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

1990 Mark Meeting

Final Minutes

Portland, Oregon **February 21, 1990**

PRELIMINARY BUSINESS

Committee members and other meeting participants introduced themselves at the start of the meeting (9 AM). A list of attendees is provided in **Attachment 1.**

Two new committee members and one alternate representative were present:

Richard Dixon (CDFG) - replacing Alan Baracco
Robert Z. Smith (NMFS-Col. River) - replacing Bob Vreeland
Don Bailey (CDFO) - substituting for Bryon Ludwig (BCFB)

Several members of the Pacific Salmon Commission's Data Sharing Committee and/or Working Group on Data Standards were also in attendance and welcomed:

Louis Lapi (CDFO) - Data Sharing (Co-chair) & Data Standards
Marc Hamer (CDFO) - Data Sharing & Data Standards (Co-chair)
Norma Jean Sands (ADFG) - Data Sharing (Co-chair)
Don Bevan (UW) - Data Sharing
Dick O'Connor (WDF) - Data Standards
Mike Matylewich (CRITFC) - Data Sharing

NOTE: Mark Committee members in attendance who also serve on one or both of the above PSC Committees included:

Margaret Birch (CDFO)
Charlie Corrarino (ODFW)
Ken Johnson (PSMFC)
Ron Olson (NWIFC)

AGENDA ITEMS

1. **Status of CWT Data Files**

   A. **Old Format (PSMFC) Recovery Data**

   The status of 1989 CWT recovery data sets currently residing on the Mark Center's computer in old format (PSMFC) was reviewed. Only California's and Oregon's 1989 data sets (incomplete) have been reported in old format and are available on-line. British Columbia, Washington, and Alaska's 1989 recovery data sets were reported only in the new PSC format since their respective software conversion efforts essentially have reached the point of "no return" to the old format. Consequently, tag coordinators were advised that on-line access to the 1989 recovery data should only be attempted using the Mark Center's new PSC based on-line data retrieval system.

B. PSC Formatted Data Sets

Considerable concern has been growing amongst the various agencies about the length of time that has already transpired without achieving a complete conversion of all CWT data files (release, recovery, and catch/sample) into the new PSC format. Therefore each agency's progress to date was reviewed in some detail. This information is summarized in **Tables 1-4** (updated through March 23, 1990).

1) CWT Release Data

Conversion of the CWT release data is the most complete, with only IDFG and NMFS (Columbia River) incomplete for years prior to 1988 (**Table 1**). Releasing agencies in Washington (WDF, WDW, NWIFC and member tribes, QDNR, and USFWS) also lack release data for years prior to 1980. These latter data are being coordinated and reported through WDF, and are expected to be available in April. NMFS (Columbia River) is also working hard on completing the conversion of their release data and expects to complete the task this spring. IDFG has had major problems with changing staff but hopes to report all Idaho tag releases by this summer.

2) Recovery and Catch/Sample Data

Progress in converting historical recovery and catch/sample data to the new format (**Tables 2-3**) has been good on the whole. However, numerous "holes" still exist as recovery agencies have encountered various challenges and obstacles in their respective conversion efforts.

To date, only Oregon, British Columbia, and the USFWS have successfully converted and reported all years of available recovery and catch/sample data (**Tables 2-3**). ADFG is fairly close behind in having their 1980-1989 data reported and validated. WDF has also made substantial progress, with years 1984 through 1989 now reported and validated.

With respect to future time tables, Richard Dixon (CDFG) reported that California expects to complete the conversion of their 1977-1987 recovery and catch/sample data during the 1990 calendar year. Tim Cochnaeur (IDFG) again emphasized staffing problems for Idaho, but noted that recovery data for 1983-1989 was largely ready now and should be reported by the end of this summer.

Dick O'Connor (WDF) reported that Washington's time table for completing 1987-1988 recoveries and catch/sample data was mid-April. The 1984-86 data will then be re-processed, with July as the goal. Plans then call for the 1981-1983 data to be converted and reported by October-November, 1990. Data for 1975-1980 likely will be delayed until 1991.

WDW's steelhead tag recoveries in the main stem Columbia River have been reported through ODFW. However, recoveries in the Columbia River tributaries and those in the Snake River are unreported for 1981-1989. Charles Morrill (WDW) noted that work on these latter recoveries would resume by mid-summer, and hopefully would be completed by the end of 1990.

TABLE 1. Status of Conversion to PSC Format 1.2

CWT Release Data

(3/23/90)

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

(S = Submitted; I = Incomplete but Validated Data Sets; V = Validated)
(Dash = Not Yet Reported in Format 1.2)

Note: WDF is coordinating the reporting of 1975-1979 releases for WDW, FWS, NWIFC, and QDNR in Washington.

ADFG's recovery and catch/sample data for 1977-1979 are not expected to be available soon as there are unresolved problems with the data for these years. Hence the data have not been reported coastwide. Karen Crandall (ADFG) noted that November likely would be the earliest that work can resume on the files. Ron Heintz (NMFS-AK) reported a similar problem for NMFS recoveries in Southeast Alaska in that conversion work was being delayed because of under-staffing for the project. He was hopeful that the data could be converted during this calendar year.

The NMFS-Col. River recovery data for 1977-1983 noted in **Table 2** represent tag recoveries made in out-migrant juveniles captured in the lower Columbia River. No time frame is available for when these data will be converted to the PSC format. Apparently there are also some unreported adult recoveries in the upper Columbia River system that are stored on the NMFS computer in Pasco, Washington. However, the scope of the data was unclear. Dick O'Connor (WDF) believed that the recoveries were part of sampling programs by the Public Utility Districts. An effort will be made to clarify the problem.

The Northwest Indian Fisheries Commission has been working with its member tribes for many months to collect hatchery and spawning return recovery data. While no data have been reported to date, Ron Olson (NWIFC) projected that the task will be completed by mid year.

Tag recovery and catch/sample data for the Quinault Indian Nation's recovery programs are currently backlogged as data only through 1986 have been reported in old PMFC format. No data have been reported in the new format. Part of the backlog problem has resulted from staff turnover in the past few years. No firm goal is available yet for when these data will be reported. However, Larry Lestelle (QDNR) noted in a phone call prior to the Mark Meeting that they may contract out the project in order to expedite its completion.

The Metlakatla Indian Nation in Southeast Alaska has reported all tag recoveries sampled in its fisheries for 1982-1989 through ADFG. However, David Houseworth noted that hatchery recoveries for the same period have not been reported in either old or new format. No time table was given on when this latter task can be accomplished.

3) <u>Unmarked Hatchery Production Releases</u>

One of the requirements of the U.S.-Canada Salmon Treaty is the exchange of unmarked hatchery production data for all salmonid species. These releases are not part of any CWT marking program.

Progress towards this goal has been limited at best (**Table 4**). To date, only CDFO has provided all unmarked production data for years 1975-1988. ODFW has also provided comparable information for years 1982-1989. However, ODFW's production release data are currently unavailable for years prior to 1982 and likely can not be collected without a major effort.

TABLE 2. Status of Conversion to PSC Format 1.2

CWT Recovery Data

(3/23/90)

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

(I = Incomplete but Validated Data Sets; V = Validated)
(Dash = Not Yet Reported in Format 1.2)

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 1.2

CWT Catch/Sample Data

(3/23/90)

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

(I = Incomplete but Validated Data Sets; V = Validated)
(Dash = Not Yet Reported in Format 1.2)

TABLE 4. Status of Conversion to PSC Format 1.2
Unmarked Hatchery Production Releases
(3/23/90)

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	-	-	-
1982	-	V	-	-	-	V	-	I	NA	-	-	-
1983	-	V	-	-	-	V	-	I	NA	-	-	-
1984	-	V	-	-	-	V	-	I	NA	-	-	-
1985	-	V	-	-	-	V	-	I	NA	-	-	-
1986	-	V	-	-	-	V	-	I	NA	-	-	-
1987	-	V	-	-	-	V	-	I	NA	-	-	-
1988	-	I	-	-	-	V	-	I	NA	-	-	-
1989	-	-	-	-	-	I	-	I	V	S	-	-

(U = Unavailable; I = Incomplete but validated Data Sets; V = Validated)
(NA = Not Applicable; Dash = Not Yet Reported in Format 1.2)

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

The USFWS is the only other U.S. agency that has reported some of its unmarked production releases. Data available to date include releases in California and Oregon for 1975-1979.

