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1999 MARK MEETING

Vancouver, B.C.
April 15-16, 1999
Final Minutes

1. General Business Items

A. Welcome/Introductions

A special thanks was given to CDFO for hosting the Mark Meeting. Doug Herriott, Marc Hamer, and Brenda Adkins played key roles and were thanked for their efforts in organizing the field trip, taking care of logistics, and assisting in hotel reservations.

Mark Committee members and other meeting participants were introduced at the start of the Mark Meeting **(Attachment 1)**. Ron Josephson (ADFG) was introduced as Karen Crandall's replacement as she had recently retired. Ken Johnson (PSMFC) paid Karen high compliments for her many years of service on the Mark Committee.

Several Mark Committee members were not able to be present. Tim Yesaki (BC Environment) was represented by Marc Hamer (CDFO). Steve Leash (MIC) was not present. Jerry Harmon (NMFS-Columbia River) and Robert Bayley (NMFS-Portland) were not present but were represented by Ron Heintz (NMFS-AK). California was not represented as Bob Kano (CDFG) was unable to get travel authorization in time.

B. Year 2000 Meeting Site and Date

The year 2000 Mark Meeting will be hosted by Washington Department of Fish and Wildlife. There is some possibility that the meeting will be in the Seattle area, with a field trip to the NMFS's research facility at Manchester. The meeting is scheduled for April 20-21, 2000.

2. Status of CWT Data Files and Reporting Backlogs

As is done each year, the status tables were reviewed for each reporting agency's CWT release, recovery, and catch/sample data files. Particular attention was focused on existing 'holes' and agency plans to report the missing data. However, this year, the review was done 'on-line' by accessing the status tables on PSMFC's website (see agenda item 3).

3. Status of RMPC Operations

A. New CWT Release Report on the Website

Jim Longwill reported that users can now select CWT release data by tagcode on the Mark Center's RMIS application on the internet. This report has long been available on the standard RMIS dial-up system but proved challenging to install on the website because of a software flaw. The flaw has since been corrected by the software vendor and the reports are working correctly.

B. New Automated Data Status Web Viewer

An automated data status web viewer was demonstrated on-line by Jim Longwill with the help of a multimedia projector. It provides 'real time' coupling of the data load and validation programs with the data status tables. As such, users can now access the web site to check on the status of any data set, including date of submission, errors encountered during validation, or date that the data were validated and available on-line. (See: http://www.psmfc.org/rmpc/dataset_status.html).

In the past, the data status tables were manually updated once a data set was fully validated and merged into the on-line data tables for user access. However, there were continual problems in maintaining current data status tables. In addition, Mark Center staff had the problem of rarely knowing if the data were incomplete or complete.

Real time data status is now achieved by using the Data Description file to automatically capture the required 'Submission Date' (field 1) and 'File Status' (field 4). This information is passed to a set of HTML pages/frames on the web page that display the current status of the data.

C. Recent International Interest in Otolith Database

The North Pacific Anadromous Fish Commission (NPAFC) met in Vancouver, B.C. on March 25, 1999 and included a working group focused on the use of thermal marked otoliths. In addition, the working group discussed the Mark Center's prototype web page for thermal marked otoliths. There is considerable interest in establishing an international repository for otolith marks because of the growing use of the stock identification tool in the North Pacific. Currently, otolith marks are being used by Japan, Russia, Canada and the United States.

In November, 1998, NPAFC met in Moscow for its annual meeting. It was decided at that time to adopt Alaska's 'RBr' coding scheme as the method for referencing otolith marks. 'RBr' stands for 'Region: Band.ring'. 'Region' is the location on the otolith where the mark first appears - either pre-hatch or post-hatch. 'Band' is an index number that refers to a group of rings that have equal spacing, and 'ring' is the number of thermal rings that appear in the band. As an example, the RBr code '1:1.5, 2.4' represents a pre-hatch mark (1 = pre-hatch; 2 = post-hatch), with five rings in the first band and four rings in the second band.

The member nations of NPAFC expressed hope at the Moscow meeting that each nation could have its own set of marks. However, subsequent work by Pete Hagen and Kristen Munk (ADFG) demonstrated that the number of unique marks or banding patterns is very limited.

Thus there will be an increasing occurrence of conflicting marks as the usage continues to grow. Generally this is not expected to be a serious problem for local domestic management of terminal fisheries. However, it is expected to present problems for offshore mixed stock fisheries. As such, there is a pressing need for a centralized repository for all otolith marking.

PSMFC's Regional Mark Center has been nominated by the United States to serve as the international repository for otolith release data. Tentative approval has been given by the NPAFC, pending funding arrangements. PSMFC has submitted a budget request for $200,000 to Congress to develop and maintain this database. However, a decision on federal funding isn't expected until the summer of 1999.

4. Report on ASMFC Tagging Workshop

Ken Johnson briefly reported on a tagging workshop sponsored by the Atlantic States Marine Fisheries Commission (August 27, 1998; Hartford, Connecticut) in response to growing concerns about the shortcomings of angler-based tagging programs. Concerns included lack of set goals and objectives, improper handling of fish, poor tagging techniques, and inadequate reporting of tagging activities. On the other hand, angler-based tagging programs can provide valuable information for fisheries management, including detailed information on life history, movement and stock identification of a variety of finfish species, and increased citizen awareness

The workshop focused primarily on the development of recommended protocols for angler based fish tagging programs to maximize the utility of the tag recovery data. In addition, considerable process was made on establishing a cooperative web-based registry for angler-based tagging programs: http://fwie.fw.vt.edu/tagging/. Initial emphasis is on capturing mark information on the eastern seaboard states and the Great Lakes region. In addition, workshop participants recommended the establishment of an interstate tagging committee patterned to a large extent after the Mark Committee on the west coast.

5. Update on Mass Marking and Selective Fisheries

A. Hatchery Coho in Oregon, Washington and British Columbia

Oregon: Christine Mallette (ODFW) reported that approximately six million 1998 brood coho will be marked in 1999 with the adipose only mark. Of those, 4.8 million juveniles will be marked in the Columbia Basin, and 838,000 will be marked at coastal facilities **(Table 1)**.

Table 1. Oregon Department of Fish and Wildlife
Brood Year 1998 Mass Marked Coho Salmon

Species	Adipose Fin Clipped Only			Double Indexed CWT Only			TOTAL
	Coastal	Columbia	SubTotal	Coastal	Columbia	SubTotal	
Coho	838,000	4,763,00	5,601,000	125,000	150,000	275,000	5,876,000

Present plans for selective fisheries on the central coast call for a quota of 15,000 finclipped coho during July 10-31 (or when the quota is reached). In the Columbia River and the ocean, a quota of 55,000 finclipped coho may be harvested during July19 to September 30. In addition, 45,000 finclipped coho may be taken in the Buoy 10 fishery during August 1-December 31.

Washington:

1) WDFW: Lee Blankenship reported that 17.8 million coho (1998 brood) in the Columbia River and 11.8 million in Puget Sound will be marked with the adipose only mark. An additional 5.9 million will be marked at coastal facilities. The statewide total is approximately 35 million hatchery fish and represents most of the hatchery production (**Attachment 2**). He noted further that negotiations were underway with several Puget Sound tribes to reach agreement on marking their hatchery coho.

Washington plans to have selective fisheries for coho on the entire coast (Areas 1-4), the western portion of the Strait of Juan de Fuca, and in South Puget Sound (Area 13). A list of the areas and their respective opening and closing dates is provided in **Attachment 3**.

2) USFWS: David Zajac distributed a summary table which summarized USFWS's mass marking of 1997 brood coho last year at five hatcheries (**Attachment 4**). He noted that most of the fish were adipose only marked (with some Ad+CWT marked fish) at the Makah, Eagle Creek and Willard hatcheries. Quilcene Hatchery applied a mixture of both marks. Quinault Hatchery did not use the adipose only mark but did release double index tagged groups.

With respect to the 1998 brood coho, he emphasized that USFWS marking plans weren't developed yet as negotiations were just beginning with the Tribes. He projected that the marking plans would likely be very similar to that done with the 1997 brood.

3) NWIFC: Ron Olson stated that a number of tribal/state cooperative programs (primarily net pens) would be mass marking their production with the adipose only mark (**Attachment 2**). In addition, some Tribes are still considering the option while others have no plans to participate. In brief, he projected that there would be little change from last year's mass marking levels.

British Columbia: Don Bailey reported that mass marking of 1996 brood coho from Canadian hatcheries occurred mainly as planned, with some minor adjustments because of stock status and disease concerns. A total of 6.8 million adipose only marked fish were released in 1998. Details are provided in **Attachment 5** (see Table 5).

Mass marking of the 1997 brood coho has been completed but final numbers weren't available at the time of the Mark Meeting. The program was expanded to add Robertson Creek (845,000 release) and Conuma River (116,000 release) stocks on the West Coast of Vancouver Island.

Marking plans for the 1998 brood coho are expected to be similar to 1997.

Doug Herriott noted that CDFO had limited selective fisheries last year in a few sport locations where there were terminal stocks. Two examples were fisheries at the mouth of the Capilano and Chilliwack rivers. However, no attempt was made to have selective fisheries on mixed stocks. While plans weren't finalized, he projected a similar approach for 1999.

B. Hatchery Chinook in Washington and Oregon

Oregon: Christine Mallette stated that approximately 5.5 million spring chinook will be marked in the Willamette basin with the adipose only mark (**Table 2**). Of those, 200,000 will be marked as a standard index with the Ad+CWT. Double index tagged (DIT) groups will also be marked.

An additional two million fish (two stocks) on Oregon's north coast will be marked with the adipose only clip. No double index tagging is planned for these two stocks. However, 25,000 fish of each stock will be given the Ad+CWT mark.

Table 2. Oregon Department of Fish and Wildlife
Brood Year 1998 Mass Marked Spring Chinook Salmon

Species	Adipose Fin Clipped Only			Double Indexed CWT Only			TOTAL
	N.Coastal	Columbia	SubTotal	N.Coastal	Columbia	SubTotal	
Spr Chin	2,094,000	5,392,000	7,486,000	50,000	100,000	150,000	7,636,000

On the south coast, approximately 1.6 million Rogue River spring chinook will be mass marked with the adipose only mark. In addition, a portion of the release will be either double indexed tagged or will receive the standard Ad+CWT mark.

Washington:

1) WDFW: Lee Blankenship reported that mass marking of hatchery chinook in Washington is well underway. For example, all of the spring chinook in the lower Columbia have been or will be mass marked in cooperation with Oregon's mass marking program. However, the situation is less clear in Puget Sound as negotiations are continuing with the Tribes (**Attachment 6**). To date, agreement has been reached with the southern Puget Sound Tribes (Nisqually, Squaxin, Suquamish, Puyallup) and a decision is pending with the Muckleshoot Tribe to mark the hatchery production on the Green River. At this point, the northern Puget Sound Tribes have not agreed to mass mark their production.

WDFW's long range goal is to have all possible spring and fall hatchery chinook production in the state mass marked with the adipose only clip.

2) USFWS: David Zajac reported that there were no plans to adipose only mark the 1998 brood hatchery chinook. However, the 1999 brood would be up for negotiations.

