



FISH PASSAGE CENTER

1827 NE 44th Ave., Suite 240, Portland, OR 97213

Phone: (503) 230-4099

Fax: (503) 230-7559

<http://www.fpc.org/> e-mail us at fpcstaff@fpc.org

MEMORANDUM

TO: FPAC
John Harrison, NPCC
Curtis Michael, BPA
Blake E. Smith, Puyallup Fisheries
Jay Hesse, NPT

FROM: Michele DeHart

DATE: July 2, 2009

RE: Adult Count Discrepancies at Columbia and Snake Rivers hydro electric projects.

The FPC received several requests regarding individual counting discrepancies at Snake River and Columbia River hydroelectric projects. We have combined the responses to all of these requests into the following review of adult counting discrepancies. In addition we have attached copies of three responses to previous requests received regarding observed count discrepancies and night time passage.

The FPC staff reviewed counting procedures, passage of PIT tagged fish and count discrepancies and concluded that count discrepancies are likely the result of:

- **Significant and variable fish passage occurring during non-counting hours. The daily proportion of fish passing during night time hours is not constant, and varies by species, project, day and time of year.**
- **Different count procedures and criteria at Public Utility projects and Corps of Engineers projects**
- **Potential errors or bias in visual size determination of fish at counting windows**
- **Adult fall back is variable but does not account for the magnitude of count discrepancy observed in 2009 between Ice Harbor and Lower Granite Dam**

Counting Procedures

Chelan PUD

Chelan PUD uses 24-hour video counts. Daily videos are reviewed by physical counters the next day or in the case of weekends, the next working day (Mon-Fri). Chelan PUD does not have a program that filters the video to only actual objects moving by the camera, so they actually review all of the tape. Chelan PUD typically keeps the last years count data archived. Chelan PUD does not currently have a QA/QC program to verify the accuracy of fish counters, and have not for at least the last decade. Chelan PUD considers all Chinook adults that are between 12 and 24 inches to be jacks. Mini-jacks are not included in counts of Chinook adults. The size of cho jacks is, 20 inches (Table 1).

Grant PUD

Grant PUD uses 24-hour video counts. Grant PUD does have a program that filters the video to only actual objects moving by the camera, so their video that is physically reviewed by fish counters is condensed. Daily videos are reviewed by physical counters the next day or in the case of weekends, the next working day (Mon-Fri). Grant PUD does have a QA/QC program to verify the accuracy of fish counters. Typically new hire fish counters or counters with suspected counting issues are asked to count a certain set of data while at least two other seasoned counters count the same data. The fish count supervisor then compares the results of all three counts for discrepancies. According to the fish count supervisor, new hires sometimes have a more difficult time differentiating some species. According to the fish count supervisor, attempts are made to ensure the fish counter in question does not know he/she is being tested, however sometimes this cannot be accomplished as all counters are housed in the same room and are often familiar what one another are working on. Grant PUD considers all Chinook adults that are less than 22 inches to be jacks. Based on these criteria, this would also include mini-jacks. As with Chelan PUD the size criteria for Coho jacks is <20 inches (Table 1).

Corps of Engineers

During the fish passage season (April through October) the COE uses visual counting from 0400-2000 PST, during periods with daylight savings time this time is actually 0500 to 2100. No adjustments are made for fish that may pass during night-time non-counting hours. Actual counting at COE projects is occurs for 50 minutes of each hour when counting occurs. The 50 minute actual count is adjusted by applying a multiplier to extrapolate the 50 minute count to adjust for the 10 minute per hour non-counting period. The COEs QA/QC program involves a one hour test each month for all fish counters. During this test, both the tested fish counter and the WDFW fish count supervisor each count each species passing for one hour. The tested fish counter must score within 95% of the counts recorded by the fish count supervisor for all species other than shad which is within 85%. According to WDFW fish count supervisors, falling below the 95% or 85% criteria is rare. Most deviations tend to occur differentiating between jacks and adults that are near the size criteria. Sometimes newer fish counts may have some initial trouble differentiating between steelhead and sockeye that are similar size. The COE considers all Chinook adults that are between 12 and 22 inches to be jacks. Mini-jacks are not included in adult Chinook counts. Coho jacks are those adults between 12 inches and 18 inches (Table 1).

