by inductively coupled plasma-mass spectrometry (ICP-MS) which is capable of measuring the atomic weights of elements in a sample at concentrations as low as micrograms/litre.

Advantages of Lanthanide Elements for Marking Salmon

(i) small amounts of element in the water supply marks large groups;
(ii) the lanthanides are bone-seeking, therefore vertebrae, otoliths and scales can be used as samples;
(iii) La^{3+} ions are taken across the gills via a similar mechanism to Ca^{2+} ions;
(iv) markers are relatively inexpensive;
(v) there are 15 lanthanide elements, thus a theoretically large number of combinations is possible;
(vi) the elements are not found in fresh water or salt water; and
(vii) they are not toxic to humans; no harmful effects have been reported in fish.

Table 1. Relative abundances of naturally occurring isotopes.

Lanthanide	At.Wt.	% Abund.	Lanthanide	At.Wt.	% Abund.
Lanthanum	138	0.09	Samarium	147	14.97
	139	99.91		148	11.24
Cerium	140	88.48		149	13.83
	142	11.07		152	26.74
				154	22.71

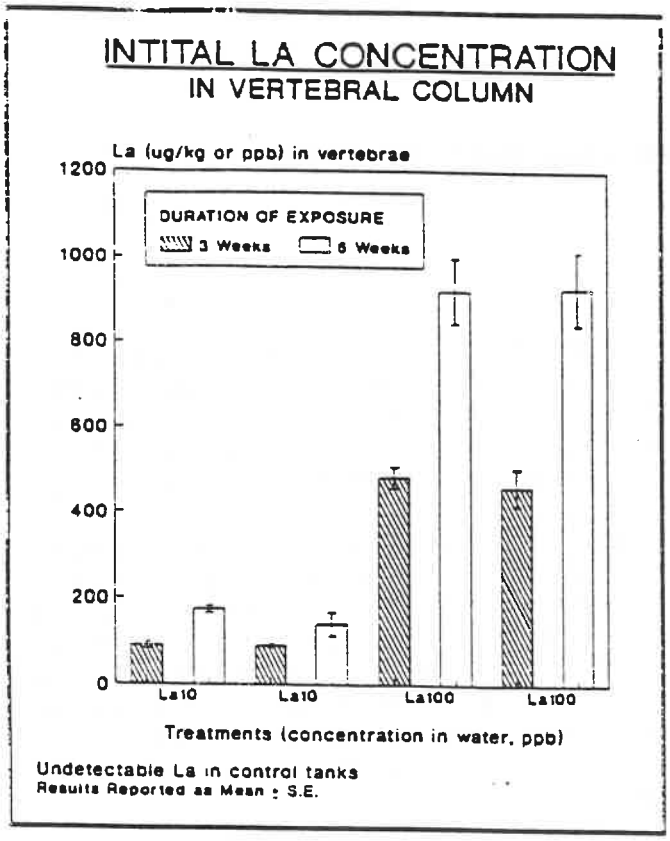

Figure 1

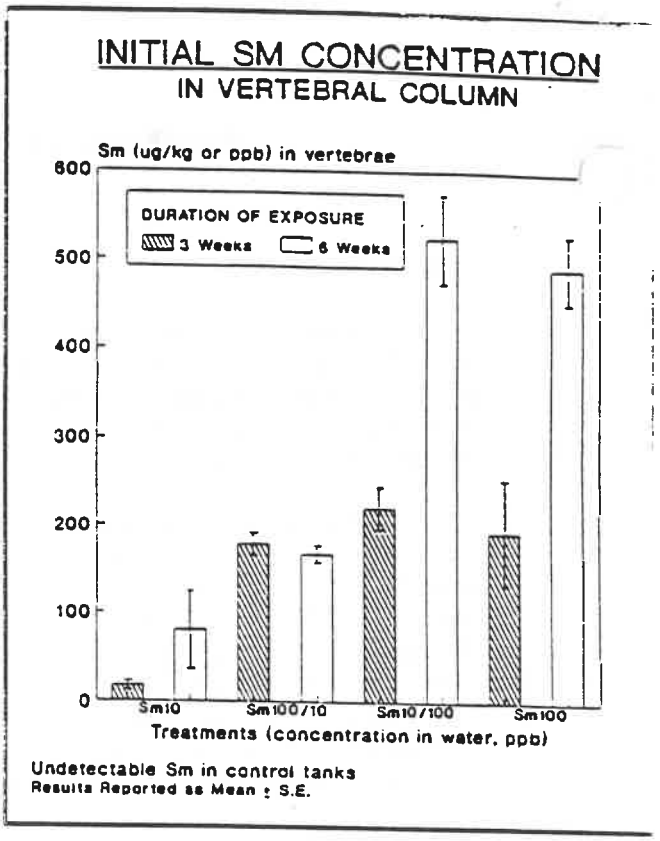

Figure 2

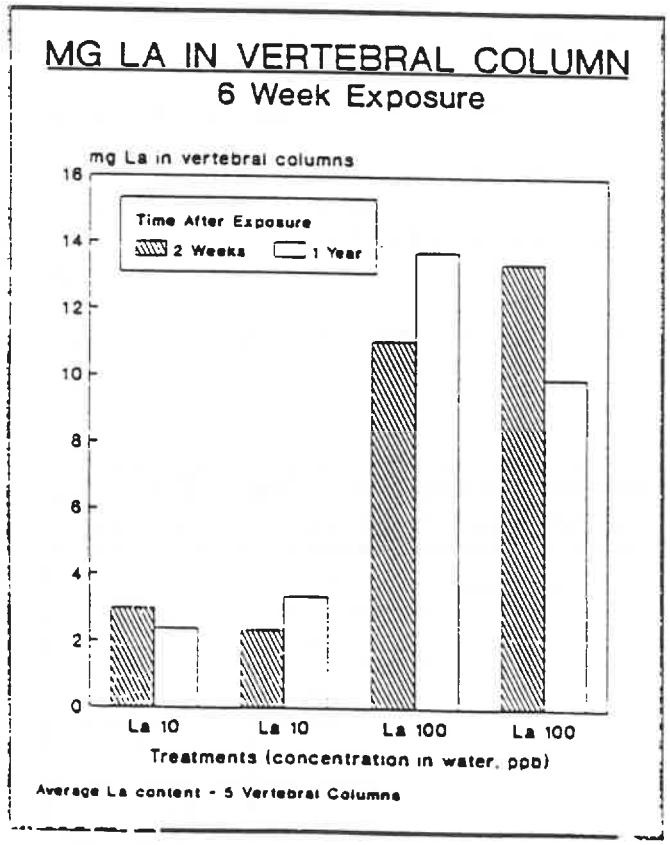

Figure 3

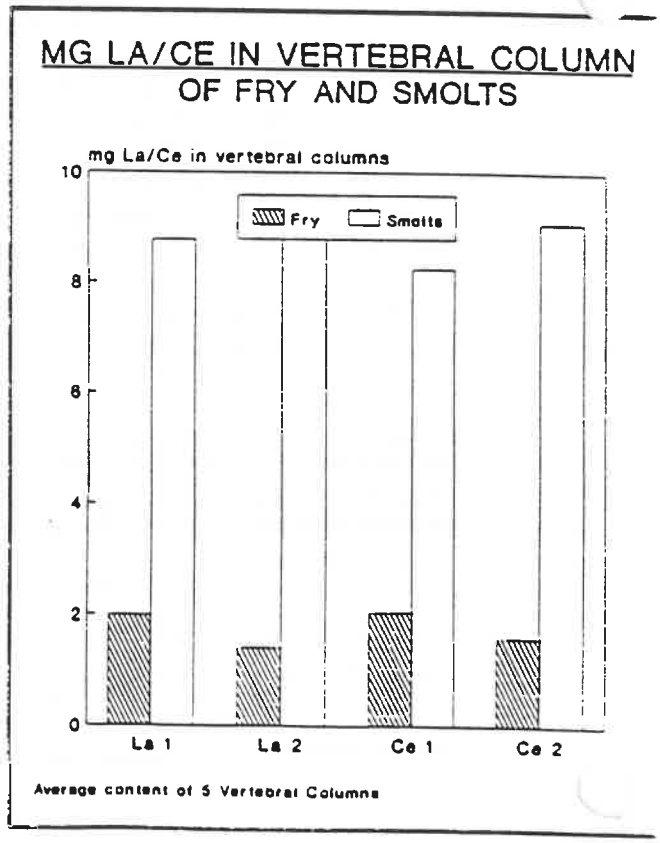

Figure 4

Conclusions

(i) Lanthanide elements introduced into the water supply are taken up and subsequently incorporated into the bony tissues of coho salmon;
(ii) uptake and retention of elements increases as concentration and duration of exposure increases;
(iii) amount of element incorporated into vertebral column remains constant for at least 1 year - the element is not being metabolized out of the tissue;
(iv) lanthanide is deposited in vertebral columns, otoliths and scales;
(v) larger fish (smolts) incorporate more element than fry;
(vi) sensitivity of ICP-MS varies for the different lanthanides; and
(vii) lanthanide elements can be safely and effectively used to mark fish.