3) NWIFC: Ron Olson noted that it had been a very interesting and unusual year with respect to mass marking chinook. By way of background, the Tribes had assumed that the Oregon/Washington mass marking/selective fisheries proposal would first receive a Pacific Salmon Commission (PSC) review and that the results would be made available in a report prior to any decision. However, the report was not ready by the time that the State wanted to begin marking. This caused NWIFC a great deal of concern with respect to technical issues. However, preliminary results of the PSC review committee indicated that the modified marking proposal (primarily limited to Puget Sound) would not create serious problems for the CWT system.

He stated that the Tribes had come under extreme political pressure to support mass marking and selective fisheries for hatchery chinook. Therefore, the Tribes have agreed to assist the State in developing an implementation plan. One key feature of this plan is that it addresses the viability of the CWT system which is in the joint interest of both the Tribes and the State. The plan gives co-managers the option to modify mass marking proposals, if need be, to be consistent with PSC objectives. It also places mass marking and selective fisheries as a component of the larger 'Comprehensive Chinook Management Plan' which includes harvest and habitat issues.

The Nisqually Tribe has agreed to mass mark their 1998 brood fall chinook at their Clear Creek Hatchery. However, Ron Olson stated that he did not expect to see any additional marked groups this year as the window of opportunity of marking was almost gone. Several other Tribes are considering the State's mass marking proposal for the future.

C. PSC Report on Mass Marking and Selective Fisheries

Marianna Alexandersdottir (NWIFC) provided an update on the recent activities of the PSC Selective Fishery Evaluation Committee (SFEC) with respect to coho and chinook.

In 1995, the Ad-Hoc Selective Fishery Evaluation Committee produced a report on mass marking and selective fisheries for coho. The report demonstrated that double index tagging (DIT) could be used to provide an estimate of total selective fishery mortality for unmarked coho salmon. However, a very significant question concerning selective fishery mortality remained. There was still no way to allocate the total selective mortality to the individual fishery-time periods. This is very important since it allows evaluation of how each fishery may or may not be contributing to the goal of reducing harvest impacts on unmarked fish. In addition, it also provides vital information for allocation issues.

Since that report, Rich Comstock (USFWS) and Pete Lawson (ODFW) have refined a promising Proportional Migration (PM) algorithm that has mechanisms for moving migrating fish across fisheries. The DIT recovery data are used to allocate estimates of selective fishery mortality to individual fisheries.

The PM algorithm may resolve the outstanding issue for maintaining the CWT program's viability for coho. Marianna noted, however, that there are still other coho issues that remain, including sampling designs that are adequate for both tagging levels and sampling rates across all fisheries (both selective and non-selective) to lower bias. She further stressed that biased estimates of cohort size and exploitation rates will result if fisheries where a DIT group is exploited are not sampled.

Modeling of selective fisheries on chinook has just started in earnest. However, the coho method of allocating selective fishery mortality across fisheries will not work for chinook because of the confounding effects of natural mortality and multiple ages in the fisheries. For coho, the natural mortality within a one-return year (basically that for coho) is small enough to ignore. For chinook, the multiple return years, coupled with large natural mortality variation from one age to the next, has confounding effects with mortality from selective fisheries mortality that is too great to ignore.

It is believed, however, that the PM algorithm with DIT recoveries may also provide a method for estimating the impact of selective fisheries on chinook across progressive fisheries by accounting more correctly for natural mortality. Work is continuing with the PM method both for coho and chinook, and will need to investigate the use of the PM in analysis including current fishery-time period structures and sampling data.

D. Update on WDFW's Automated Fish Marking and Tagging Machine

Lee Blankenship (WDFW) reported on the current status of the prototype automated fish marking and tagging machine. He noted that the machine works very well and has largely met most of the original goals of fin clipping and tagging quality. Areas still needing improvement include the rate of marking (now 1.5 fish/sec) to meet the original goal of 2 fish/sec. In addition, problems continue to persist with sorting as the machine is very sensitive to size. Congressionally approved funding has been obtained to continue the research and development work, with the goal of completion by this fall.

Guy Thornburgh (NMT) added that WDFW's machine is the prototype model. NMT has also just completed its first production model that will undergo shakedown tests at Samish Hatchery in the next few weeks. A second production model will be completed by June. Plans then call for extensive testing before building more units. However, an additional eight units will be available by next spring. In conjunction with this, Guy announced that a new company, 'World Mark', is being formed to carry out the mass marking services. The trailers will travel from hatchery to hatchery and perform the mass marking and related tagging on a cost/fish basis.

6. Electronic Detection of CWT's in Adult Salmon and Steelhead

A series of reports were presented by ODFW, NWIFC & USFWS, WDFW, and CDFO on their various research results on electronic detection. Reports were distributed at the meeting and can be obtained from the respective Mark Coordinators.

A. ODFW: Christine Mallette distributed a final report on ODFW's electronic sampling of adult and jack coho salmon in the fall of 1997 for the presence of CWTs using both the hand wand and the tube detector. The wands were used in the various sport fisheries and in hatcheries where there were low returns, while the tube detectors were used in hatcheries with larger volume returns. A total of 3,591 fish were sampled by wand and 9,147 fish with tube detectors.

Both detectors worked well on finding CWTs in coho, with an accurate detection rate of 96.8% for the wand and 92.5% for the tube detector. When including the false positive detections, the effective detection rate increased to 98.1% for the wand and 98.6% for the tube detector. The average percentage of missed tags averaged 2% for the wand and 1.4% for the tube detector. Christine stressed, however, that sampling accuracy was found to be closely linked to standardized procedures and adequate training for infrequent or novice samplers. Poor techniques at one hatchery led to much higher rates for missed tags.

B. NWIFC & USFWS: Ken Phillipson (NWIFC) prefaced his report by noting that the Oregon/ Washington proposal to mass mark chinook in 1999 would necessitate the use of electronic sampling to recover CWTs. While the wand has been shown to be highly effective for detecting tags in the smaller coho, questions linger about its detection capability in the larger chinook. NMT guarantees a detection depth of 20 mm for single length tags (1.1 mm) and 30 mm for length and a half tags (1.5 mm). However, because of the large size of chinook heads, some tags are expected to reside at depths greater than 30 mm.

Accordingly, the joint NWIFC and USFWS study in 1998 attempted to measure the CWT detection rate of wands used on hatchery returns of chinook tagged with standard length wire. Complicating the research was the fact that returning fish had either 'old wire' (lower magnetic moment) or new wire (higher magnetic moment and detectability). The age five fish (1993 brood) carried 'old wire' tags while the age 2-4 fish (1994-1996 broods) had new wire tags.

Wand detectors were tested for accuracy during the fall of 1998 on adipose marked chinook returning to four hatcheries: 1) Nisqually Hatchery at Clear Creek; 2) Kalama Creek Hatchery; 3) Grovers Creek Hatchery; and 4) Makah National Fish Hatchery. In addition, the variability in detection depth was compared between six newly purchased wands in a laboratory test.

A total of 319 marked hatchery chinook were sampled at the four hatcheries with the wands. Out of the 258 tagged fish, the wands successfully identified 256 fish for a success rate of 99.2%. The two missed tags were in larger fish and also misplaced (i.e. behind the eye in one fish and near the roof of the mouth in the second fish). In addition, one of the missed tags was the older style wire. This represented one out of 34 'old wire' tags recovered.

The results for the detection variability between equipment indicated that the maximum detection depth for length and a half wire ranged from 38 to 44 mm. Greater depth detection was uniformly found when the wand was used in a parallel orientation to the tag. However, when used in the perpendicular orientation to the tag, all wands had a uniform depth detection of 37 mm when sampling length and a half wire.

Ken concluded that the wand does have the potential to detect standard length 'new wire' tags in adult chinook. However, given the limited sample size and study design, he stressed that further testing was needed in actual fishery situations, with particular emphasis on the larger fish in the 4 and 5 year old age classes.

He also argued that there was a great need for a standard to test the wands against. He noted that when samplers work most of a day without their wand 'beeping', they begin to lose confidence in the equipment. Hence, the ability to test the wand against a known standard would resolve this type of problem. Dr. Keith Jefferts (NMT) agreed a working standard was needed and said that the simplest standard would be a coded wire tag. However, it wouldn't be a satisfactory standard as it could be altered by a magnet. He added that there was a technically feasible solution that would provide a stable standard and that NMT would be willing to develop it in consultation with the tagging agencies.

C. WDFW: Geraldine Vander Haegen presented WDFW's report (**Attachment 7**). The study was designed to test whether the use of 1.5 mm tags affected the adult hatchery rack returns relative to standard 1.1 mm wire. In addition, the study tested whether 1.5 mm CWTs (new wire) can be detected at greater accuracy than 1.1 mm CWTs (old wire). While adults returning to the rack are only part of the overall survival, any negative effects of the 1.5 mm wire on survival would be measurable at the rack.

The study was done at Hupps Springs, Soos Creek, and Kendall Creek hatcheries (Puget Sound facilities) using 1994 brood chinook. Equal numbers of fish were marked with one of the two tag types and given an adipose clip. The tagged fish were then mixed and reared together until release as either subyearlings or yearlings. Size at marking ranged from 248 fish/lb to 92 fish/lb for both tag types. Mean fish lengths at tagging ranged between 61 and 67 mm for most groups.

The first year returns were sampled last fall by first using the wand detector and then the tube detector. The fish were then split into three groups:

(1) tag detected by the wand
(2) tag detected by the tube detector but not the wand
(3) no tag detected; assumed no tag present.

The recovery data indicated that there were no significant differences in survival between fish marked with the old 1.1 mm and the new 1.5 mm wire tags as measured by tag retention. All marked groups were excellent, regardless of the size of the fish tagged. The lowest rate was 97.7% retention. In addition, the study confirmed that chinook juveniles as small as 60 mm in length (~2.2 gram fish) can be safely tagged with 1.5 mm wire.

With respect to tag detection, the wand detected 90.8% (454/500) of the old 1.1 mm wire tags and 99.4% (500/503) of the new 1.5 mm wire tags. Tags missed by the wand were typically found in the larger fish as expected. Part of this may relate to poor tag placement and perhaps poor sampling technique as the tag depth was within the range of other detected tags.

Geraldine concluded that the use of 1.5 mm wire will minimize detection failures caused by poor wanding techniques by some samplers. The use of the 1.5 mm wire also increases the probability of recovering tags from the largest chinook.

Lee Blankenship also commented that next year's sampling would include rubbing the wand on the roof of the mouth of the largest chinook (5 year olds) to see if that will decrease the number of missed tags in the larger fish. Rodney Duke (IDFG) commented that his tag lab staff had gone to doing this practice on the five year olds because it did work in many cases.

D. CDFO: Doug Herriott reported that he was a one-person evaluation team last year and had six tube detectors at his disposal for testing at Chilliwack Hatchery. He emphasized that he was very confident that the wands and tube detectors would perform as needed in any sampling environment that they are used in.

His biggest concern, he noted, was in fixing the minor things that the hatchery people didn't like about the sampling equipment and supporting equipment. As a case in point, he pointed out that the desiccant filter in the tube detector is too small as it needs to be replaced every few months when it turns orange. However, he found that the hatchery staff would often ignore changing the filter even though the color had changed to telltale orange. After a few tries, he found a readily available industrial recyclable filter that costs $200 but is good for 10 years. While the initial cost is high, he stressed that it was far cheaper than NMT's replacement filters when viewed over years. In addition, it eliminated the problem of staff not properly maintaining the hardware.