C. Concerns and Recommendations

Following the lengthy discussion of the status of each agency's data, **attention again focused on concerns that this conversion effort be accomplished as quickly as possible.** Both ADFG and CDFO, for example, are currently experiencing major problems in data management and report generation because the CWT release file is still incomplete for non-agency tag codes.

This has also been a major problem for the Mark Center in trying to maintain two sets of files in old and new format. Since most agencies can no longer report in both formats, it means that both the old format and new format data sets are incomplete. Consequently, it has become very difficult to provide complete data for many normally simple data requests.

Dick O'Connor (WDF) noted that he personally has little control over accelerating the rate of WDF's data submissions because of budget constraints and other existing staff duties. However, he suggested that priorities could possibly be changed if upper management was informed of the situation and asked for their help.

The Mark Committee readily endorsed this suggestion and decided to extend it to include all agencies which still have major backlogs in data conversion. It was also agreed that the PSC Data Sharing Committee should be encouraged to also write to agency directors in order to further stress the importance of the data conversion effort.

ACTION:

The Mark Coordinator was instructed to write to the appropriate agency directors and seek their assistance in accelerating the conversion of their agency's respective CWT data sets into PSC format. The letters are to be individualized in order to address specific needs for each agency. A letter is to be also forwarded to PSC Data Sharing Committee encouraging them to write similar letters to agency directors in order to further underscore the importance of completing the data conversion task as quickly as possible.

2. Status of RMPC Operations

A. Software Development

Jim Longwill (PSMFC) reviewed the Mark Center's progress to date in implementing the new PSC formatted database. Error checking and validation programs have been operational for quite sometime for data submitted in PSC Format 1.2.

An on-line data retrieved system is now functional as well, and provides to the new systems the same basic types of reports now available on the "old" system. A "Users Guide" was distributed to meeting participants and reviewed to highlight differences between the old system.

One feature not yet operable on the new system is the capability to select tagcode releases or recoveries based on values contained in a number of key fields. This "keyword" query option, unfortunately, is not presently available because of limitations imposed by the computer's operating system. Work is proceeding on finding a satisfactory solution to this latter problem.

B. Funding Shortfall for FY1990

Ken Johnson (PSMFC) informed the Mark Committee that a funding proposal for $55,000 had been approved by the U.S. Pacific Salmon Commission's Budget Committee for FY1990. Unfortunately, the line item was subsequently deleted from the overall budget during final budget work in Washington, D.C. This unexpected development left the Mark Center facing a critical shortfall of funding for maintaining normal operations in 1990. Therefore, PSMFC must again seek contributions of $6,000 from each of the major tagging agencies. Tag coordinators were advised that the letters to their respective agencies would soon be in the mail.

Note: Bob Smith (NMFS - Col.R.) took the initiative to call the appropriate people in his agency during a break in the meeting and was successful in obtaining a funding commitment of $6,000 for the Mark Center. Needless to say, this support and Bob's efforts are deeply appreciated!

C. Peripheral Developments Impacting the Mark Center

1) PIT Tag Information System

Ken Johnson also noted that recent developments with the PIT Tag program in the Columbia Basin will soon have a positive impact on operations of the Regional Mark Center. In April, 1989, NMFS announced their intention to phase out of their leadership role with the PIT Tag program. Therefore, in order to ensure continuity, the member fishery agencies and tribes of the Columbia Basin Fish and Wildlife Authority (CBFWA) agreed that a single information system (PTAGIS) was needed to perform all PIT Tag related activities. This information center will be housed at the PSMFC office in Portland, Oregon, and will utilize PSMFC's data center facilities.

This expanding work load necessitates that PSMFC's MicroVAX II be upgraded. Therefore plans are underway to install a MicroVAX 3800 computer. The upgrade will provide substantial improvement in computing power (4X) and will thus benefit both CWT data users and PIT tag data users.

2) Installation of Relational Database Management System

Alaska Department of Fish and Game (ADFG) and PSMFC recently worked out an arrangement to have "INGRES", a relational database management system, installed on PSMFC's MicroVAX II computer. A Portland - based contract programmer was then hired to merge five separate but related fishery databases into a single relational database using INGRES.

The direct benefit to PSMFC's data center is that INGRES will also be used to develop the new PIT Tag information system. Furthermore, the

availability of INGRES now affords the Mark Center a great opportunity to convert the entire CWT database into a unified relational database that will greatly enhance data retrieval by users. This option, however, will depend entirely on being able to obtain the necessary funding in the future for the programming.

The question was then raised as to the coastwide use of INGRES besides ADFG and PSMFC. In response, Ken Johnson noted that CDFO's headquarters and the Pacific Salmon Commission in Vancouver both have INGRES installed on their computers. Dick O'Connor (WDF) also noted that WDF is looking at INGRES for the future, and that the University of Washington has INGRES. He therefore encouraged other agencies to give serious consideration to adopting INGRES as a coastwide standard. Ron Olson also confirmed that NWIFC is likely to install INGRES in the near future. Dr. Don Bevan (UW) then raised the question as to whether anyone was looking at the big picture. He noted that NMFS (Seattle) is in the process of a computer upgrade and will soon be getting $1.7 million to address the first year. He therefore questioned how this new system might be linked with other systems such as the Mark Center's system. Ken Johnson responded that PSMFC was not involved in the NMFS's planning process but that it would definitely be looked in to.

3) **Report on PSC's Working Group on Data Standards**

Mark Committee members were brought up to date on PSC formats for CWT data exchange. Following the establishment for PSC Format Version 1.2 in 1988, the Working Group on Mark Recovery Databases was dissolved. During subsequent months, agencies found a number of shortcomings as they attempted to convert historical data into PSC Format 1.2. Therefore in April, 1989, the PSC Data Sharing Committee organized a new Working Group on Data Standards to resolve these data conversion problems, and in general, deal with other CWT related data issues as they arise in the future.

The Working Group on Data Standards met twice in 1989 and made a number of revisions and improvements to Format 1.2., resulting in Format Version 2.0. These changes (**Attachment 2**) were reviewed for the Mark Committee. However, it was noted that a few more minor additions to Format 2.0 might still be necessary, depending on how the Committee elected to handle the issue of sequential tags later in this meeting.

Following some discussion, the Mark Committee approved the recommended additions to Format 1.2, resulting in Format 2.0 (**Attachment 2**). However, several members voiced strong concern that PSC Formats not be changed frequently because of the major impact on all agencies coastwide.

ACTION:

The Mark Committee approved Format Version 2.0, with the understanding that a few more changes might be still made before it is finalized. The Committee also requested that the Working Group on Data Standards not change formats more frequently than once a year.

4. **Improving Communication and Coordination between the Mark Committee and PSC Committees.**

A lively discussion was held on why confusion and friction has occasionally occurred between the Mark Committee and the PSC Committees involved with CWT issues. Mark Committee members pointed out to PSC Committee Members, for example, that several decisions had been made at the 1989 Mark Meeting that in turn had been rejected or over-ruled by either Data Sharing or Data Standards. This included the decision to add "Funding Agency" to the new PSC formatted release database, and the decision to treat all recoveries of re-used tag codes as "Status 7's" (i.e. unresolved discrepancies). Furthermore, some concern and frustration was expressed at having little to no input into the new PSC formats, and yet being expected to fully support the new standards and the necessary data conversions. California's absence from PSC Committees was cited as a prime example.

In response, Louis Lapi (CDFO; Co-chair Data Sharing) provided an overview of the Data Sharing Committee's responsibilities. He noted that the committee reports to PSC's Research and Statistics Committee (comprised of commissioners and technical committee chairs) and is charged with meeting the data needs of the various PSC Committees.