WDF Study: Comparison of Mortality of Tagged and Untagged Fish
(Preliminary Results) - Lee Blankenship

At Cowlitz Hatchery we have monitored the daily mortality of both the coded-wire tagged (CWT) and untagged populations of the spring chinook being reared for yearling release. The size of the population at the time of tagging (April 6-26, 1990) was 1,271,800 (847,860 untagged and 423,940 tagged). We are fairly confident that most of the mortalities are being observed (at least 90%) since they are being picked every day and Cowlitz Hatchery has net protection to avoid bird predation.

Cowlitz Hatchery is the only hatchery of the three in this study with netting and is why we chose that hatchery to monitor and report the results. The monthly mortalities are graphed and can be seen on Figure 1. The mortality thus far (seven months) for the total population has been about one percent. Of the one percent that has died, there has been a 27 percent higher mortality among the CWT fish than you would expect from the tagged/untagged ratio at the time of tagging. However, since only about one percent of the total population has died, the differential mortality of the CWT fish compared to the untagged is only .3 percent after seven months. As expected, and can be seen in Figure 1 there was a significant difference in mortality between the tagged and untagged populations within a couple weeks of tagging.

After the initial differential mortality however, the mortality has continued to be very slightly higher. It is also interesting to note that in August when the population became sick and were subsequently treated with medication that the differential mortality increased. This differential mortality observed when a "stress test" occurred happened only 2-3 months after tagging. It would be interesting to see if the same differential mortality occurred now that 7-8 months has transpired.

MORTALITY: TAGGED VS UNTAGGED