Requested improvements for the R95 tube detector included clips for the cable connectors that go down to the diverter gate because they occasionally disconnect during use. A second desired feature is the ability to tally chinook and coho species separately. This feature will be essential for sampling the commercial troll fishery.

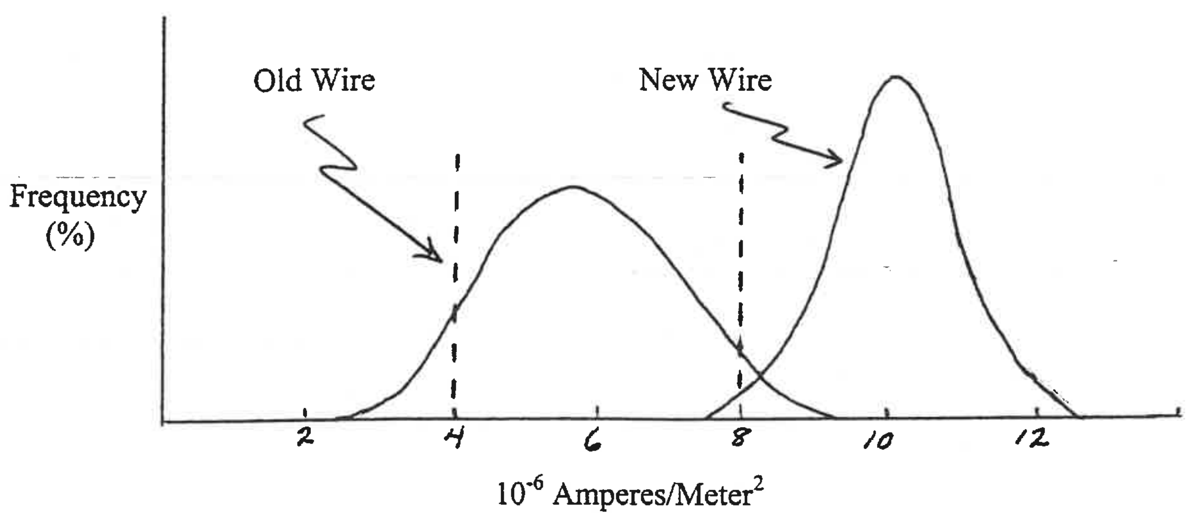
7. Northwest Marine Technology

A. Proposed Minimum Standards for Tag Magnetic Quality

Dr. Keith Jefferts (NMT) responded to a number of questions from the Mark Committee regarding NMT's proposal that a minimum standard be established for tag magnetic quality. The questions and Dr. Jefferts' responses are listed below.

1) What is the optimal magnetic moment for detection purposes?
2) What is the acceptable minimum standard in the real world?
3) What level is unacceptable?

Dr. Jefferts answered these three questions by sketching a graph showing the distribution of the magnetic quality of 'old wire' and the 'new wire' versus frequency of occurrence. The generalized graph is presented below, with magnetic moment represented on the X axis in units of 10^{-6} amperes/meters^2. (As an aside, he explained that the 10^{-6} am/m^2 units used to be expressed as10-11 weber meters). The Y axis represents the frequency of a given magnetic moment for the two types of wire.



Sketch of basic magnetic properties of 'old' and 'new' wire (**data points not accurate!**)

The 'old wire' was quite variable in magnetic moment and the bell shaped distribution ranged from approximately $3*10^{-6}$ am/m^2 to over $8*10^{-6}$ am/m^2. NMT set the minimum standard at $4*10^{-6}$ am/m^2. In contrast, the 'new wire' has both a much higher mean magnetic moment and a much narrower distribution range. Its lower range slightly overlaps the upper range of the 'old wire'. Dr. Jefferts noted that this limited overlap explains why some 'old wire' has sufficient magnetic moment to meet NMT's minimum standard of $8*10^{-6}$ am/m^2 set for the 'new wire'. He also added that this minimum standard is verified internally by the Mark IV tag injectors.

4) What are the repercussions of setting an optimal standard as the minimum standard (i.e. would an optimal standard be significantly more expensive)?

The practical standard that NMT has set for the 'new wire' is double that for the 'old wire' and provides a comfortable margin over the ability to produce the high quality wire with a much narrower distribution. He also noted that the choice of the minimum level was somewhat arbitrary. However, lower levels would reduce the probability of missed tags in large fish, and that was an unacceptable option in NMT's view.

5) How do we define what level of magnetic moment is acceptable?
6) How did NMT decide on the stated minimum magnetic moment of $8*10^{-6}$am/m^2? (and what units do 'am' represent?)

As seen in the graph above, the distribution of the 'new wire' was paramount in selecting a practical minimum standard for magnetic moment. In addition, the tube detectors are calibrated to detect the weakest of the tags.

7) Is it possible that this level is 'too hot' and possibly impact salmonid homing behavior?

Dr. Jefferts noted that he had not put an upper range on the potential magnetic moment of wire for tagging. He added that he did not believe that it was technologically likely that it could be increased much beyond the present level. However, should the tags become too magnetic in the future, the obvious solution would be to make the tags smaller (length and/or diameter) to keep the detection quality high. This would have been a problem with binary tags but size is not a limitation for the new laser etched decimal tags

8) Why are tags produced by NMT before January, 1994 described as not suitable for use involving electronic detection (May 22nd letter) when 'old wire' in 1995 brood coho worked fine with wand detectors during field tests conducted by NWIFC, WDFW, and CDFO?

This was answered in the response to questions 1-3. In effect, there is a modest overlap in magnetic moment between the 'old wire' and 'new wire' tags. The second reason is that the coho were much smaller and thus tag depth is generally not a factor. Fortunately, there isn't much 'old wire' left in the system now but it can't be assumed to be adequate for chinook.

9) Along the same line of thought, why are the tags of MicroMark described as unsuitable when the wire was reportedly purchased from the same vendor and with the same magnetic moment specifications (given the inside information of the former NMT employees)?

NMT obtained a large quantity of wire from MicroMark at the time of the buyout and subsequently ran tests to determine the mean level of magnetic moment. It was found that the mean was just slightly better than that of 'old wire'. Hence, contrary to MicroMark's assurances, the wire was not suitable for electronic detection.

10) What is the minimum level of magnetic moment that can be detected by NMT's wands and tube detectors?

NMT's tube detectors are calibrated to find any 'new wire' tag. Wand detectors are more challenging as they are hand tools and subject to correct procedures to guarantee high performance. However, they are all designed to exceed the minimum specifications in magnetic moment. Dr. Jefferts added that he expected that NMT will continue to improve the product's capability in the future.

11) Has NMT done any studies to test different levels of magnetic quality? Question by-passed.

12) What impact will NMT's proposed minimum standards have upon other potential vendors' ability to produce CWTs? (i.e. Does it set an unnecessarily high standard that only NMT can easily achieve, thus excluding tags that still pass acceptable levels of magnetic moment and could be less expensive?)

In the near future, NMT will certify that every spoon of wire adheres to this proposed minimum standard and meets National Institute of Science and Technology (NIST) standards. (This will not add to the cost of the tags.) The machine is already on line and just needs NIST certification. Dr. Jefferts added that he didn't know if it would be hard for other vendors to meet the recommended minimum standard for magnetic moment. However, they wouldn't be excluded from the market as they could also buy the services of certification. One suggestion was to use the Thomas Register for industries to find such services.

Dr. Jefferts reiterated that there are actually two parts to certification. The first has to do with the magnetic properties of the wire itself. The second part has to do with the actual magnetization that happens as the wire passes through the tag injector. Hence, NMT's concept of certification refers to meeting the minimum standard of $8*10^{-6}$ am/m^2 as the tags exit the Mark IV injector.

Action: There was consensus that the idea of a minimum standard for magnetic moment had merit to protect the integrity of the coastwide program. However, it was also recognized that this standard had to be flexible in the event that some vendor developed a more sensitive detector. It was agreed that a Subcommittee on CWT Magnetic Moment Standardization would develop a recommendation for addressing the issues.

Adrian Celewycz (NMFS), Lee Blankenship (WDFW), Rodney Duke (IDFG), Christine Mallette (ODFW) and Don Bailey (CDFO) volunteered to serve on the subcommittee.

B. NMT Research and Development

See Agenda item 5.D for Guy Thornburgh's comments about NMT's automated mass marking and tagging machine as it moves into large scale production.

C. NMT's Laser Etched Decimal Tags

Sale of NMT's new decimal tags is expected to begin on January 1, 2000. Pricing will be the same as for the binary CWTs.

1) Decimal Format: Ray Glaze reviewed a number of minor format changes that were made to NMT's decimal tag format that was initially presented to the Mark Committee in 1998. A copy of the current format specifications can be obtained from NMT or from the Mark Center.

Changes that affect all formats include the use of a flag character to orient the reader. It will occur to the left of the first digit of the agency code. Digits will be imaged in a 7 x 10 matrix, with spacing of at least two blank rows or columns between characters. Zeros will be used in the place of blanks in any data position. Lastly, the decimal tag's code capacity is substantially greatly than that of binary tags.

The decimal standard tag and the length and a half tag formats are almost identical. Each will have the six character tag code (i.e. Agency, Data 1, Data 2) written on each of the four sides of the wire, with the starting point offset by four character positions for each side. This redundancy will make the tag readable in almost any situation. Code capacity increased from 4,096 (binary) to 10,000 unique codes per agency. The only differences of the decimal length and a half tags are the extra length (1.6 mm vs 1.1 mm) and a wider spacing of the characters.

The decimal half length tag is compatible to the binary tag in that it has five words (i.e. Agency, Data 1, Data 2, Data 3, Data 4). However, it differs greatly in its layout. The agency word will be two digits long (like the binary version), while the four data words will be only one digit each. To fit the code on the shorten tag (0.5 mm), the code will be written in two adjacent longitudinal rows. The first row will contain the Agency and Data 1 values, while the two rows will contain the digits for Data 2, Data 3, and Data 4.

During subsequent discussion, it was noted that the compressed format of the half length tag produces a six character tagcode that visually looks just like the standard tag codes. In effect, leading zeros need to be added to the codes for Data 1 through Data 4 (e.g: 165809 should be written out as 1605080009). This may lead to data management problems (i.e. apparent re-use of standard tagcodes) unless the tag type is also recorded at the time of decoding.

It was also noted again that the new format for sequential tags will present a problem for data management (See agenda item 14.B, 1998 Mark Meeting minutes). Under the scheme for binary tags, Data 3 and Data 4 were used to identify the row and column of the sequential table so that the actual sequential number (up to 5 characters) could be determined. The decimal tag avoids this step and provides the sequential number directly. Unfortunately, PSC Format Version 3.2

only allows for the 3 character row and column values. Hence, there is no way currently to capture 5 character sequential values under Format 3.2. This is viewed as a temporary problem because the PSC Data Standards Committee has begun serious discussions on advancing to Format 4.0

2) **Demonstration**: Terje Vold distributed several very small ingenuously designed monocular microscopes for viewing samples of NMT's new decimal wire. In a word, the tags were AWESOME! The excitement of the Mark Committee members was very apparent because of the clarity of the codes on the tags.