The U.S./Canada Salmon Treaty calls for a sharing of fishery resources, and hence sharing of data on those resources. One of Data Sharing's major responsibilities, therefore, has been to develop standard formats for coastwide exchange of CWT information. This task was carried out by the Working Group on Mark Recovery Databases (now Data Standards) under direction of the Data Sharing Committee and resulted in PSC Format Version 1.2. A second Working Group on Mark Recovery Statistics is charged with developing standard methods for analyzing the data. In the future, a catch database and exchange format also will be developed under Data Sharing Committee's direction.

Marc Hamer (CDFO) noted that part of the problem is that the Working Group on Data Standards can only work within the explicit terms of reference (i.e. assigned duties) outlined by Data Sharing Committee. In brief, this is an exchange of needed CWT data in standard format between Canada and the United States. Hence some issues such as the addition of "Funding Agency" to the release data format fall outside of that required for exchange between Canada and the U.S.

As the discussion continued, it became clear that the real issue was that the spheres of responsibility had become blurred between the Mark Committee and the PSC Committees. Consequently misunderstandings, confusion, and occasional disagreements were inevitable unless the respective roles were more clearly defined.

The concept of placing the Mark Committee under PSC direction and perhaps combining it with Data Standards into a single committee was briefly considered. However, the idea was not pursued since the PSC "agenda" for tagging fish is considerable more restricted than that for the entire coastwide tagging community. A significant amount of tagging, for example, is done for non-PSC related purposes by most agencies.

Dick O'Connor (WDF) noted that for years the Mark Committee has effectively carried out regional coordination of all aspects of CWT usage. However, he further emphasized that the playing rules for U.S. agencies have now changed with the signing of the U.S./Canada Salmon Treaty. Any CWT issue now involves more people

and cannot be effectively coordinated without working with the PSC groups. The situation now is that the Mark Committee no longer has the full authority to designate data format changes.

Don Bailey (CDFO) also noted that the role of the Mark Committee has been evolving for a number of years. During the early and mid 70's, the focus was primarily on marking issues. This was followed by a focus on sampling concerns in the late 70's and early 80's. Today, the focus has shifted to emphasize data management needs.

Margaret Birch (CDFO), in turn, strongly emphasized that these on-going changes demonstrate the continued need for a coastwide forum where all tagging groups can be represented. Consequently she argued that the Mark Committee's role should continue to focus on policy issues as it has in the past rather than re-hash PSC Data Sharing issues. This position was unanimously agreed to. Louis Lapi (CDFO; Co-Chair Data Sharing) was also supportive of this position and noted that Data Sharing will only make recommendations on what the Mark Committee should do about policy issues. In turn, data management issues will be deferred to the PSC Committees since the Treaty dictates the need for data exchange between the two nations in standardized format.

It was also proposed and agreed to that the Mark Committee schedule its annual meeting back to back with a meeting of Data Sharing Committee. There was enthusiastic support for this proposal because of the positive exchange of information and improved communication experienced during this meeting. Future meetings may be held in cities other than Portland, depending on coordination with Data Sharing Committee.

ACTION:

Tag Coordinators and PSC Committee members jointly agreed that the Mark Committee's role will continue to be that of establishing coastwide policy for tagging issues. Matters of data management, in turn, will be the responsibility of the PSC Committees. Data formats, for example, will continue to be the responsibility of the Working Group on Data Standards.

Future meetings of the Mark Committee will be held each February back-to-back with a meeting of the Data Sharing Committee. Meeting sites may include cities other than Portland in the future.

5. Discussion on the Future of Embedded "Replicate" Tags

A. Recommendation to Discontinue Usage

As expected a very lively discussion was generated by the Working Group on Mark Recovery Statistics' proposal to discontinue usage of embedded "replicate" tags. Both pro and con position were strongly argued. In the end, however, neither side scored a decisive knockout and the issue was put on hold until next year's Mark Meeting at which time more information will be available to make the final decision.

Dick Ledgerwood (NMFS-Col.R.) led off the discussion with a brief presentation on NMFS's evaluation of embedded replicate information from the Bonneville Dam

Survival Study (**Attachment 3**). Over 18,000 tagged juveniles were recovered, with 72 tag codes represented. Each tag code had three replicate codes.

When the recoveries were analyzed, each of the three replicate codes accounted for 33% of the total recoveries. As a result, the replicates provided no gain in information. Variation seen between tag codes was attributed to "sampling error" only and was found to lead to false interpretation of experimental results. Ledgerwood also demonstrated that embedded replicates create an additional burden during the decoding process (See **Attachment 3**, page 2).

Lee Blankenship (WDF) noted that he initially thought that embedded replicate tags were a great idea when they were first introduced because it seemed to provide a standardized means of estimating variance. As additional information has become available, he now agrees that it can't be used as a variance estimator for fishery contributions. However, in an attempt to determine if there are other uses for the tags, he obtained two independent opinions with the assistance of NWMT from Dr. Loveday L. Conquest (UW) and Dr. Lars Mobrand. These two opinions were distributed at the meeting (**Attachments 4 and 5**) with the understanding that tag coordinators would review the opinions in more depth following the Mark Meeting.

Dr. Conquest (**Attachment 4**) found that embedded replicates (i.e. multiple codes repeated serially) were not an estimator for fisheries contribution. Rather the concept is very close to the statistical technique called "bootstrapping" and is simply a means of dividing the sample of fish into random subsamples. She notes further that since this method is done without replacement, one gets the same "grand estimate" back as if there were no embedded replicates when weighted estimates from the subsamples are combined.

Dr. Mobrand took a somewhat different approach to the question and argued that the usefulness of this type of replication depends on the experimental purpose, design, and assumptions (**Attachment 5**). He offered two hypothetical examples to illustrate situations where he felt it was appropriate (Example 1) and inappropriate (Example 2). Questions were raised, however, as to whether or not his first example was correct, thus casting doubts on his conclusion that there were some uses for embedded replicates.

Vic Palermo (CDFO) followed with a short presentation and argued that classical mathematics (and statistical theory) is inadequate to fully comprehend the "true" variability of dynamic biological systems. The new theory of chaos mathematics seems promising. He then cited an example provided by Dr. Peter Larkin wherein a single fish is measured 50 times on a rolling boat. A mean and the variance can then be calculated. However, the measurements represent only the variance of the system (i.e. measuring error) since the fish didn't change length.

Palermo then offered two basic rules: 1) Keep it very simple; and 2) Think very deeply about it. He also recommended two good books on dynamic systems: 1) "Does God Play Dice" by Ian Steward, and 2) "It's a Wonderful Life" by Stephen J. Gould. He concluded his remarks by stating that he wasn't arguing for or against embedded replicates, but rather that they shouldn't be thrown out until it is certain that they have no use to the tagging community.

Debate had to be curtailed at this time in the interest of time and tag coordinators were offered three options:

1) Endorse the recommendation of the Working Group on Mark Recovery Statistics and discontinue future use of embedded replicates.

2) Approve continued use of embedded replicates until the original studies are completed and evaluated fully.

3) Keep embedded replicates until the Working Group can develop an alternative means of obtaining variance estimates that can be standardized coastwide.

During the ensuing discussion, Mark Committee members were in full agreement that embedded replicate tags are **NOT** an estimator of variance for fishery contributions. However tag coordinators for CDFO, BCFB, WDF, and NMFS-Alaska were unwilling to discontinue usage immediately because of possible usefulness in other areas. Ron Heintz (NMFS-Alaska) also emphasized that they are experiencing 100% variation for replication and very interested in using embedded replicates as a means of analyzing these sampling errors.

Given this combined interest, the Mark Committee agreed to continue the use of embedded replicates for at least one more year (option 2 above). In addition, the Committee strongly endorsed Lee Blankenship's recommendation that the Working Group on Mark Recovery Statistics make as their top priority the development of a standardized means of estimating variance for tag recoveries and fishery contributions.

ACTION:

The Mark Committee approved continued use of embedded replicate tags for at least one more year. In addition, the Mark Coordinator is to write to PSC Data Sharing Committee and request that the Working Group on Mark Recovery Databases make on their highest priority the development of a variance estimator for fishery contributions.