Table 1. Adult and Jack Salmon Length Classifications for Columbia, Snake River Dams' and Willamette Falls Fish Counts

Entity	Jack Chinook Length Used	Adult Chinook Length Used	Jack Coho Length Used	Adult Coho Length Used
USACE –	12” – 22”	>22”	12” – 18”	>18”
Grant PUD –	<22”	≥22”	<20”	≥20”
Chelan PUD –	12-24”	≥24”	<20”	≥20”
Douglas PUD	12” – 22”	>22”	not assessed	any coho
ODFW (Willamette Falls)	15”-22”	>22”	<18”	>18”

Differences in count procedures and jack/adult criteria can affect count discrepancies

Counting procedures and criteria differ among projects potentially contributing to count discrepancies.

For example, the FPC reviewed the 2009 count data at Ice Harbor and Lower Monumental Dams. The Chinook adult and jack counts at Ice Harbor and Lower Monumental Dam in 2009 demonstrate the potential difficulty of counters distinguishing between adults and jacks. As of 6/29/09, a total of 106,176 combined jack and adult Chinook were counted at Ice Harbor Dam. Of this total, 70,561 Chinooks were adults and 35,615 were jacks. At Lower Monumental Dam, the total combined adult and jack Chinook were similar at 109,776, however a higher number were recorded as adults (83,683) and a lower number were counted as jacks (26,093). This difference in jack proportion illustrates the possibility that fish passing the count window that are close to the 22” adult/jack criteria, may be recorded differently from project to project, with one project tending to count these fish as jacks while the other tending to record them adults. Differentiating jack versus adult, according to the size criteria would be especially difficult if numerous fish were near the 22” criteria and if multiple fish passed the count window simultaneously.

The FPC addressed the apparent count discrepancy in fall Chinook jack counts in a September 22, 2008 memorandum (fpc.org memorandum 150-08). The fall Chinook jack count discrepancy was the result of differing count criteria among projects. Priest Rapids and Wanapum Dam have been including mini-jacks in their daily jack counts since 2006. Priest Rapids and Wanapum are the only Columbia River Basin projects that include mini-jacks in their jack counts. The inclusion of mini-jacks in the jack count resulted in an extreme discrepancy in jack counts between McNary and Priest Rapids and Rock Island dams. The Rock Island project Chinook jack counts do not include mini-jacks. Grant County PUD began including mini-jacks into their jack counts when they switched to a video-based fish-counting system in 2006. This is mostly due to difficulty in determining sizes among these smaller Chinook adults.

Fish Passage during night time non-counting periods

In order to assess the significance and variability of fish passage during nighttime hours the FPC staff reviewed 24 hour count data from Chelan County PUD projects, reviewed PIT tag detection data at adult passage facilities with PIT tag detectors, and reviewed the results of two days of 24 hour counting at Bonneville Dam.

Chelan County 24-Hour Count Data:

As mentioned above, adult salmonid counts from Chelan PUD, Grant PUD, and COE operated projects differ in their counting periods. Chelan PUD and Grant PUD counts are 24 hour counts, where as COE adult counts are not. At COE operated sites, there is a period during the evening hours where no counting occurs (i.e., non-counting periods). These non-counting periods can differ between projects and during different times of the year (Table 2).

Table 2 – Counting and non-counting periods for COE operated projects on the Lower Columbia and Snake River in 2009.