8. Special Requests to use the Adipose Only Clip for Mass Marking

A. Mass Mark Snake River Chinook with the Adipose Only Clip

IDFG and USFWS requested a five year exemption to continue mass marking a major portion of their Snake River hatchery chinook production (sixth year) with the adipose only mark. . Idaho also plans to mark some groups with either the LV or RV mark. Representative stocks will be adipose clipped and tagged with a CWT. In addition, some stocks will be tagged and released without the adipose clip.

Action: The five year exemption was approved with the stipulation that the Mark Committee would be given an annual update on future marking plans. In addition, IDFG agreed to continue coordination with the Nez Perce Tribe on marking plans.

B. USFWS - Adipose Only Mark Quilcene Summer Chum

USFWS was given approval to continue a mass marking program for Quilcene summer chum that was started in 1998. Hatchery production (350,000) will be adipose only marked.

C. Alaskan Pink Salmon Fry (*Approval already granted)

ADFG was earlier granted a temporary exemption to mark 50,000 pink salmon fry with the adipose only mark as part of a genetic study. This request was reviewed by the Committee in February because of the need to mark the fish as early as possible.

D. Request to Adipose Only Mark a Small Group of Lake Ozette Sockeye Salmon

The Makah Tribe was granted approval to again mark a small group of Lake Ozette hatchery sockeye fry salmon with the adipose only mark. This is a repeat of the request granted for the past three years. However, the proposed number of fry to mark has decreased from 50,000 to 28,000 and a decision is pending on whether or not the fish will be marked.

9. Revised Charter for the Mark Committee

The full committee reviewed the Charter Subcommittee's recommended changes to the draft charter that have first been presented during the 1998 Mark Meeting in Lewiston, Idaho. These changes include a recommendation to reduce the voting level from 75% to 67% for approval of new proposals. In addition, further clarification had been added to help identify which marking issues should come before the Mark Committee and which ones should be forwarded to the Pacific Salmon Commission.

The discussion proved to be very interesting and took a surprise turn that reflected political reality. Most of the Subcommittee's changes to the Charter, including the 2/3 vote needed for approval, seemed to meet with agreement.

Consensus unraveled when the discussion turned to the final phase of having the various agency directors sign the Charter. Marc Hamer (CDFO) noted that he wasn't able to endorse the document for forwarding to his director until it had been more thoroughly reviewed in-house. As the discussion continued, it became increasing clear that it would be next to impossible to get the necessary signatures of all of the agencies represented by the Mark Committee. The problem was not with the Mark Committee's role, per se, but more one of political cautiousness by the various agencies in giving 'power' to any group when it could be interpreted to supercede their authority.

Action: The Committee agreed to drop the attempt to have the agency directors sign the Charter. In its stead, the Charter will be redefined as the guiding Principles and Guidelines for the normal operations of the Mark Committee.

The Subcommittee on the Charter was asked to complete the task and report back to the full committee. Ron Olson (NWIFC), David Zajac (USFWS), Lee Blankenship (WDFW), and Ken Johnson (PSMFC) agreed to continue serving on the Subcommittee of the Charter.

10. Update on PSC Data Standards Meeting

Marc Hamer (CDFO) reported that the PSC Data Standards Working Group (DSWG) met just before the Mark Committee (April 13-14). Among other tasks, they evaluated the effectiveness of PSC Format Version 3.2 in capturing the necessary release and recovery information associated with mass marking and selective fisheries. He noted that Jim Longwill (PSMFC) gave a brief presentation on some of the protocols (e.g. HTML) that might be considered for future data exchange. It was proposed that DSWG adopt a CSV format and implemented as Version 4.0. Included was a draft set of specifications using the CSV format. Time constraints precluded the group from discussing the full set. However, the DSWG did decide to provisionally go with the CSV format for Version 4.0.

Action: The new format will be the main agenda item at a DSWG meeting tentatively scheduled in the fall of this year.

Another item discussed was the intent and utility of the data description file in both the current and proposed exchange systems. The original intent of the file was to inform users what the initial file contained, or if re-submitted, what had changed from the previous submission. Committee members agreed that it is impractical to expect an agency to track every field within every file and report every change. Similarly, it is difficult to specify just what changes are to be reported. Therefore, it was decided that reporting agencies should be able report any information related to the status of the datasets that was considered to be relevant, regardless of its nature. Under the existing description file specifications for Version 3.2, this type of reporting is very difficult. Consequently, it was recommended that a free format be used.

Action: Kathy Fraser (CDFO) will develop a Window's based program that will permit free form input and generate a formatted description file.

A third key issue that Data Standards discussed concerned the impact on data management of tag recoveries when a tag code is reused. For many years now, a reused tagcode resulted in the first release being re-coded as a "*1", while the second release was coded as a '*2'. As a recent example, tag code 635005 (92 brood summer chinook from Wells Dam) was impacted by the release of the same code in 93 brood coho from Voights Creek Hatchery, also in Washington. Using the existing coding agreements, a '*1' was appended to the original tagcode in the release file. However, any recoveries remained as the original code in the recovery files. As such, the recoveries for 635005 became invisible to data users who attempted to retrieve them by using the 635005*1 version (then the only valid tag code in the release file). In this example, approximately 185 recoveries became out of synch with the release file.

Marc stressed that reused tags have been discussed many times during the last fifteen years by both the Mark Committee and the DSWG. While no workable solution has been found to eliminate the reuse of CWT's, it was noted that the frequency of reuse has dropped in recent years. Although DSWG does not condone the reuse of CWT's, it decided to alter the specifications for release and recovery files in order to make it easier for the database systems to handle the reused tag information.

Action: A new field will be added to the release record format to indicate tag reuse. The original release record will carry a value in the new field if the tag code has been reused.

In addition, the use of the '*1' value will be no longer used to indicate the first use of a tagcode that was reused. Said another way, the original tagcode in both the release and recovery files will not be altered. (i.e., no future use of '*1' if the tagcode is reused. However, the second release will still continue to have a '*2' appended to the release file tagcode.

Recoveries from the reused CWT release may be reported with the '*2'. However, as with the current specifications, it is the reporting agency's option to resolve them or choose to report them as status 7's. Historical release and recovery information which currently carries the '*1' coding need not be altered.

11. Agency Reports on Tagging and Marking Plans for 1999

Tag coordinators reported that they did not foresee any significant changes for tagging and marking levels in 1999.

12. Update on 1998 High Seas Sampling Program

Adrian Celewycz (NMFS-Alaska) reviewed the high seas sampling program for CWT marked fish, including fisheries sampled, research conducted, and occurrence of ESA-listed stocks. His report is presented below in its entirety:

High-seas cwt recoveries in 1997

by Adrian Celewycz, NMFS, Auke Bay Laboratory

In 1997, observers on US domestic groundfish vessels in three trawl fisheries on the high seas in the North Pacific Ocean, Gulf of Alaska, and Bering Sea recovered a total of 124 cwts from 51,163 salmonids examined for a cwt occurrence rate of 0.24% (or 1 cwt/413 fish examined). Chinook salmon comprised 96% of tagged fish recovered in the commercial trawl fishery, accounting for 119 of the 124 cwts recovered.

In the 1997 trawl fishery targeting whiting in the North Pacific Ocean off Washington, Oregon, and California, chinook salmon and coho salmon were the only species with cwt recoveries. Of the total of 1913 salmon examined for cwts, 79% were chinook salmon, with coho salmon, pink salmon, and chum salmon comprising the other 21%. Of the 1511 chinook salmon examined, 54 cwts were recovered, for a tag occurrence rate of 3.6% for chinook . Of the 157 coho salmon examined, 4 cwts were recovered, for a tag occurrence rate of 0.9% for coho. The 54 cwt chinook salmon recovered in this fishery in 1996 represented a 42% increase over the 38 cwt chinook that were recovered in this fishery in 1996, but only about half of the 104 cwt chinook recovered in 1995. Because the total bycatch of chinook in this fishery was 4414, a rate of 2.9 can be applied to the 54 cwt recoveries to come up with an approximation of 158 cwt chinook salmon in the total catch of chinook salmon in the 1997 whiting fishery off Washington, Oregon, and California. This approximation should not be considered an "expansion", because a true expansion would be calculated on a vessel by vessel basis in this fishery and would take into account the ratio of marked to unmarked fish released for each tag code. This approximation is calculated simply by multiplying the number of cwt chinook recovered by the ratio of total chinook captured over the number of chinook examined for cwts.

In the 1997 trawl fishery in the Gulf of Alaska, chinook salmon was the only species with cwt recoveries. Of the total of 2576 salmonids examined for cwts, 82% were chinook salmon, 17% were chum salmon, and the remaining 1% were pink, coho, and sockeye salmon. Of the 2130 chinook salmon examined, 12 cwts were recovered for a tag occurrence rate of 0.6% for chinook salmon. Because the total bycatch of chinook in this fishery was 15,118, a rate of 7.1 can be applied to the 12 cwt recoveries to come up with an approximation of 85 cwt chinook salmon in the total catch of chinook salmon in the trawl fishery in the Gulf of Alaska in 1997.

In the 1997 trawl fishery in the Bering Sea-Aleutian Islands, chinook salmon comprised 98% of the cwt recoveries, with chum salmon comprising the other 2%. Of the 46,674 salmon examined for tags, 53% were chum salmon, 46% were chinook salmon, with pink, coho, and sockeye salmon comprising the remaining 1%. Although over 6 times as many chinook salmon were examined for cwts in the Bering Sea-Aleutian Islands trawl fishery than in the North Pacific and Gulf of Alaska trawl fisheries combined, only 45% of the total cwt chinook salmon were recovered from the Bering Sea-Aleutian Islands. Of the 21,777 chinook salmon examined, 53 cwts were recovered for a tag occurrence rate of 0.2%. Because the total bycatch of chinook salmon in this fishery was 50,217, a rate of 2.3 can be applied to the 53 cwt recoveries to come up with an approximation of 122 cwt chinook salmon in the total catch of chinook salmon in the trawl fishery in the Bering Sea-Aleutian Islands in 1997. Notable recoveries in this fishery include: 1) the first information on summer distribution of Yukon River chinook salmon in the offshore waters of the eastern Bering Sea, and 2) the second and third reported recoveries of Washington-origin chinook salmon in the Bering Sea. One cwt chum salmon was also recovered out of the 24,897 examined, for a tag occurrence rate of 0.004%. An approximation of the total catch of cwt chum salmon could not be calculated, because the total harvest of chum salmon in this fishery is not known.

Approximations of the total bycatch of cwt chinook salmon were calculated for each of the three trawl fisheries for the period 1991-97:

	WA-OR-CA	Gulf of Alaska	Bering Sea-Aleutian Islands
1991	93	343	7
1992	110	379	47
1993	56	518	88
1994	239	507	71
1995	453	292	0
1996	117	78	68
1997	158	85	122

(Approximations of total bycatch of cwt chinook salmon were calculated in the same manner as described previously.) The bycatch of cwt chinook salmon in the whiting fishery off the coast of Washington, Oregon, and California peaked in 1995, when 453 cwt chinook were captured. Throughout the 90's, the bycatch of cwt chinook salmon in the Bering Sea-Aleutian Islands trawl fishery has generally been lower and more stable from year to year than in the other two fisheries. The Gulf of Alaska trawl fishery had the highest bycatch of cwt chinook salmon of all three fisheries in the early 90's. Since the peak years of over 500 cwt chinook salmon in the Gulf of Alaska in 1993 and 1994, the bycatch has declined to 85 cwt chinook salmon in 1997. In two out of the last three years of data, the highest bycatch of cwt chinook salmon occurred in the whiting fishery off Washington, Oregon, and California.