B. Guidelines Needed for Use of Embedded "Replicate" Tags

Tag coordinators were advised of a situation in which an agency in Oregon released a large number of fish bearing embedded replicate tags. However, when these fish returned to the hatchery, workers only decoded and reported the standard tag code (i.e. Agency, Data 1, Data 2). Consequently, this negated the efforts of head labs up and down the coast which had gone to the extra effort and expense of decoding the entire code with the replicate number. As a result, the entire data set for these tag codes is rendered useless as far as the replicate information is concerned. Therefore, recognizing that embedded replicates will continue to be released at least one more year and that recoveries will continue for a number of years, it was proposed that all recovery agencies be required to fully decode and report all embedded replicate tags recovered. This recommendation was approved.

ACTION:

Tag coordinators of recovery agencies were instructed to make certain that all recoveries of embedded replicate tags be fully decoded and reported with the respective replicate numbers.

C. Possible Confusion over Decoding Convention

No changes were made to ADFG's reading convention rules for decoding "tough" embedded replicate tag recoveries.

6. Data Processing of Re-Used Tag Codes - Revisited

Tag recoveries for re-used tag codes have long been a vexing problem for data processing because of the inherent confusion and inability to assign all tag recoveries to the correct release group (*1, *2, etc.). During the 1989 Mark Meeting, the decision was made that all such recoveries should be reported without the *1, *2, etc. assigned and given a status of "7" (i.e. unresolved discrepancy). This decision was subsequently rejected by Data Sharing during their October, 1989 meeting since it effectively eliminated all such recoveries from Canada's historical data base. Accordingly this issue was again addressed by the Mark Committee with the benefit of input from attending members of Data Sharing Committee.

Louis Lapi (CDFO-Data Sharing) explained to the Mark Committee that the basic problem was that CDFO's Mark Recovery Program can not handle "partial" tag codes that do not exist in the release file. Therefore, if the *1, *2, etc. assignment is not made for recoveries of re-used tags, the tag code is seen as invalid. CDFO's only solution in this case is to blank out the tag code in the tag code field of the recovery record. Therefore, if this strategy was adopted, it would mean that Canada could not provide U.S. agencies with tag code information for recoveries of re-used tag codes.

After some discussion, the Mark Committee remained of the strong opinion that recoveries of re-used tags should not be assigned but treated as "Status 7's" (unresolved discrepancies). It also was acknowledged that some recovery data from Canada would be lost but it was a price the tag coordinators were willing to pay in order to eliminate the on-going problem.

Some concern was expressed that the first release of a re-used tag code should not be penalized for a subsequent re-use. The hope was that perhaps some way could be found to leave recoveries of the first release intact and only penalize the second study. Dr. Keith Jefferts (NWMT), however, pointed out that both studies or release groups become corrupted when a tag is used a second time. Hence there is little point in trying to salvage the first study.

ACTION:

The Mark Committee reaffirmed the policy that recoveries of re-used tags will no longer be assigned the *1, *2, etc. and will be labeled "Status 7" (unresolved discrepancies).

Implementation will apply to recoveries from 1990 onwards. This action will mean that Canadian recoveries of re-used tag codes will be reported with the tag code blanked out because of their inability to handle incomplete tag codes. American agencies, however, will report the tag code. In all cases, the recovered tag codes will be returned to the releasing agency.

The release file will continue to contain the *1, *2, etc. assignments for re-used tags in order to maintain an accurate record of tag releases.

7. Reporting of Unmarked Releases - Revisited

One of the requirements of the new PSC data formats is that unmarked, unrepresentative production also be reported. The Mark Committee addressed the issue in 1989 but did not adopt a standard reporting procedure because of concerns in coordinating reporting and the potential for double reporting. Rather, the tag coordinators were asked to be especially cognizant of the need for accurate data and to work closely with hatchery managers and other tag coordinators as needed.

Data Sharing Committee was advised of the position taken by the Mark Committee and asked for further guidance. The Committee's subsequent response (**Attachment 6**) and recommendations were therefore discussed during this year's Mark Meeting to be certain that there were no misunderstandings and that the Mark Committee would agree to the recommendations.

Louis Lapi (CDFO-Data Sharing) emphasized to the Mark Committee that the reporting of unmarked production data is very important to resource allocation decisions being made between Canada and the U.S. This includes the reporting of all salmonid species. As an example, he noted that Alaska has been increasing its hatchery production in recent years. In all fairness, Alaska should get credit for its hatchery "add-ons" when allocation decisions are being made between the two nations through the Pacific Salmon Commission.

One of the key recommendations of the Data Sharing Committee was that reporting problems could be avoided if the total number of unmarked releases per hatchery is reported only by the agency responsible for that hatchery. Lee Blankenship (WDF) agreed with this position and expressed his feeling that it was a clear cut issue. Further discussion revealed a consensus that the agency responsible for the hatchery is to be responsible for reporting, unless other arrangements have been worked out.

Dick O'Connor (WDF) voiced his opinion, however, that while he agreed that unmarked production is was important to report, he did not feel that the CWT database was necessarily the best way to do so. In Washington, unmarked production's maintained by the Salmon Culture Division while CWT data are maintained by the Planning and Research Division. As such, he noted that Lee Blankenship as CWT Coordinator doesn't really have jurisdiction for reporting Salmon Culture's production data. Hence the reporting issue can be quite complicated when more than one jurisdiction is involved within an agency.

ACTION:

The Mark Committee endorsed Data Sharing Committees' recommendation that reporting of total unmarked production be done only by the agency responsible for maintaining the hatchery, except in those cases when other arrangements have been made. Reporting is to included unmarked production releases for all salmonid species. Tag coordinators are to work closely with hatchery managers and other tag coordinators as needed to insure the integrity of the data.

8. Need for With-In State Standardization of Location Codes

One of the guidelines established by the Working Group on Data Standards was that all location codes within a state be standardized, and further, that the state agency (e.g: CDFG, ODFW, IDFG, WDF, CDFO, and ADFG) be responsible for establishing and maintaining these codes.

This recommendation was approved by the Mark Committee. The NMFS and USFWS programs in the Columbia Basin are impacted the most by this decision. However, Jerry Harmon (NMFS) and Tom Kane (USFWS) are actively working with WDF, ODFW, and IDFG tag coordinators to standardize the required location codes.

ACTION:

All location codes within a state are to be standardized, with the state agency (e.g: CDFG, ODFW, WDF, IDFG, CDFO, ADFG) responsible for establishing and maintaining the codes.

9. Proposed Changes in RMPC Publications

Ken Johnson (PSMFC) advised the Mark Committee that the Mark Center must continue to streamline operations because of more restricted funding. This year's budget was particularly "lean" because of the loss of the $55,000 in promised PSC funding. He noted that publications were one area in which economics could be made without a major impact on users.

Both the CWT Release Report and the Mark List have traditionally included all years of data from approximately 1970 to the time of annual publication (Note: The 1989 CWT Release Report was an exception since not all data were available in the new format--hence only 1989 data were published). Johnson argued that commulative type reports are a luxury today since few if any people ever need all years of release data in printed form.

It was therefore proposed that the 1990 CWT Release Report would be the final volume in which all release data are published (new format). Each year thereafter, the report would be limited to only the latest 7-8 years of tag code releases for tagged fish still in the ocean. Users will therefore need to save the 1990 cumulative release report for years prior to approximately 1982. Those with PC's could also opt to download release data on an annual basis and maintain the entire file if they wished.

A comparable proposal was made for limiting the Mark List to the last 7-8 years maximum. Only 20 copies were distributed this year, with no outcries of distress. Hence the report has a more limited benefit to marking agencies. The proposal would be implemented this year. Both of these proposals were accepted.

ACTION:

The Mark Committee approved plans to limit the CWT Release Report and Mark List to the latest 7-8 years of data. In each case, the 1990 report will be the last cumulative report containing all years of data.