Project	Monitoring Dates	Counting Period [†]	Non-Counting Period
BON	Jan. 1-Mar. 31 (video)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
	Nov. 1-Dec. 31 (video)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
TDA	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
JDA	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
MCN	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
IHR	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
LMN	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
LGS	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
LGR	Mar. 1-Mar. 31 (video)	7:00 am – 5:00 pm	5:00 pm – 7:00 am
	Apr. 1-Oct. 31 (direct)	5:00 am – 9:00 pm	9:00 pm – 5:00 am
	Nov. 1-Dec. 15 (video)	7:00 am – 5:00 pm	5:00 pm – 7:00 am

[†] Times in table are for Daylight Savings Time, during standard times, these counting periods are shifted to 1 hour earlier

To investigate whether there is evidence of adult salmonids passing projects during these non-counting periods, FPC analyzed 24-hour count data from Rock Island and Rocky Reach dams supplied by Chelan County PUD from 2004 through 2008. At the time of this analysis, hourly count data from Rock Island in 2005 was not available. Each hour of counting was categorized as being during a counting and non-counting period, according to the criteria in Table 2. Counting and non-counting periods were adjusted for day-light savings time and standard time for each individual year. For these analyses, we assumed the counting and non-counting period for Bonneville Dam. On days where the total adult count for a particular species was ≥ 20 we then estimated the percent of adults that passed each project during COE non-counting periods. Overall, this methodology provided for conservative estimates of passage during non-counting periods because it eliminated days where the non-counting period passage was bias high due to low overall passage on that day.

Based on these analyses, there is evidence that some adult salmonids pass Rock Island and Rocky Reach dams during COE non-counting periods (Table 3). However, the percentages of adults passing these two project during COE non-counting hours is highly variable between

species and projects. For all species except sockeye, average passage during COE non-counting periods was higher at Rock Island Dam than at Rocky Reach Dam (Table 3). Furthermore, the average percentage of adult spring and summer Chinook passing during COE non-counting periods is relatively low compared to that for fall Chinook, steelhead, sockeye, and coho. For both projects, coho had the highest estimates of passage during non-counting periods, where as summer Chinook had the lowest estimates.

Table 3– Average percent of adults counted at Rock Island and Rocky Reach dams that were counted during COE non-counting periods in return year 2004 through 2008.

Species-Race	Return Year	Rock Island	Rocky Reach
CH-Spring	2004	7.23	3.81
	2005		3.09
	2006	3.63	3.93
	2007	3.91	3.03
	2008	4.32	1.86
	<i>Average</i>	4.77	3.14
CH-Summer	2004	2.67	1.39
	2005		1.31
	2006	2.32	1.73
	2007	2.30	1.89
	2008	1.59	2.50
	<i>Average</i>	2.22	1.76
CH-Fall	2004	10.68	5.90
	2005		6.65
	2006	9.87	7.61
	2007	10.61	5.19
	2008	7.71	6.59
	<i>Average</i>	9.72	6.39
ST	2004	14.73	5.93
	2005		4.52
	2006	11.42	5.55
	2007	9.28	4.31
	2008	7.54	4.15
	<i>Average</i>	10.74	4.89
SO	2004	5.93	7.97
	2005		10.51
	2006	5.96	9.20
	2007	6.50	11.43
	2008	6.06	8.90
	<i>Average</i>	6.11	9.60
CO	2004	17.69	9.60
	2005		14.84
	2006	18.26	14.13
	2007	20.42	15.55
	2008	15.32	11.01
	<i>Average</i>	17.92	13.02

In addition, passage of adult salmonids during COE non-counting hour is highly variable throughout the year (Figure 1 and Figure 2). This was true for both Rock Island and Rocky Reach dams.