Approximations of the total bycatch of Snake River fall chinook salmon were calculated for each of the three trawl fisheries for the period 1991-97:

	WA-OR-CA	Gulf of Alaska	Bering Sea-Aleutian Islands
1991	8	0	0
1992	8	0	0
1993	0	0	0
1994	4	0	0
1995	4	0	0
1996	19	0	0
1997	12	0	0

The only trawl fishery in which Snake River fall chinook appeared was the whiting fishery off Washington, Oregon, and California. The peak harvest of Snake River fall chinook occurred in 1996, when the total number of cwts was approximated to be 19.

Tagged salmonids were also sampled on the high seas by Fisheries Agency of Japan (FAJ) gill-net and longline research. A total of 7 cwt steelhead salmon were recovered by FAJ in 1997. Four of these steelhead originated in Idaho, and three originated in Washington. Six of these fish were recovered at longitude 180, at latitudes ranging from 41 to 49 degrees North. The other steelhead was recovered in the Gulf of Alaska.

Tagged salmonids (juveniles, immatures, and adults) were also captured in the Gulf of Alaska in 1996 by the Ocean Carrying Capacity (OCC) program, cooperative research between the National Marine Fisheries Service (NMFS), the Canadian Department of Fisheries and Oceans (CDFO), and the Fisheries Research Institute (FRI). Out of the 5202 salmonids examined for cwts (44% chum salmon, 25% pink salmon, 21% sockeye salmon, 8% coho salmon, and 1% chinook salmon), two cwt coho salmon and one cwt chinook salmon were recovered.

Preliminary analysis of 1998 data has yielded some interesting recoveries; research trawl surveys conducted by NMFS, Auke Bay Laboratory have confirmed the presence of yearling Columbia River basin stream-type chinook salmon off the coast of northern southeastern Alaska in June. In June, 1998, three cwt chinook salmon were recovered off the coast of northern southeastern Alaska just a couple months after being released from hatcheries in the Columbia River basin. These yearlings, 8-9" long and just under 0.5 lbs in weight, swam >1550 km in <100 days at sea. Not only were these fish captured on the same day in June, they were captured in the same location. Columbia River basin stream-type chinook salmon in their first summer at sea have only been recovered off the coast of southeastern Alaska in June; none have ever been recovered in trawl surveys later in the season in July, August, September, or October.

13. Enumerating CWT Pre-release Mortalities in Mass Marked Groups

Ron Olson (NWIFC) requested a discussion of whether or not agencies are checking 'morts' for CWTs with a wand to correct the number of fish released with tags.

Lee Blankenship responded that WDFW checks for 'morts' for only the first 10 days. The assumption is that there is equal mortality between tagged and untagged fish. Ron Olson questioned if differential mortality might be a biasing factor when double index tagging chinook. Lee replied that the experimental design would be the same, with no biasing expected from differential mortality.

Christine Mallette (ODFW) stated that ODFW also assumes equal rates of mortality between tagged and untagged fish. The bulk of the fish are ponded together and tag retention samples (500 fish) are taken at 30 days. Rodney Duke also added that Idaho follows the same basic procedure.

14. Differential Survival of Ventral Fin and Adipose Fin Clips

Geraldine Vander Haegen (WDFW) presented the final results for a long term WDFW/USFWS study designed to measure the effect on survival following removal of the ventral and adipose fin on coho (1990-1991 broods) and fall chinook (1992-1994 broods). The study was conducted at Spring Creek NFH on the Columbia River. Coho were marked with the LV+CWT or Ad+CWT mark, while fall chinook were marked with either the CWT only, Ad+CWT, LV+CWT, or Ad-LV+CWT mark (**Attachment 8**).

More coho returned with the Ad+CWT mark than the LV+CWT mark. The left ventral marked fish has a reduced survival ranging from 6% to 55%. While the difference was not statistically significant, it was very close and the power of the ANOVA was low. Hence, Geraldine strongly recommended caution in selecting the use of the ventral clip as a mass mark.

Fall chinook likewise returned in decreasing numbers in the following order: CWT only (highest returns), Ad+CWT, LV+CWT, Ad-LV+CWT. Compared with CWT only returns, declines in returns averaged 8.1% for Ad+CWT, 51% for LV+CWT, and 63% for Ad-LV+CWT. The differences were statistically significant between the CWT only mark and the Ad-LV and Ad-LV+CWT marks.

Geraldine noted that Washington releases about 143 million chinook annually. Hence, based on the differences in survival rates reported above, the use of the LV as a mass mark could result in approximately 47% fewer adults returning than if the adipose clip is used. At a return rate of 0.06%, this would equate to 40,000 fewer adults! Clearly the ventral fin is not recommended as a mass mark.

15. Update on Photonic Marking (ODFW)

Christine Mallette presented the results of ODFW's study: 'Evaluate the technical and biological feasibility of using photonic marking to mark large numbers of juvenile coho salmon'.

Two groups of 16,000 juvenile coho at Sandy Hatchery were marked with a fluorescent red mark or a cryptic blue mark, respectively. Each group also received a CWT and adipose clip. No photonic marks were observed on either returning jacks or adults.

Her conclusion was succinct: Photonic marking is not a feasible mass marking method for identifying adult returns.

16. Update on Visual Implant Elastomers (ODFW)

Christine Mallette also reported on ODFW's study: 'Evaluate the technical and biological feasibility of using Visual Implant Elastomers to mark large numbers of juvenile coho salmon'.'

In July, 1998, a total of 66,170 juvenile coho at Sandy Hatchery were marked with a red elastomer tag in the right jaw. Later that fall, the fish were give a CWT and then remarked with a green VIE tag if the red VIE tag was not easily detected.

A standard pre-release CWT and VIE tag retention sample revealed that 2% of the fish had shed the VIE tag during the period of 3-7 months. Returning jacks will be sampled for the CWT and VIE marks in the fall of 1999.

17. Returns of Chinook Salmon Coded-Wire Tagged with 1.1 mm and 1.5 mm Coded-Wire Tags and Adult Electronic Detection (WDFW).

This agenda item was included in WDFW's report on electronic detection (see Item 6c).

18. Chi Square Analysis of Double Index Tag Groups Released in Washington (WDFW)

Lee Blankenship reported on a preliminary comparison of the survival of Ad+CWT versus CWT only marked fish in limited selective fisheries and non-selective fisheries (**Attachment 9**). It was found that significantly more CWT only fish than Ad+CWT marked fish returned to Forks Creek, Bingham Creek, and Humptulips hatcheries after having been exposed to limited selective fisheries. In contrast, fish returning to George Adams hatchery and not having been subjected to a selective fishery exhibited no difference between the Ad+CWT and CWT only marks. He noted that while this is a very preliminary analysis, the trends bear out the prediction that selective fisheries will protect wild fish.

5:00 P.M. Meeting closed

6:00 P.M. Vancouver Aquarium for 'behind the scenes' tour.

April 16 (Friday): Morning Tour of Capilano Hatchery.

Attachment 1`

Mark Committee Meeting -- April 15-16, 1999

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WDFW 1998 Brood Coho Mass Marking

Columbia River Total	17,780,000
Puget Sound Total	11,739,000
Coast Total	5,856,000
State Total	35,375,000

NB: Asterisks indicate areas where we have co-managers' agreement and are preparing to mark, lines through production indicates it will not be marked, and the remainder is intended for marking following co-managers' agreement.

Columbia River

Complex	Hatchery	Stock	Number	Comments
Elochoman	Deep River NP	Type-S (Grays River)	*400,000	
	Elochoman	Type-N (General)	*550,000	
		Type-S (General)	*450,000	
	Grays River	Type-S (Grays River)	*150,000	
	Steamboat Slough NP	Type-S (Grays River)	*210,000	
Cowlitz	Cowlitz Salmon	Type-N (Cowlitz)	*4,000,000	
	Riffe Lake Program	Type-N (Cowlitz)	*200,000	
	~~Cowlitz Falls Project~~	~~Type-N (Cowlitz)~~	~~1,000,000~~	
	Kraus Project	Type-N (Cowlitz)	*10,000	
Kalama	North Toutle	Type-S (Toutle)	*1,100,000	
	Fallert Cr	Type-S (General)	*525,000	
	Kalama Falls	Type-N (General)	*700,000	
Lewis	Lewis River	Type-N (General)	*2,115,000	DIT 150K
		Type-S (General)	*880,000	DIT 150K
	Speelyai	Type-S (General)	*1,000,000	
Washougal	Washougal	Type-S (General)	*1,800,000	
		Type-N (General)	*1,200,000	
		Type-S (General)	*100,000	
	Morgan Creek Pond	Type-N (General)	*25,000	
	Ted Shaw Ponds	Type-N (General)	*15,000	
Klickitat	Klickitat	Type-N (General)	*1,350,000	DIT 90K

Washington Coast

Complex	Hatchery	Stock	Number	Comments
Grays Harbor	Aberdeen Net Pens	Wishkah R (22.0191)	*300,000	
	Bingham Cr	Satsop R (22.0360)	*300,000	DIT 150K
		Satsop R Late Stock	*300,000	
	Buzzard Creek	Wishkah R (22.0191)	*25,000	
	Carlisle Lake Project	Satsop R (22.0360)	*100,000	
	Eight Creek Project	Satsop R (22.0360)	*100,000	
	Elma FFA	Satsop R (22.0360)	*1,000	
	Elma Game Assoc.	Satsop R (22.0360)	*500,000	
	Grays Harbor Gillnetters	Humptulips R 22.0004	*200,000	
	Humptulips	Humptulips R 22.0004	*1,350,000	
		Satsop R Late Stock	*200,000	
	Johnson Project	Satsop R (22.0360)	*50,000	
	Lk Aberdeen	Van Winkle	*30,000	
	Ocean Shores Net Pens	Humptulips R 22.0004	*100,000	
	Skookumchuck	Satsop R (22.0360)	*100,000	
	Westport Net Pens	Humptulips R 22.0004	*200,000	
Willapa	Forks Creek	Willapa (Fork Creek)	*500,000	DIT 150K
		Willapa Lates	*100,000	
	Naselle	Naselle R (24.0543)	*800,000	
		Naselle Lates	*100,000	
	Nemah	Nemah R (24.0460)	*500,000	