10. Review of Regional Agreements

David Zajac (USFWS) noted a potential problem in that the regional agreements state that chum, pink and sockeye salmon do not require a CWT if they are adipose clipped in combination with another fin clip. Yet, in another section (III.A), the agreements state that recovery agencies no longer sample ocean fisheries for fin marks other than the adipose mark. This being true, it is therefore possible for agencies to mark and release large numbers of chum, pink, or sockeye with the adipose clip plus some other fin clip that in turn would be routinely sampled as adipose only marks since other fins aren't being checked. Carrying this one step further, such "recoveries" could have a major impact on the head labs as valuable time and labor would be wasted looking for non-existent tags.

Karen Crandall (ADFG) agreed that it could become a problem in the future. She noted that private non-profit groups in Alaska had been considering heavy use of the adipose plus another fin for marking these species. These plans have been dropped. However, she acknowledged that ADFG's samplers would not be looking for other fins during sampling. Thus the potential was there for large numbers of tag-less heads turning up at ADFG's head lab if such a marking program was instigated.

Other tag coordinators also recognized that this could be a potential problem. However, the general consensus was that there was a number of factors that discouraged heavy use of the adipose plus other fin clips on chum, pink, and sockeye salmon. One reason cited was that it is well known that double fin marks result in increased mortality. A second major reason is that chinook and coho are the only two species for which there is a true coastwide recovery program. Sampling for the other four species (chum, pink, sockeye and steelhead) is also widespread but spotty in many cases.

ACTION:

No action was taken. The general consensus of the Mark Committee was that the potential exists for sampling significant numbers of untagged chum, sockeye, or pink salmon marked with the adipose fin clip plus another fin clip. However, it wasn't considered a serious enough problem at this time to change the current wording of the regional agreements and perhaps also require a CWT in any chum, pink or sockeye that has an adipose clip in combination with another fin clip.

11. Update on 1989 High Seas Sampling Program

Ron Heintz (NMFS-AK) reported that a total of 214 CWT's and 209 adipose-only heads were recovered from chinook, coho, and steelhead taken in the high seas fisheries. The majority of the tags (194) were recovered in chinook sampled in the foreign joint venture hake fishery off the coast of Oregon and Washington (see **Attachment 7**). One of the reasons for this is that there were no observers in the Bering Sea and only sporadic coverage of domestic fisheries. In contrast, the joint venture fisheries had 100% coverage.

One new range extension was reported. A Quinault River steelhead was recovered 5,370 km from "home" at 163° 22' E 44° N.

Observer coverage in 1990 will be required on all domestic trawlers greater than 125 ft. in length, and on 30% of the trawlers in the 50-125 ft. class. (Note: Please refer to **Attachment 7** for Ron Heintz's complete report).

12. Agency Reporting on Tagging Plans for 1990.

As requested, each of the tag coordinators provided a summary table of projected tagging plans for 1990 and actual tags released in 1989 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 1990 total 49.2 million fish. This represents a 12% increase over 1989 when 43.8 million fish were tagged. Most agencies projected modest or little change from 1989 levels. The most notable exception is WDF which plans to increase tagging from 6.7 million in 1989 to 10.5 million in 1990. Nearly all of the increase will be chinook marked in the Columbia Basin. ADFG also projects to increase its tagging level substantially from 4.3 million in 1989 to 5.4 million in 1990. The NMFS (Col. River) is the only agency to show a major decrease in tagging and will drop from 3 million tags in the Columbia Basin in 1989 to 2.1 million in 1990.

Table 5. Comparison of Agency Tagging Levels

Reporting Agency [1]		Tagging Levels ($X10^3$) 1989	Tagging Levels ($X10^3$) 1990
Alaska			
	ADFG (+PNP)	4,380	5,420
	Metlakatla	790	690
	NMFS-AK	305	245
British Columbia			
	CDFO	10,155	10,225
	CDFR	462	362
	BCFB	10	10
Washington			
	WDF	6,700	10,500
	WDW	352	310
	NWIFC	2,941	2,975
Idaho			
	IDFG	2,000	2,108
Oregon			
	ODFW	5,960	6,230
California			
	CDFG	3,415	3,350
Federal (Regional)			
NMFS	Col. Basin	3,002	2,132
USFW	Col. River	2,600	3,200
	Puget Sound Wash. Coast	270	650
	California	500	800
TOTALS:		43,842	49,207

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

13. Advances in Marking Technology

A. Binary Tags - Northwest Marine Technology

Dr. Keith Jefferts and Dr. Richard Fralick reviewed NWMT's major developments during the past year. The primary effort was devoted to the relatively new visual implant tags that typically can be inserted into the clear tissue near the eye. Tag retention has been very good in salmonids, while other species have also shown good retention.

Considerable effort was also devoted to increasing the automation of manufacturing the tags. The second generation "coding" equipment provides both quicker turn around and higher quality. The latter was achieved by increased precision of mark placement on the wire.

Several new tools were also announced:

1) Tag Detector: A new tag detector has been developed that has two levels of detection. At the highest level, both standard and half length tags are detectable. The detector is omni-directional and comes with a standard $2\frac{1}{2}$" tube to allow sampling of larger fish.

2) Wand Type Tag Detector: This hand held detector is very sturdy and has a 2 cm detection range. It can be used in water and is good for certain large fish that don't detect well in standard "V" shaped detectors.

3) Hand Tag Injector: A small hand-held tag injector has been recently developed to the prototype stage. The unit will pre-magnetize the tags and can reasonably tag a thousand fish per day. It will be able to be used for sequential tags (see below). NWMT has not yet determined if the demand and economics are adequate for production (possible price in range of $2,500). Therefore, input was requested as to its usefulness for tagging programs.

B. Proposal to Sanction Use of Sequential Tags on the West Coast

Two requests were received from CDFO researchers interested in having sequential tags approved for use with the adipose clip. Benefits cited include the ability to purchase small lots of tags and then give each fish in the small release groups a unique code. As such, the tags appear ideally suited for genetic studies and for marking wild stocks.

Margaret Birch (CDFO) noted that her agency had given the proposal considerable thought and felt that sequential tags could be used with the adipose clip provided that the same rules applied to them as to standard binary tags. Usage was expected to be relatively low and primarily research oriented.

Dr. Fralick (NWMT) noted that decoding of these 6-word tags is fairly straight forward. The Master Word, Agency, Data 1 and Data 2 would be read as normal and provide the standard tag code for the sequence group. Data 3 and Data 4 then provide the "row" and "column" in the sequential numbers table to find the unique sequence number. He further cautioned that tag users will need to understand that because of

the nature of the design used, the sequence codes ARE NOT LINEARLY but jump around some.

After some lively discussion, the Mark Committee **approved use of the new tags with the explicit understanding that all rules that apply to standard tags will also apply to sequential tags.** These requirements are listed below in the ACTION summary statement.

In addition, it was agreed that the Working Group on Data Standards would have the responsibility of determining how sequential tags should be handled for data management purposes. These new changes will be included in PSC Format Version 2.0 (see **Attachment 2**).

ACTION:

Sequential tags are approved for use with the adipose fin clip. All rules that apply to standard binary tags apply equally to sequential tags. These include the following key restrictions:

1) **Tag codes can be used only once:**
   a) **used in only one species**
   b) **used in only one year**
   c) **used in a single watershed that is suitable for stock assessment**

2) **Any re-use (intentional or accidental) will result in subsequent recoveries reported as "status 7's" (i.e. unresolvable discrepancy)**

3) **Recovery Agencies agree to fully decode all sequential tags recovered and forward them to the respective releasing agencies.**

4) **Purchase of the sequential tags will be possible ONLY through the approval of the appropriate tag coordinator. (This was felt necessary to prevent improper use of the sequential tags).**

Decisions on how the tags should be coded for data management purposes has been assigned to the Working Group on Data Standards. These changes will be included as part of PSC Format Version 2.0 (see Attachment 2).

C. PIT Tags

This agenda item was deleted as time was running extremely short and no one had a formal presentation. (See Agenda Item 2.C for recent developments in the PIT Tag Program).