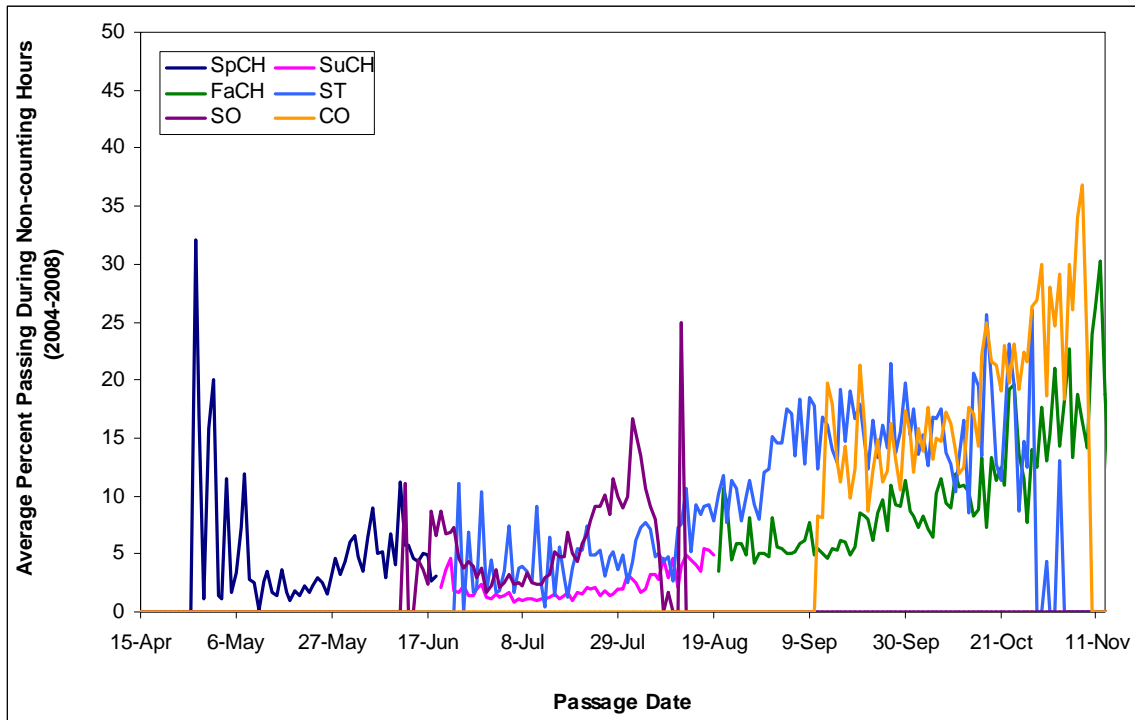


Figure 1. Daily average percent of adults passing Rock Island Dam that passed during COE non-counting hours From 2004, 2006-2008..