Puget Sound

Complex	Hatchery	Stock	Number	Constraints
Nooksack	Kendall Cr	Nooksack (Kendall Cr)	300,000	DIT 90K
	Blaine High School		10,000	
	Glenwood Springs	Whatcom Cr (01.0566)	100,000	
	~~RFEG 1 Nooksk/Samish~~	~~Skookum Cr (01.0273)~~	~~50,000~~	
	Whatcom Cr	Nooksack (Kendall Cr)	5,000	
Skagit	Marblemount	Skagit R (03.0176)	250,000	DIT 90K
	Laebugten Wharf Net Pens	Skagit R (03.0176)	30,000	
	Indian Slough	Skagit R (03.0176)	100,000	
	Oak Harbor Net Pens	Skagit R (03.0176)	30,000	
	Rfeg 2 Skagit	Skagit R (03.0176)	150,000	
Snohomish	Wallace River	Skykomish -May Creek	300,000	DIT 90K
	Ballard Salmon Club	Skykomish -May Creek	30,000	
	RFEG 3 Stilly-Snohom	Skykomish -May Creek	20,000	
	~~Washington Trollers~~	~~Skykomish -May Creek~~	~~15,000~~	
Green River	Issaquah	Issaquah Cr 08.0178	450,000	
	~~Bridgehaven Assoc~~	~~Issaquah Cr 08.0178~~	~~25,000~~	
	Cross Project	Issaquah Cr 08.0178	50,000	
	Lynnwood High School	Issaquah Cr 08.0178	10,000	
	Soos Creek	Big Soos Cr 09.0072	600,000	DIT 90K
	Crisp Creek	Big Soos Cr 09.0072	600,000	400K to Elliott Bay Pens
	Marine Tech Center		10,000	
	Seattle Aquarium	Big Soos Cr 09.0072	25,000	
	~~Vashon Sportsmen~~	~~Big Soos Cr 09.0072~~	~~30,000~~	
	UW	Portage UW	*90,000	
Puyallup	Voights Cr	Voight Cr (10.0414)	1,180,000	DIT 90K
		Voight Cr (10.0414)	200,000	
Minter	Coulter Cr	Minter Cr (15.0048)	*600,000	
	Fox Island Net Pens	Minter Cr (15.0048)	*50,000	
	Minter Cr	Minter Cr (15.0048)	*1,444,000	
	NWSSC - Des Moines	Minter Cr (15.0048)	*20,000	
	SOS	Minter Cr (15.0048)	*30,000	
South Sound	South Sound Net Pens	Skykomish -May Creek	2,400,000	DIT 90K
Hood Canal	George Adams	George Adams (Purdy)	500,000	DIT 90K
	George Adams	Big Quilcene R (17)	425,000	
Dungeness	Dungeness	Dungeness R 18.0018	800,000	
	~~Hurd Creek~~	~~Snow Creek (17.0129)~~	~~10,000~~	Critical stock recovery (probably CWT only)
	Solduc	Summer Soleduck R	200,000	
	Solduc	Fall Soleduck R	600,000	DIT 150K

Coho Selective Fisheries for Washington 1999-2000

As of April 12, 1999, wild coho must be released in the following fisheries:

Area	Date
Marine Area 1 - Ilwaco	Jul 19 - Sep 30
Marine Area 2 - Westport-Ocean Shores	Jul 19 - Sep 30
Marine Area 2-1 (east of Buoy 8 line)	Aug 16 - Jan 31
Marine Area 3 - LaPush	Jul 19 - Sep 30
Marine Area 4 - Neah Bay	Jul 19 - Sep 30
Marine Area 5 - Sekiu and Pillar Point	Aug 1 - Sep 30
Marine Area 6 - East Juan de Fuca Strait	Aug 1 - Sep 30
Marine Area 13 - South Puget Sound	Jul 1 - Oct 31
Marine Area 13 - South Puget Sound, Fox Island Public Fishing Pier	Jul 1 - Oct 31

Attachment 4

USFWS COHO MASS MARKING
BROOD YEAR 1997

HATCHERY	RELEASE SITE	TOTAL PROD	# AD CLIP	# CWT/AD CLIP	# CWT/NO CLIP	NO TAG/CLIP
Makah	Sooes R. (Wa)	200,000	128,000	36,000	36,000	0
	Waatch R. (Wa)	30,000	30,000	0	0	0
Quinault	Cook Cr. (Wa)	690,000	0	80,000	80,000	530,000
Quilcene	Quilcene R. (Wa)	450,000	360,000	45,000	45,000	0
	Quilcene Bay (Wa)	200,000	0	49,000	45,000	107,000
Eagle Cr.	Eagle Cr. (Or)	1,137,000	1,037,000	50,000	50,000	0
	Youngs Bay (Or)	963,000	913,000	25,000	25,000	0
Willard	L. W. Salmon R (Wa)	2,100,000	2,000,000	50,000	50,000	0
	Clearwater R (Id)	568,000	0	50,000	50,000	468,000

January 26, 1999

Canada

1996 Brood. Mass marking of 1996 brood coho from Canadian hatcheries occurred mainly as planned. Some minor stocks were not marked, due to concerns about their stock status, and reduced numbers were marked at two hatcheries due to disease concerns. Additional numbers were marked at other sites where more fish were available than expected. A total of 6.8M adipose clipped coho were released in 1998. Details of mass marking and tagging are in Table 5.

1997 Brood. Mass marking of 1997 brood coho is completed, but final numbers are not yet available. Similar stocks and numbers were marked as for 1996 brood. The program was expanded to include two stocks on the West Coast of Vancouver Island. 845k Robertson Creek and 116k Conuma River coho were adipose clipped and will be released in the spring of 1999. Robertson Creek stock was double index tagged with 40k ad-CWT and 40k CWT-only.

Table 5: Actual 1996 Brood Mass Marked Coho Released by Canada in 1998

Project	Stock	Target Release	Clipped Release	Coded-Wire Tags		Comment
				Ad-CWT	CWT	
Capilano River	Capilano R	525,000	529,904	43,393		
Chapman Creek	Chapman Cr.	75,000	80,000			
Powell River	Lang Creek	55,000	58,067	20,165		
Reed Point/Ioco	Capilano R	10,000	2,180			
Sechelt	Maclean Bay	17,000	23,752			
Sliammon River	Sliammon R	30,000	26,723	26,723		
Trans Mountain	Capilano R	10,000	10,100			
Big Qualicum R	Big Qualicum	1,250,000	1,192,901	40,331	41,355	additional 10% released unclipped
Goldstream R	Goldstream R	81,000	29,912	29,912	21,990	DIT tagging only; rest unclipped; total release 79,970
Puntledge River	Puntledge R	800,000	520,678	37,626		additional 25% released unclipped due to disease
Quinsam River	Quinsam R	1,200,000	811,536	39,813	40,078	additional 45% released unclipped due to disease
Chehalis River	Chehalis R	1,007,000	1,171,184	35,696		
Chilliwack R	Chilliwack R	1,950,000	1,776,574	37,282	38,316	additional 5% released unclipped
Inch Creek	Inch Creek	200,000	164,646	41,918	43,569	
Inch Creek	Stave River	430,000	448,085	30,209		
Robertson	Robertson	800,000	0	39,578	39,789	934k released;96 brood WCVI sites not mass marked
		8,440,000	**6,841,242**	**422,646**	**225,097**	

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Trans Mountain	Capilano R	10,000	10,100			
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		8,440,000	**6,841,242**	**422,646**	**225,097**	

WDFW 1998 Brood Chinook Mass Marking

	Status Legend	Available Production Zero	Yearling	% of Total*
NO	No Agreement at this time	4,560,000	1,780,000	27%
PEND	Agreement Pending	3,240,000	300,000	15%
YES	Approved to Start	6,810,000	1,325,000	35%
DONE	Done	3,685,000	1,642,000	23%

* % of Total is the percent of fish available to mark. This is not the percent of all chinook production

Complex	Hatchery	Available Production Zero	Yearling	Marking Status	Co-Managing Tribe
Nooksack	Kendall		100,000	NO	Nooksack/Lummi
	Glenwood Springs	500,000	200,000	NO	Nooksack/Lummi
	Whatcom Creek	500,000		NO	Nooksack/Lummi
	Samish	1,560,000		NO	Nooksack/Lummi
Skagit	Ballard SC		20,000	NO	Muckleshoot/Suquamish
	Elliott Bay NP		60,000	NO	Muckleshoot/Suquamish
	NWSSC - Demoines		30,000	NO	Muckleshoot
	NWSSC - Mukilteo NP		20,000	NO	Tulalip
	Oak Harbor NP		30,000	NO	SSC/Lummi/Tulalip
	RFEG Skagit		60,000	NO	SSC
	RFEG Stilly-Snohomish		15,000	NO	Stillaguamish
	Roche Harbor NP		7,500	NO	Nooksack/Lummi/SSC
	San Juan NP		10,000	NO	Nooksack/Lummi/SSC
Snohomish	Wallace River		600,000	NO	Tulalip
	Tumwater Transfer	2,200,000		YES	Squaxin/Nisqually
	Sea Springs		375,000	YES	Squaxin/Nisqually
Green River	Issaquah	1,000,000		PEND	Muckleshoot
	Soos Creek	2,240,000		PEND	Muckleshoot
	Icy Creek		300,000	PEND	Muckleshoot
	UW	60,000		YES	Muckleshoot
Minter	Coulter	1,000,000		YES	Squaxin/Nisqually/Suquamish/ Puyallup
	Minter	1,800,000		DONE	Squaxin/Nisqually/Suquamish/ Puyallup
	RFEG South Sound	35,000		DONE	Squaxin/Nisqually/Suquamish/ Puyallup
	Tumwater Transfers	1,500,000		YES	Squaxin/Nisqually
Puyallup	Voights	800,000		YES	Puyallup
	Chambers Bay		100,000	YES	Nisqually/Puyallup

Complex	Hatchery	Available Production Zero	Available Production Yearling	Marking Status	Co-Managing Tribe
South Sound	Garrison	425,000		DONE	Nisqually/Puyallup
	Chambers		200,000	YES	Nisqually/Puyallup
	Lakewood		200,000	DONE	Nisqually/Puyallup
	Tumwater @Lakewood	300,000		DONE	Squaxin/Nisqually
	Mcallister	1,125,000		DONE	Squaxin/Nisqually
Nisqually Tribe	Clear Creek	1,000,000		YES	Nisqually
Hood Canal	George Adams	1,500,000		NO	Point-No-Point Treaty Tribes
	Hoodsport	500,000	250,000	NO	Point-No-Point Treaty Tribes
	Tumwater Transfer		250,000	YES	Squaxin/Nisqually
	Ricks Pond (Floor)		100,000	NO	Point-No-Point Treaty Tribes
	Lilliwap (Floor)		100,000	NO	Point-No-Point Treaty Tribes
	Fox Island		250,000	YES	Squaxin/Nisqually
	SSNP		150,000	YES	Squaxin/Nisqually
	Sund Rocks		150,000	NO	Point-No-Point Treaty Tribes
	Hood Canal Marina		12,500	NO	Point-No-Point Treaty Tribes
	Pleasant Harbor		15,000	NO	Point-No-Point Treaty Tribes
Total Puget Sound Chinook		18,045,000	3,605,000		
Columbia River					
Cowlitz	Cowlitz Salmon		912,000	DONE	
	FOC transfer		20,000	DONE	
Kalama	Fallert Creek	250,000		YES	
Lewis River	Lewis River		600,000	DONE	
	Fish First transfer		110,000	DONE	
Total Columbia River Chinook		250,000	1,642,000		
Total Washington State Chinook		18,295,000	5,247,000		

APRIL 13, 1999

Returns of chinook salmon coded-wire tagged with 1.1 mm and 1.5 mm coded-wire tags and adult electronic detection.