D. Use of Mass Spectrometry

Mr. Bob Brown of Elemental Research ,Inc. was unable to attend the Mark Meeting because of prior speaking commitments. However, he kindly forwarded a brief summary of developments and progress during the past year on using elemental marks for the identification of hatchery stocks.

This summary is provided in **Attachment 9** and the reader is urged to read it for a more detailed picture. In brief, however, Mr. Brown's firm has made significant progress and remains confident that the technique can be successfully used to identify entire hatchery stocks.

E. Update on Smith-Root, Inc.

Smith-Root, Inc. continues to maintain an interest in micro-tagging of fish and still sells color-coded tags and tagging machines. However, in recent years, Smith-Root, Inc. has experienced tremendous success in designing and marketing electric barrier systems and electric guidance systems for fish. Therefore, the projected development of a new type of micro-tag which was discussed briefly three years ago has been placed on hold at this time.

14. Fin Mark Allocation for 1990

A list of available Fin Mark requests for 1990 (and later years) was distributed to tag coordinators with the instruction to review them in the next week. If no objections were raised within that time, the marks were approved for use.

ACTION:

All fin mark requests distributed at the Mark Meeting were approved.

Attachment 1

1990 Mark Meeting Attendees

February 21, 1990

*	Don Bailey	CDFO - Vancouver, B.C.
	Dr. Don Bevan	UW - Seattle, WA
*	Margaret Birch	CDFO - Vancouver, B.C.
*	Lee Blankenship	WDF - Olympia, WA
*	Tim Cochnauer	IDFG - Lewiston, ID
*	Charlie Corrarino	ODFW - Portland, OR
*	Karen Crandall	ADFG - Juneau, AK
*	Richard Dixon	CDFG - Rancho Cordova, CA
	Dr. Richard Fralick	NWMT - Shaw Island, 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	METL - 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
	William Kinney	WDF - Olympia, WA
	Louis Lapi	CDFO - Nanaimo, B.C.
	Dick Ledgerwood	NMFS - Hammond OR
	Jim Longwill	PSMFC - Portland, OR
	Lynn Megaard	WDF - Olympia, WA
	Susan Markey	WDF - Olympia, WA
	Mike Matylewich	CRITFC - Portland, OR
*	Charles Morrill	WDW - Olympia, WA
	Bill Murray	ODFW - Clackamas, OR
	Dick O'Connor	WDF - Olympia, WA
*	Ron Olson	NWIFC - Olympia, WA
	Vic Palermo	CDFO - Vancouver, WA
	Steve Pastor	USFWS - Vancouver, WA
	Pat Poe	BPA - Portland, OR
	Ken Phillipson	NWIFC - Olympia, WA
	Ralph B. Roseberg	USFWS - Ahsahka, ID
	Norma Jean Sands	ADFG - Juneau, AK
*	Robert Z. Smith	NMFS - Portland, OR
	Greg Volkhardt	NWIFC - Olympia, WA
	S. Neil Williscroft	CDFO - Vancouver, B.C.
*	David Zajac	USFWS - Olympia, WA

* Mark Committee Member or Designate

Summary of New Fields in PSC Format Version 2.0

1. Release Format:

New Field	Bytes	Justif.	Format	Explanation
26. Sample Size Tag Loss (Cols. 221-225)	5	R	Numeric	Number of Fish sampled to calculate tag loss (field 14); May be blank.
27. Lower Range of sequential series (Cols. 226-230)	5	R	Numeric	Smallest value in sequential number series; Blank filled.
28. Upper Range of sequential series (Cols. 231-235)	5	R	Numeric	Largest value in sequential number series; Blank filled.

2. Recovery Format:

New Field	Bytes	Justif.	Format	Explanation
29. Run (Col. 92)	1		1 = Spring 2 = Summer 3 = Fall 4 = Winter 5 = Hybrid 6 = Landlocked 7 = Late Fall	Used when sample is stratified by entry run timing (e.g. freshwater sport fisheries where runs can be identified by morphological differences)
30. Sample Length Class (Cols. 93-100)	8		Numeric	Length interval range (mm) Zero filled; (e.g. 800-900mm. length interval coded as 08000900); Blank filled if not used.
31. Sample Sex Class (Col. 101)	1		F = Female M = Male	Blank filled if sex unknown
32. Sampling Agency (Cols. 102-105)	4	L	Alpha	Agency responsible for sampling and tag recovery; May differ from Reporting Agency (field 1)

33.	Sequential Table Column No. "Data 3" (Cols. 106-108)	3	R	Numeric	Value in "Data 3"; Corresponds to column number in Sequential Numbers Table; Zero filled.
33.	Sequential Table Row No. "Data 4" (Cols. 109-111)	3	R	Numeric	Value in "Data 4"; Corresponds to row number in Sequential Numbers Table; Zero filled.

3. **Catch/Sample Format:**

New Field	Bytes	Justif.	Format	Explanation
28. Run (Col. 107)	1		1 = Spring 2 = Summer 3 = Fall 4 = Winter 5 = Hybrid 6 = Landlocked 7 = Late Fall	Used when sample is stratified by entry run timing (e.g. freshwater sport fisheries where runs can be identified by morphological differences)
29. Sample Length Class (Cols. 108-115)	8		Numeric	Length interval range (mm) Zero filled; (e.g. 800-900mm length interval coded as 08000900); Blank filled if not used.
30. Sample Sex Class (Col. 116)	1		F = Female M = Male	Blank filled if sex unknown
31. Sampling Agency (Cols. 117-120)	4	L	Alpha	Agency responsible for sampling and tag recovery; May differ from Reporting Agency (field 1)

4. **Location Format:**

New Field	Bytes	Justif	Format	Explanation
6. Short Description (Cols. 133-152)	20	L	Alpha-Numeric	Concise description of the location.

Evaluation of Embedded Replicate Tag Information
from the Bonneville Dam Survival Study, 1989.

In 1989, the National Marine Fisheries Service, in co-operation with the U. S. Army Corps of Engineers, conducted the third year of a study to evaluate relative survival of subyearling chinook salmon passing Bonneville Dam via the Second Powerhouse turbines, bypass system, or spillway. More than 2.2 million juveniles were marked with 72 unique coded wire tags (6 treatments, released on 12 days); replicate format codes 1, 2, and 3 were used. The experiment was a random block design where each of the release days was considered a block, thus providing replication through time.

Over 18,000 tagged juveniles were recovered 157 Km downstream of the dam in the Columbia River estuary at Jones Beach. Juvenile recoveries provided a short-term evaluation of survival differences between treatments; tag data from returning adults will provide an additional evaluation. Random block analysis of the juvenile recovery data enabled us to detect 7.3% differences between treatments (at $\alpha = 0.05$). If only embedded replicate information were used in the analysis a 4.7% difference became significant. To gain the increased 2.5% detectable difference using the randomized block design would have required the release of 500,000 additional marked fish for each treatment. Unfortunately, the apparent gain in detection provided by the embedded replicate tag data is erroneous and leads to false interpretation of experimental results. Replicate subgroups were marked, held, transported, released, and recovered in an identical manner. Variance estimation using only 'replicate' tag data does not measure these potentially important variance components. This 'replication' measures sampling error only. Appropriate estimates of experimental error were obtained by blocking over time because each of the above experimental parameters were replicated.

Expected recovery percentages for each embedded replicate code (33%) and observed recovery percentages were not significantly different for any of the 72 groups (totals presented below).

Replicate code:	1	2	3
Total recovered:	6,111	6,171	6,102
Percent of total:	33.2	33.6	33.2

The embedded replicate tag format created an additional burden during the decoding process. A computerized verification procedure (separate handout) was used where batches of 25 tags were decoded and verified by a single tag reader. When 1st and 2nd readings did not match, the computer prompted for 3rd and 4th readings as necessary. After an initial training period, greatly complicated by instructions for decoding replicate format tags, 4 tag readers were selected to decode tags. It was rare for accomplished readers to require 3rd readings, however, of the 1312, 3rd and 4th readings required to obtain a match, a total of 751 (57%) involved miss-matches with the replicate code.