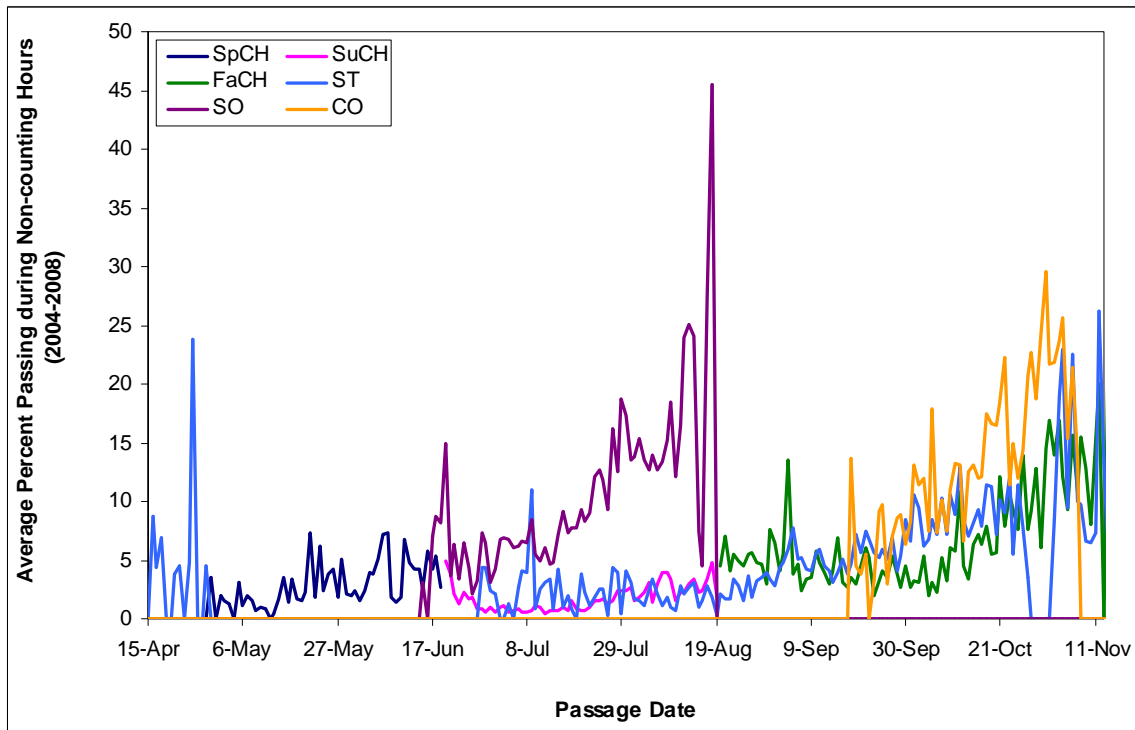


Figure 2. Daily average percent of adults passing Rocky Reach Dam that passed during COE non-counting hours from 2004, 2006-2008.

Analysis of PIT-Tag data of Adult fish passage at Lower Granite at:

In May 2009, the FPC received a data request to review PIT-tag detections for adult fall Chinook and steelhead at LGR to estimate the prevalence of night-time passage (see attached memo from June 11, 2009). This analysis revealed that approximately 3.15% of PIT-tagged fall Chinook adults detected at LGR were detected during the non-counting periods. The passage of fall Chinook adults during non-counting periods seemed to increase as the season progressed. In addition, approximately 3.21% of PIT-tagged steelhead adults detected at LGR were detected during the non-counting periods. The passage of steelhead adults during non-counting periods was highest in the spring (March-April), decreased in the summer and then increased in the late summer and fall. When adult fall Chinook counts were adjusted based on seasonal estimates of passage during non-counting periods the counts at LGR increased by 2-5%. When adult steelhead counts were adjusted based on seasonal passage during non-counting periods the counts at LGR increased by 5-8%.

Four days of night time video counting at Bonneville Dam

In early May of 2009, the Washington Department of Fish and Wildlife was asked by TAC to begin video counting over the nighttime period at Bonneville Dam. TAC was interested in determining the percentage of nighttime passage relative to daytime passage at Bonneville Dam and if this nighttime percentage could have a measurable impact on the official counts at Bonneville Dam that are counted visually over a 16-hr period from 0400-2000 Pacific Standard Time. WDFW has reviewed four nighttime periods of video from May 11-14, 2009. The following table (Table 4) displays the nighttime counts over the four night periods available as well as the daytime counts over the same days for adult and jack Chinook.

Table 4. Day time and nighttime (i.e. non counting periods) counts over the four night periods available as well as the daytime counts over the same days for adult and jack Chinook

	Combined Nighttime		Combined Daytime		Percent Nighttime/Daytime	
	Chinook Adult	Chinook jack	Chinook Adult	Chinook jack	Chinook Adult	Chinook jack
11-May-09	579	284	3481	2765	16.6	10.3
12-May-09	126	57	3821	4660	3.3	1.2
13-May-09	102	43	1848	2408	5.5	1.8
14-May-09	73	37	1897	2952	3.8	1.3
	Average				7.3	3.6

Nighttime video counting of Lamprey, will be taking place at Bonneville Dam from June 15th through the end of September and at McNary Dam from July 1st through the end of September. The present COE contract is to review each days eight hour nighttime tape to record Lamprey

passage, although other fish passing the project at this time are visible on the tape, they are not recorded. This is an excellent opportunity to begin collecting 24 hour count data at Bonneville and McNary at least through the end of September.

All three of these analyses provide evidence that adult passage during COE non-counting periods does occur and can be quite high for some species. Furthermore, there is evidence that passage during non-counting periods is variable between projects. Given this variability, it is possible that adults passing during the day at one project might be missed at the next project if travel times are such that they arrive at the next project when no counting is occurring. This could be particularly true for those species that are more likely to pass at night (e.g., steelhead, coho, and sockeye). Therefore, it is possible that some of the counting discrepancies between projects could be due to some adults being missed during the non-counting periods.

Analysis of Adult Fall Back at Snake River projects based upon PIT Tag detections

The FPC staff reviewed adult PIT tag detections to assess the magnitude of adult fall back and therefore double counting of adults.