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In Washington, anadromous salmon have historically been, and are still, economically and culturally important. However, many salmon populations have declined to the lowest levels ever recorded, resulting in drastic reductions in the sport and commercial fisheries. In 1993, the Washington State Legislature mandated mass marking of appropriate hatchery salmon to allow the possibility of selective fisheries for exploitation of healthy stocks, while protecting weak stocks. Excision of the adipose fin was chosen as the mass mark for hatchery fish because anglers can easily identify it, the associated mortality is low compared with the excision of other fins, and application is inexpensive (PSMFC 1992). In a selective fishery, anglers could retain salmon missing an adipose fin, but must release those with an adipose fin.

Before 1996, a missing adipose fin had signified the presence of an internal coded-wire tag (CWT). Sequestering the adipose clip to designate a hatchery reared fish therefore meant that the presence of a CWT could not be determined from this clip. Using a second fin clip, such as a right or left ventral clip to designate the presence of a CWT was unacceptable because of the high associated mortality. Therefore, electronic detection was chosen for recovering CWT salmon. Four electronic instruments are used to detect CWTs: a portable hand-held wand, a V-shaped portable sampling detector, and two rectangular tunnel detectors, the R-8000 and the R-9500, all manufactured by Northwest Marine Technology (NMT). Recreational fisheries and fish recovered during spawning ground surveys generally will be sampled using the hand-held wand detector, and commercial fisheries and hatchery rack recoveries generally will be sampled using the tunnel detectors.

The standard length of a CWT is 1.1 mm. A portable wand detector can detect this tag from a distance of 20 mm. However, on a large salmon, the tag may be more than 20 mm from the surface, and could go undetected by the wand. Using 1.5 mm CWT can increase the detection distance to 30 mm, and therefore decrease the number of missed tags. However, a longer CWT could interfere with an internal compass or damage the olfactory nerves which would increase straying or reduce survival (Morrison and Zajac 1987, Morrison et al. 1990, Habicht et al. 1998). To further enhance detectability, NMT manufactured "new" wire with a stronger magnetic moment than "old" wire. The magnetic moment of the new 1.5 mm wire is about 200% stronger than that of the old 1.1 mm wire, and the magnetic moment of 1.1 mm new wire is about 60% stronger than that of the old 1.1 mm wire (Northwest Marine Technology, pers. comm.)

This study had two objectives: first, to test whether using 1.5 mm CWT affects adult hatchery rack returns compared with 1.1 mm wire, and second, to test whether we can detect new 1.5 mm CWT with greater accuracy than old 1.1 mm CWT using a wand detector. Adults returning to the hatchery rack represent only part of the overall survival. However, if the longer and larger magnetic moment tags reduced survival or increased straying, the effects would be measurable at the hatchery rack.

Methods

This study was done at Hupp Springs, Soos Creek and Kendall Creek hatcheries in Puget Sound, WA. All are owned and operated by the Washington Department of Fish and Wildlife (WDFW). At each hatchery, we simultaneously tagged equal numbers of 1994 brood year chinook with either old 1.1 mm or new 1.5 mm coded wire tags and marked each with an adipose fin clip (Table 1). Standard WDFW procedures were used for tagging (Schurman and Thompson, 1990). We mixed the tagged fish into the same rearing vessel and reared them until release as either yearlings or subyearlings. Twenty-one days after tagging, we checked the CWT retention and clip quality on about 1500 chinook from each group. Release numbers were adjusted accordingly.

Table 1: Tagging and release parameters, 1994 brood year chinook.

Hatchery	Race	Tag Code	# Tagged Fish Released	Tag Type	Release Stage	Mean FPP Tagged	Mean Length Tagged (mm)	% Tag Retention
Hupp Springs	Spring	635828	127,094	1.1 mm, Old Wire	Subyearling	160	65	98.2
Hupp Springs	Spring	635833	127,786	1.5 mm, New Wire	Subyearling	160	65	98.8
Hupp Springs	Spring	635827	43,662	1.1 mm, Old Wire	Yearling	190	61	97.7
Hupp Springs	Spring	635832	44,094	1.5 mm, New Wire	Yearling	190	61	98.9
Soos Creek	Fall	635826	149,740	1.1 mm, Old Wire	Subyearling	92-248 (range)	77-56 (range)	98.5
Soos Creek	Fall	635831	150,986	1.5 mm, New Wire	Subyearling	92-248 (range)	77-56 (range)	99.1
Kendall Creek	Spring	635829	90,412	1.1 mm, Old Wire	Subyearling	180	62	98.8
Kendall Creek	Spring	635834	85,370	1.5 mm, New Wire	Subyearling	180	62	98.8
Kendall Creek	Spring	635830	82,544	1.1 mm, Old Wire	Yearling	140	67	99.8
Kendall Creek	Spring	635835	80,691	1.5 mm, New Wire	Yearling	140	67	99.4

At the three hatcheries in the fall 1998, returning we examined adults for CWT using a hand-held wand detector. If no CWT was detected, we passed the fish through an R9500 rectangular tunnel detector. In this way, we sorted the fish into three groups: CWT detected using only the wand, CWT not detected using the wand, but detected with the rectangular detector, and no CWT detected. We measured all fish with CWT, noted the sex, and removed the snout CWT recovery. At Kendall Creek Hatchery, coded-wire tags from the first group of fish spawned was recovered by visual identification of fish missing their adipose fin because the electronic detection equipment was unavailable. These 261 heads are included in calculations of the percent return. At Hupp Springs, one extra tag was recovered by visual identification of a fish missing its adipose fin.

Results

Tag Retention

We found no significant difference in tag retention between the old 1.1 mm wire and the new 1.5 mm wire at release ($t=0.31$, $p<0.05$). These retention rates help confirm the statement "WDFW and CDFO tagging supervisors believe that length-and-a-half CWTs can be easily placed in 60 mm (2.2 g) salmon" (SFEC 1995).

Tag Detection

On average, the wand detected 454/500 (90.8%) of the old 1.1 mm wire tags, and 500/503 (99.4%) of the new 1.5 mm wire tags it was exposed to (Table 2).

Table 2: Tag detections and adult returns. Because only the 1998 rack recoveries are currently available, the estimates of adult returns are preliminary. Superscript letters indicate where a chi-square analysis showed a significant difference in hatchery rack returns at the 0.05 level between the fish tagged with 1.1 mm and 1.5 mm wire within each release type. NSD = no significant difference in hatchery rack returns.

Tag Code	Tag Type	Release Stage	# Detected with Wand	# Missed with Wand	% Detected	% Return
Hupp Springs, Spring Chinook						
635828	1.1 mm, Old Wire	Subyearling	37	0	100	0.03[NSD]
635833	1.5 mm, New Wire	Subyearling	42	0	100	0.03[NSD]
635827	1.1 mm, Old Wire	Yearling	6	0	100	0.01[a]
635832	1.5 mm, New Wire	Yearling	18	0	100	0.04[a]
Soos Creek, Fall Chinook						
635826	1.1 mm, Old Wire	Subyearling	77	19	80.2	0.06[NSD]
635831	1.5 mm, New Wire	Subyearling	102	1	99.0	0.07[NSD]
Kendall Creek, Spring Chinook						
635829	1.1 mm, Old Wire	Subyearling	327	27	92.4	0.54[NSD]
635834	1.5 mm, New Wire	Subyearling	334	2	99.4	0.53[NSD]
635830	1.1 mm, Old Wire	Yearling	7	0	100	0.02[b]
635835	1.5 mm, New Wire	Yearling	4	0	100	0.01[b]

The mean size of fish with undetected tags was significantly larger than the mean size of fish with tags the wand could detect ($t=9.24$, $p<0.001$). However, the sizes of fish with undetected tags fell within the range of sizes with detected tags (Figure 1). That is, there was no cut off after which a tag could no longer be detected, but as a fish grew larger, the probability of detecting its tag declined. Because males tend to be larger, the probability of missing a tag was significantly higher in males than in females ($\chi^2=28.246, p<0.001$).

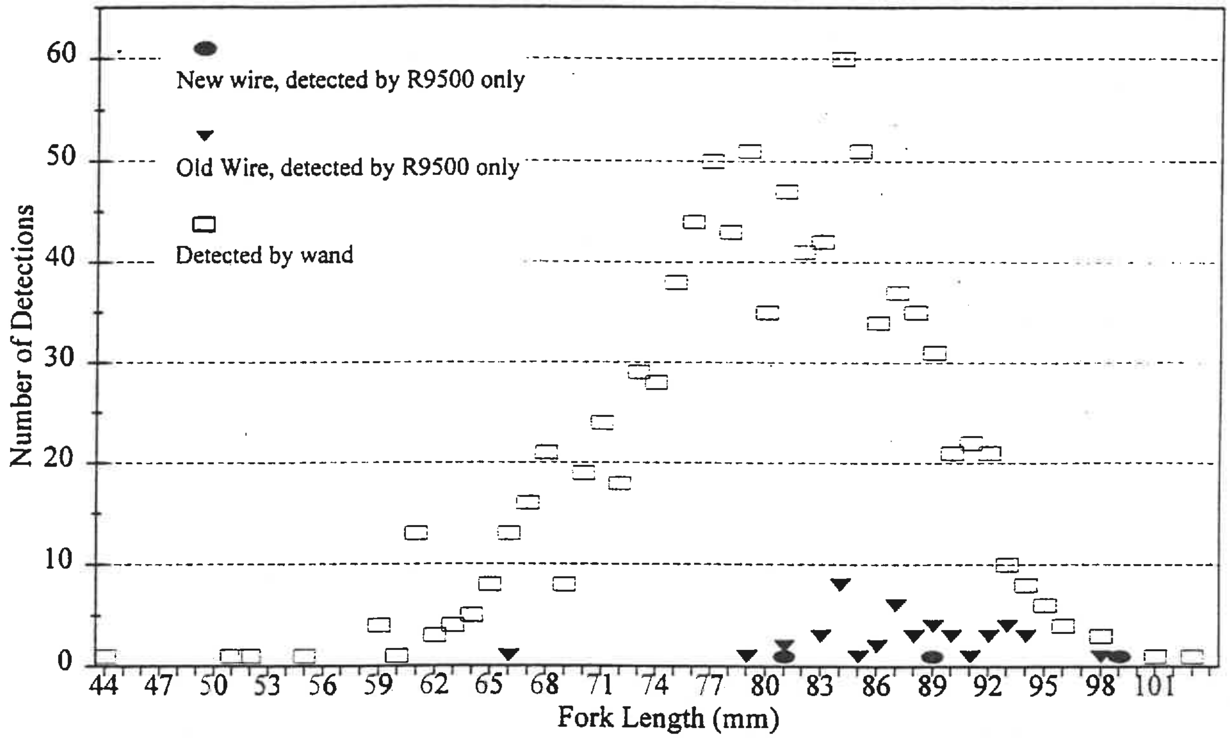

Figure 1:· Fork lengths of fish detected by the wand or missed by the wand and detected by the rectangular tunnel detector. The mean size of the fish with missed tags was significantly larger than the mean size of fish with detected tags (p=9.24, p<0.05).