RANDOMIZED BLOCK ANOVA

Source	df	Mean Squares	Expected Mean Squares
Block (B)	b-1	SSB/b-1	-------
Treatment (T)	t-1	SST/t-1	$\sigma_*^2 + r\sigma_*^2 + br\Sigma_i X_i^2/t-1$
B x T (EE)	(b-1)(t-1)	SSEE/(b-1)(t-1)	$\sigma_*^2 + r\sigma_*^2$
Replicates (SE)	bt (r-1)	SSSE/bt(r-1)	σ_*^2
Total	btr-1		

Where: EE = Experimental Error
SE = Sampling Error
b = No. of blocks; t = no. of treatments; r = no. of replicates.
SS = Sum of Squares
σ_*^2= true sampling error; σ_*^2 = true experimental error

Source	df	Mean Square	F-test
B	11	0.89175	
T	5	0.12708	F(T,EE) = 7.043
EE	55	0.01804	F(T,SE) = 16.650
SE	144	0.00763	
Total	215		F(EE,SE)= 2.364

Imbedded Replicates for Coded Wire Tagging: One Step in a Statistical Bootstrapping Technique

Dr. Loveday L. Conquest
Center for Quantitative Science
University of Washington
Seattle, WA 98195

15 February, 1990

Imbedded replicates involves the notion of multiple codes repeated serially on a single roll of tagging wire. Fish which are chosen randomly for tagging would presumably then have the multiple codes distributed randomly among them. It turns out that the concept of imbedded replicates is actually very close to a single step in a computer-intensive statistical technique known as "bootstrapping". As it stands, using imbedded replicates is simply a way of dividing up a sample of fish into random subsamples. Since this method is done without replacement, when one combines weighted estimates from the subsamples into an overall estimate for the grand sample, one gets the same "grand estimate" back as if there were no imbedded replicates at all.

I shall illustrate this with two cases, [1] the estimate involving a sample proportion (as might be used in a mortality study, or any study involving a dichotomous outcome), and [2] the estimate involving a sample mean.

Estimate involving a sample proportion. Suppose we want to estimate a proportion p, e.g., the proportion of fish that return, given that we know the total number of fish that were originally released. (This assumes that we have a random variable that fits the definition of the binomial distribution, "number of successes, X, out of N independent trials, with probability p of success at each trial"). We can estimate it by using the overall observed proportion $\hat{p}$, which is simply the number of fish displaying that particular characteristic divided by the total number of fish. With the use of imbedded replicates, we can get several estimates of p (k of them, for example), and use the k separate estimates to get $\bar{p}$, the overall estimate of p. But when this is worked out algebraically, we find that we get the *same result* as when we simply take the overall observed proportion of fish displaying that particular characteristic. In fact, as Schnute points out in his remarks, one could have used computer simulation to distribute the multiple codes amongst the fish *after* the experiment was complete. The actual proof of equality of the two estimates (the "grand proportion" vs. a weighted estimate of the k observed proportions) is presented below:

Let X_i = # of "successes" in the i^{th} group (the i^{th} code). Then $X = \sum_{i=1}^{k} X_i$ = total number of successes out of N trials. Let $\hat{p}_1 = \frac{X_1}{n_1}$, $\hat{p}_2 = \frac{X_2}{n_2}$, ... $\hat{p}_k = \frac{X_k}{n_k}$ ($N = \sum_{i=1}^{k} n_i$.) Weighted estimate $\bar{p} = \frac{n_1\hat{p}_1 + n_2\hat{p}_2 + \cdots + n_k\hat{p}_k}{n_1 + n_2 + \cdots + n_k} =$

$\frac{X_1 + X_2 + \cdots + X_k}{N} = \frac{X}{N} = \hat{p}$, the overall proportion which ignores the multiple codes anyway.

Estimate involving a sample mean. Suppose we want to estimate an average response (e.g., length, biomass) by simply taking the sample average of all the returned fish. With imbedded replicates, we can get several estimates $\bar{X}_i$ (k of them, for example, and they can be unequal sample sizes) and use the k separate estimates to get $\bar{\bar{X}}$, the overall estimate of the population mean . But again, when this is worked out algebraically, we get the *same* results as when we simply take the overall mean from all the returning fish, without regard to which imbedded code it has. The proof is as follows: Let $\bar{X}_i$ = sample mean for the i^{th} group (i^{th} code), $i = 1, \ldots, k$. So $\bar{X}_i = \frac{T_i}{n_i} = \frac{\sum_{j=1}^{n_i} X_{ij}}{n_i}$. (continued...)

Weighted estimate $\hat{} \quad \frac{n_1 + n_2 + \cdots + n_k}{N} \sim \frac{}{N}$

$= \bar{X}$, the overall grand mean which ignores multiple codes again.

Imbedded Replicates and the Bootstrap Estimate

Schnute's comments about imbedded replicates and the statistical procedures involved with imbedded replicates are closely related to the concept of what might be termed "primitive bootstrapping without replacement". "Bootstrapping" (Diaoconis and Efron 1983, Efron and Gong 1983, Efron and Tibshirani 1986) is a statistical technique involving computer-intensive resampling of an original, presumably "representative" data set to get the *sampling distribution* of a given estimator, from when one can obtain variance estimates and confidence intervals for the unknown parameter. As has been pointed out, the imbedded coding could actually be done *after* the experiment is complete via computer simulation. This is precisely what is done in bootstrapping, by continually resampling (with replacement) from the original data set and recomputing the estimate each time to give empirical variances and confidence intervals. So the data set itself is used to generate the sampling distribution of the estimator. In other words, one is doing a Monte Carlo simulation from the data set rather than from a pre-specified probability distribution. In this sense imbedded replicates constitute a *single step* in a statistical bootstrapping technique. Indeed, if current variance formulae for certain estimators lean too heavily upon an underlying Gaussian distribution, or are otherwise mathematically intractable (sometimes the variance can be derived but the exact nature of the confidence interval is not known), then one might wish to try a bootstrapping technique on the original data set. These remarks are not meant to be a substitue for a handbook on the bootstrap, but whenever complicated variance formulae and associate confidence intervals are difficult to derive, or as yet underived, bootstrapping may prove useful. Bootstrapping *does* require independent samples (the observations should not be correlated). Also, since one is replacing the actual population (i.e., its probability distribution) by the data set, one must also assume that the data set is indeed representative of that population.

Imbedded replications and pseudoreplication

Hurlbert (1984) has coined the very useful phrase "pseudoreplication". A principal concept from that is the definition of just what constitutes a true statistical replicate or experimental unit. An experimental unit is the smallest amount of material to which a single treatment application occurs. If 100 fish are raised in a single pond under the same conditions, that constitutes *one* replicate for the pond treatment, not 100 replicates. In an experiment where there are many levels of different units (e.g., fish within a pond, several ponds at a hatchery, perhaps several hatcheries of a given type or within a given region), what constitutes precisely a statistical replicate will depend upon what type of treatment one is talking about, how that treatment was applied, and to what level of unit. I would certainly advocate the use of different codes for fish reared in different ponds; this is entirely appropriate for circumstances where the pond is the replicate (e.g., "pond" may constitute one application of fish reared under a specific set of conditions) and we need to distinguish between fish from different ponds.

References

Diaconis, P. and B. Efron. 1983. Computer-intensive methods in statistics. *Scientific American 248(5)*, 116-130. A good introduction to bootstrapping, written for the nonstatistician.

Efron, B. and G. Gong. 1983. A leisurely look at the bootstrap, the jackknife, and cross-validation. *The American Statistician 37(1)*, 36-48.

Efron, B. and R. Tibshirani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. *Statistical Science 1(1)*, 54-77.

Hurlbert, S.H. 1984. Pseudoreplication and the design of ecological field experiments. *Ecological Monographs 54(2)*, 187-211.