Hatchery Rack Returns

Hatchery rack returns were estimated by dividing the number of tags recovered at the hatchery racks in 1998 by the number of tags released. Because only one year of rack recovery data is available, these are preliminary estimates. For all hatcheries combined, preliminary tag recoveries (Table 2) show no significant difference in hatchery rack returns between fish tagged with old 1.1 mm wire compared to fish tagged with new 1.5 mm wire. Separately, significantly more Hupp Springs spring chinook released at age 1+ and tagged with new 1.5 mm wire returned than those tagged with old 1.1 mm wire. Conversely, significantly more Kendall Creek spring chinook released at age 1+ and tagged with old 1.1 mm wire returned than those tagged with new 1.5 mm wire. The yearling groups from Hupp Springs and Kendall Creek both had low return rates.

Discussion

The wand detected 91% of old 1.1 mm wire tags it was exposed to, and 99% of the new 1.5 mm wire tags. Thus, the stronger magnetic moment of the new wire improved detectability by about 8%. This improved tag detectability will result in a substantial number of tag recoveries when the total number of fish checked in a year is considered. The preliminary hatchery rack recoveries show that this improved detectability did not compromise chinook adult returns to the hatchery.

Because the wand was able to detect a CWT in the largest fish, it is likely that the techniques of the person using the wand plays a significant role in detection success, and that the correct technique is especially important for larger fish. When a wand is to be used for CWT recovery, the possibility of missed tags disproportionately representing fish larger than 80 cm needs to be considered. This bias will be greatly minimized by using the new, 1.5 mm wire and by careful use of the wand. An alternative approach to 1.5 mm wire would be to use the portable sampling detector for fish greater than 80 cm fork length.

References

Habicht, C., S. Sharr, D. Evans, and J.E. Seeb. 1998. Coded-wire tag placement affects homing ability of pink salmon. Trans. Amer. Fish. Soc. 127:652-657.

Morrison, J.K., C.L. Coyle and S.E. Bertoni. 1990. Histological effect of tagging chum and coho salmon fry with coded-wire tags. Prog. Fish. Cult. 52:117-119.

Morrison, J., and D. Zajac. 1987. Histological effect of coded-wire tagging in chum salmon. N. Am. J. Fish. Manage. 7:439-441.

PSMFC (Pacific States Marine Fisheries Commission). 1992. Mass marking anadromous salmonids: Techniques, options, and compatibility with the coded-wire tag system. PSMFC. Gladstone, Oregon.

Schurman, G. and D. Thompson. 1990. Washington Department of Fisheries' mobile tagging units: Construction and operation. American Fisheries Society Symposium 7:127-133.

SFEC. 1995. Pacific Salmon Commission selective fishery evaluation. Pacific Salmon Commission, Vancouver, BC, Canada.

Effects of ventral fin and adipose fin clips on survival of coho and fall chinook salmon.

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Our goal was to evaluate how different fin clips affect the return rate of coho and fall chinook salmon. We had two hypotheses. First, survival of coded wire tagged (CWT) coho marked with left ventral clips (CWT +LV) or adipose clips (CWT+AD) was the same. Second, fall chinook marked with CWT only, CWT+AD, CWT+LV or CWT+AD+LV survive equally well.

Methods

We marked hatchery coho and fall chinook with combinations of fin clips and gave each group unique coded-wire tags (Table 1). We sampled returning adults for CWTs using electronic equipment. If we detected a CWT, we examined the fish and noted whether any fins were missing, and if so, the fin clip quality. Because fin clips might not be distinguishable, we used the CWT to assign each fish to the correct treatment.

Results

More coho marked with CWT+AD returned than coho marked with CWT+LV (Figure 1). This difference ranged from a 6% to a 56% decline in survival (Table 1). The effect was not significant ($F=6.19$, $p=0.055$). We estimated that the power of the ANOVA was less than 0.30; we therefore had a 70% chance of committing a Type II error.

Fall chinook returned in descending numbers by fin clip in the following order CWTonly, CWT+AD, CWT+LV, CWT+AD+LV (Fig. 2). Analysis of variance and multiple comparisons showed significantly more fish with CWTonly returned than fish with CWT+AD+LV ($F=7.12$, $p=0.02$). At $p=0.1$, fish marked with CWT+AD+LV also showed a significantly lower return rate than fish marked with CWT+LV or CWT+AD. Compared with fish with CWTonly, declines in returns averaged 8.1% for CWT+AD, 51% for fish marked with CWT+LV, and 63% for fish marked with CWT+AD+LV (Table 1).

Clip type did not affect the length at return in coho or chinook. In both coho and fall chinook, adipose marks were easily identified and most were classified as "good" clips. Left ventral clips had fewer "good" clips than adipose clips, and when combined (AD+LV) the quality generally dropped for both clips.

Discussion

We observed fewer coho with left ventral fin clips returning to hatcheries than coho with adipose clips. The difference was not significant, but because it was very close to significance and the power of the ANOVA was low, we recommend caution when selecting a ventral clip rather than an adipose clip. Our study supports the use of the adipose clip rather than a ventral clip for mass marking. For Washington's coho production of 45.7 million fish annually returning at 2.8%, the average 23% decline we observed by using a ventral clip compared with an adipose clip adds up to 294,000 fewer adults.

For conservative management of chinook, our study would recommend the adipose clip rather than a ventral clip. In Washington, 142.6 million chinook are released annually, and if the left ventral clip were used to mark all these fish rather than an adipose clip, we might expect 47% fewer adults returning. At a return rate of 0.06%, this would be about 40,000 fewer adults. Presumably, other sectors of the fishery would have an equal reduction. Once the decision has been made to release hatchery fish, the choice of mark is an important way that we can influence the number of fish available for harvest.

Table 1: Releases and recoveries of coho and fall chinook. For coho, "relative return as escapement" is relative to the corresponding CWT+AD and for chinook, it is relative to the corresponding CWTonly.

Hatchery	Brood Year	Relative Return Rate					
		CWT+AD	CWT+LV	CWT+AD+LV	CWTonly	CWT+VIF	CWT+VIE
COHO							
Voights Cr	1990	X	-6.0%				
Voights Cr	1991	X	-19.4%	-5.1%			
Soos Cr	1990	X	-17.7%				
Soos Cr	1991	X	-11.5%	-8.9%			
George Adams	1990	X	-55.7%				
Marblemount	1991	X	-31.5%	-24.8%	+3.6%	-58.4%	-16.7%
FALL CHINOOK							
Spring Creek NFH	1992	-23.0%	-65.5%	-80.8%	X		
Spring Creek NFH	1993	-8.1%	-48.9%	-63.5%	X		
Spring Creek NFH	1994	+6.1%	-38.8%	-45.2%	X		

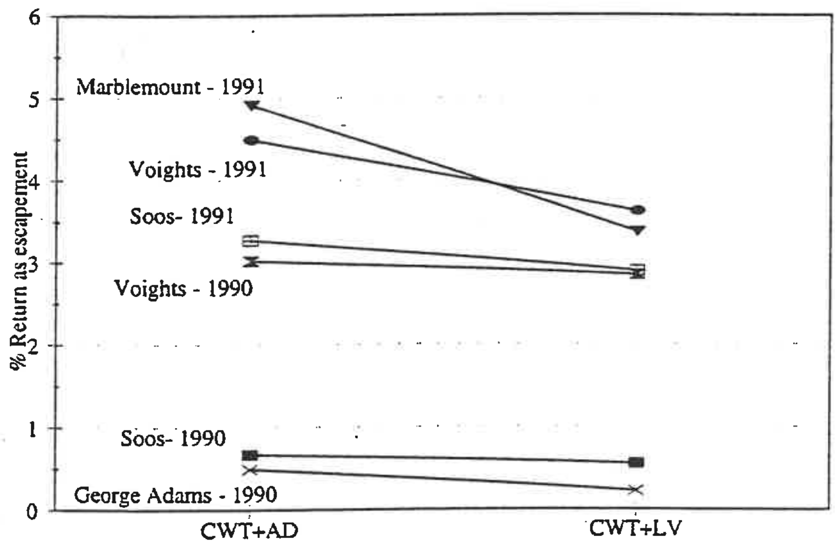

Figure 1: Coho percent return as escapement.

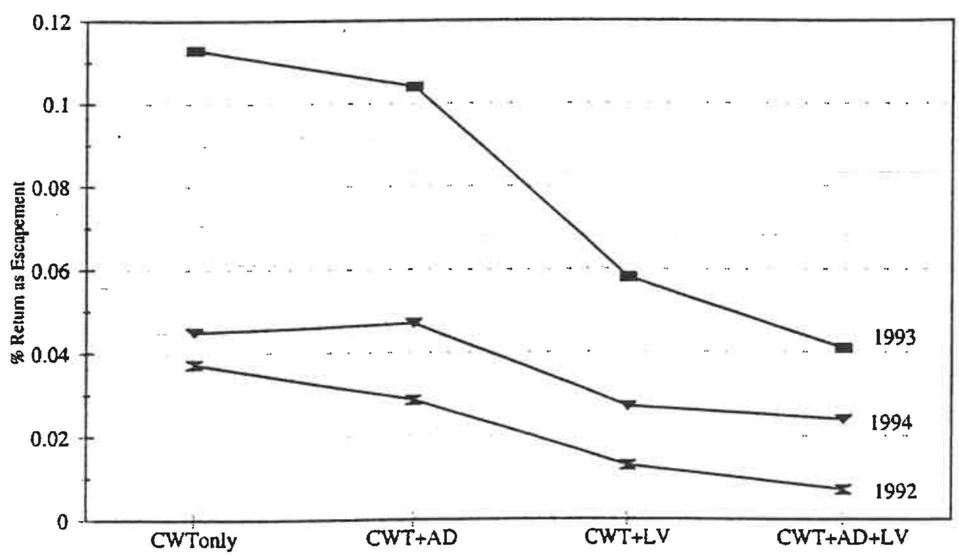

Figure 2: Percent return as escapement of fall chinook released from Spring Creek NFH.

Attachment 9

Chi Square Analysis - Double index tag groups released in Washington
1995 brood coho

Hatchery	Tag Group	Escapement	Unrecovered	Total Released	Chi Square Calc*	Chi Square, 0.05, 1	Conclusion
Exposed to Limited Selective Fisheries							
Forks Creek	AD+CWT	182	75112	75294	8.637	3.841	Significantly more CWT only fish were recovered at the hatchery rack than AD+CWT fish.
	CWT only	242	75255	75497			
	Total	424	150367	150791			
Bingham Creek	AD+CWT	715	71255	71970	8.354	3.841	Significantly more CWT only fish were recovered at the hatchery rack than AD+CWT fish.
	CWT only	831	71509	72340			
	Total	1546	142764	144310			
Humptulips	AD+CWT	219	78853	79072	5.105	3.841	Significantly more CWT only fish were recovered at the hatchery rack than AD+CWT fish.
	CWT only	268	78874	79142			
	Total	487	157727	158214			
Not Exposed to Selective Fisheries							
George Adams	AD+CWT	195	44872	45067	0.305	3.841	No significant difference in the number of fish recovered at the hatchery rack.
	CWT only	184	45058	45242			
		379	89930	90309			

* Reference Zar, J.H. 1984. Biostatistical analysis, 2nd edition. Prentice Hall, USA p. 62