ON THE ISSUE OF THE "CWT BUILT IN REPLICATION"

The usefulness of this type of replication depends upon the experimental purpose, design, and assumptions. There are clearly examples where it is a very appropriate and efficient approach and others where it is inappropriate. Below are two hypothetical examples illustrating this:

Example 1. Suppose we want to test the hypothesis that broodstock A produces a higher proportion of resident offspring (non-migratory) than stock B. Suppose the two treatment groups are reared identically with the exception that they are held in separate raceways until they are marked (using "auto-replicate" CWT). Suppose further that final rearing occurs in a common vessel (e.g. acclimation pond). In this situation the validity of the auto replication approach is reasonable and testable. The independence of the replicates in a single experiment can be questioned in this case, however since experiments of this kind always should be repeated (at different hatcheries and/or different years) valid conclusions are likely.

Example 2. Suppose we want to test the same hypothesis between two different hatcheries (instead of two broodstocks). In this case, because of contageous behavior among groups of fish released together, the within treatment variation would be underestimated using either auto-replication or replicates from different raceways released together. In this situation and also when we, for example, want to estimate fishery contribution rates with confidence, we must make our observations on independent replicates. This is often difficult in fisheries studies, since it usually requires multiple release sites for each hatchery.

The answer to the question is to review the purpose and assumptions for each application and to consult a statistician.

ATTACHMENT 6

PACIFIC SALMON COMMISSION

ESTABLISHED BY TREATY BETWEEN CANADA
AND THE UNITED STATES OF AMERICA
MARCH 17, 1985

600 - 1155 ROBSON STREET
VANCOUVER, B.C. V6E 1B9
TELEPHONE: (604) 684-8081
FAX: (604) 666-8707

July 7, 1989

Dr. Ken Johnson
Pacific Marine Fisheries Commission
Regional Mark Processing Center
Portland, OR 97201-5346

Dear Dr. Johnson:

Your letter of April 17, 1989, was presented at the Data Sharing Committee meeting held in Seattle on April 18, 1989. The concerns you addressed in your letter generated considerable discussion at our meeting and this letter summarizes the discussions and conclusions. In your letter you outlined three concerns brought up at the Mark Meeting in February of this year. Those concerns were:

1. The potential problem of double reporting of unmarked hatchery production and the need for reporting all unmarked production of all species.

2. The need for standardization of stock codes and names.

3. The need to modify PSC data formats (version 1.2).

The problem of double reporting of unmarked hatchery production appears to be a U.S. problem. In Canada the problem has been solved by having the hatchery manager report all releases from the facility rather than the various agencies utilizing the hatchery. Fish not released from the facility (fish taken off site) are reported by the agency that removed the fish. The Province, public involvement groups, and others have all agreed to this procedure and, thus, Canada has not had a problem with double reporting.

For U.S. hatcheries, it was suggested that total unmarked releases per hatchery should be reported only by the agency responsible for that hatchery. It was also pointed out that each hatchery can provide total release information and this can be used to check for double reporting by the agencies in a verification run. If there is a continuing problem on the U.S. side that cannot be worked out between the agencies involved, perhaps the U.S. section of the Data Sharing Committee could write a procedure guideline for reporting unmarked releases. This topic should be brought up at the next U.S. section meeting of the Committee.

It was also brought up in the discussions, that the problem of double reporting may be more of a problem with past data than currently reported data. Historical data from both the U.S. and Canada should be checked for evidence of double reporting. Perhaps the Work Group on Data Standards should work on a procedure for dealing with this issue.

There is general agreement that the original intent for this database was to have it as complete as possible and, therefore, to include all unmarked production of all species for any hatchery, broodstock, and releases occurring within areas of concern to the PSC. Such a complete database is needed to determine ratios of hatchery to wild production of each species in the various fisheries. Within the scope of the Treaty more and more emphasis is placed on allowing each nation the benefits from their hatchery productions. More detailed analysis requiring more detailed data bases are being done each year to determine hatchery contributions to the fisheries, estimate bias in cwt estimates, compare returns of marked and unmarked fish, etc.

1989 High Seas CWT Recoveries

From January 1989 through the end of September U.S. observers recovered 224 CWT. In addition 209 salmonids with missing adipose fins were processed. Data come predominately from the hake fishery located off the coast of Oregon and Washington. This year that fishery was wholly Joint Venture. Three new agencies were identified among the tags recovered; Skagit Cooperative, Nisqually, and Lummi Indians. Bering Sea, and Gulf of Alaska groundfish observers on Joint Venture vessels recovered no CWT. Only one CWT was recovered in the Gulf of Alaska from domestic vessels. This is the first tag recovered by an observer on a domestic trawler. Once again the Japanese mothership salmon gillnet fishery did not operate this year. Research fisheries contributed a new range extension for Washington state steelhead. The Quinalt River steelhead was recovered 5370 km from home at 163 22' E. 44 N.. The following table summarizes the tag recovery data.

CWT RECOVERIES BY FISHERY

FISHERY	NUMBER OF CHINOOK TAGS	NUMBER OF COHO TAGS	NUMBER OF STEELHEAD TAGS
J.V. Hake	194	1	0
J.V. GoA	0	0	0
J.V. Bering	0	0	0
Dom. GoA	1	0	0
Dom. Bering	0	0	0
Resrch gillnet	0	0	2
Resrch longln	0	0	15
Resrch trawl	1	0	0
	196	1	17

The "hole" in observer coverage due to increased allocations to domestic vessels continued this year. Coverage was sporadic and similar to 1988 where observers were placed on voluntary vessels. This year (1990) observers will be required on all domestic trawlers greater than 125' and 30% of the trawlers in the 50 - 125' class.

Japan, Korea, and Taiwan continued fishing for squid with driftnets outside the EEZ, but did allow some observer coverage. In 1989 there was a U.S. observer on one Korean and one Taiwanese vessel. Thirty-two boats in the Japanese fleet had observers and 14 were North American. The data from these cruises are not summarized yet, but it is unlikely that many salmon were observed. This is because sea surface temperatures were above normal this year so salmon distributions were more northerly than in past years. Also, there was no observer coverage in the time/areas (170 E. to 180 during July through September) where salmon are normally intercepted. Negotiations between Japan and the U.S. in 1990 will address the number of observers and the location of the observed vessels. In 1990, 24 Taiwanese vessels are slated to be observed along with 26 Korean vessels. Approximately half of these observers will be from the U.S..

BROWN, MEDDINGS
Elemental Research Inc.

MEMORANDUM

DATE: February 19, 1990

TO: Ken Johnson
Pacific States Marine Fisheries Commission

FROM: Bob Brown, Elemental Research, Inc.

SUBJECT: Mass Spectrometry in Elemental Fish Marking Program

Work is still continuing to determine the feasibility of using elemental marks introduced during the freshwater growth period for the identification of hatchery stocks.

1) In cooperation with UBC Animal Sciences and Fisheries Canada, a large number of samples have been examined to determine the presence of elemental marks introduced through:

    1) Food: strontium, rubidium, barium
    2) Freshwater: lanthanum and samarium

2) We have established a methodology to determine the presence of the elements to the sub ppm level in samples of 0.1 to 0.2 milligram size (100 to 200 micrograms).

3) Most work has been carried out on scale samples but some also on vertebrae.

4) It has been demonstrated that elements are retained in the skeletal structure, and can be detected and determined with acceptable accuracy using conventional analysis of solutions of the samples on our ICPMS.

The success of the above work encouraged us to carry out some work using laser ablation ICPMS for the investigation of the spatial distribution of a strontium mark in juvenile salmon scales with a diameter of approximately 0.8 millimeter (800 microns). A series of laser shots across the scales indicates that we can determine the increase of strontium at the portion of the scale produced during the feeding of high strontium diet. Further work should be carried out on strontium and other elements including rubidium, lanthanum, and samarium. I thank Battelle Memorial Institute at Hanford for the use of their laser

ablation ICPMS; at least the preliminary work shows that the method has potential.
Our inability to raise sufficient funding for purchase of the laser ablation attachment to our ICPMS to this date precludes further work on the laser technique in our laboratory. We have applied to BC Science Council for funding assistance to pursue this work but we do not know if we have been successful in our application.

I am sorry to have missed your meeting but I am giving a presentation elsewhere on the 21st.

Regards,