- Examination of PIT-tag data found that between 1% and 11% of spring/summer Chinook adults passing upstream at Lower Granite Dam between April 1 and June 30 would have been recounted in window counts in the years 2004 to 2009 and between 3% and 8% of adults at Ice Harbor Dam would have been recounted.
- Recounts of fallbacks that re-ascend ladders represent a positive bias in window count data.
- Since both Ice Harbor Dam window counts and Lower Granite Dam window counts are biased high by recounts of fallbacks, and Lower Granite Dam recount proportion was higher in 2009, recounting of fallbacks could not explain the 10,000 fewer spring Chinook adults estimated to have passed Lower Granite Dam than Ice Harbor Dam that spring.

In 2009 there was a difference of greater than 10,000 adult spring Chinook adults counts (jacks included) between Ice Harbor and Lower Granite dams. Concerns about a difference between adult counts between Lower Monumental and Little Goose dams, led fisheries managers to test changes in spill operations at Little Goose Dam to attempt to pass adult fish that may have been delayed. However no increase in adult passage was observed as a result of the spill test and managers were left to speculate about the accuracy of counts at the dams as a possible explanation for the difference.

One possible explanation for the discrepancy between Ice Harbor Dam and Lower Monumental Dam total adult counts in 2009 compared to those upriver at Little Goose and Lower Granite dams could have been the rate at which adult spring/summer Chinook fallback and then re-ascend the adult ladder at each dam. If a salmon ascends the adult ladder and falls back via spill or turbine or even juvenile bypass (i.e. some route other than the ladder) and subsequently re-

ascends the adult ladder, that fish would be counted twice at the fish counting window. Recounting fish that re-ascend could bias counts if re-ascension rates were relatively high. The FPC staff reviewed adult PIT tag detections to assess the magnitude of adult fall back and therefore the double counting of adults. Since only Ice Harbor and Lower Granite dams have PIT-tag detection systems in their adult ladders, and the discrepancy in counts was similar between these two projects to the difference between Lower Monumental and Little Goose dams, detection data from Ice Harbor and Lower Granite was used to assess potentially differential fall back rates. If fallback and subsequent re-ascension rates were higher at Ice Harbor Dam than Lower Granite Dam, then differences in total counts between those two sites might be explained to some extent by the difference in recounting rates at each dam. And by extension given the similar pattern differences in total adult counts between Lower Monumental and Little Goose dams, the differential fallback rates estimated between Ice Harbor and Lower Granite, might help explain discrepancies between those dams without tag detectors as well.

To evaluate the potential effects of recounting fallbacks that re-ascend at a dam, we evaluated PIT-tag detections by coil from PTAGIS data for hatchery and wild spring/summer Chinook detections for the years 2004 to 2009 during the period April 1 to June 30. Our analysis looked at the proportion of adult PIT-tagged fish (including jacks) that were detected ascending the adult ladder more than once at a dam. Fish were considered to have exited a ladder up-river if detection at an uppermost coil was their last detection. Fish were considered to re-ascend if once they successfully exited they were again detected at a lowermost downstream coil at least 3 hours later. Typically the gap between upstream exit and downstream re-detection was in the order of 24 hours (or longer), however, a few fish were found to have re-ascended relatively quickly (4 to 5 hours) so that a shorter “time-gap” was necessary. In addition, many fish ascended and descended within the ladder. But in every case we examined, detections on intermediate coils between the uppermost and lower most coils were found such that it was clear the fish descended via the ladder. And the time gap between these detects of within ladder movements was often only a second or two, so they were quite distinct from the exit and re-entry time gaps used to evaluate re-ascensions. A fish that was detected moving down the ladder was not considered to have re-ascended the ladder if it was again detected in the lowermost downstream coils since it would have been subtracted from total counts if it continued downstream--passing by the counting window. If it then re-ascended, such a fish would be counted at the window but such a recount would be an accurate depiction of passage numbers. If a PIT-tagged fish did not pass downstream as far as the counting window, then it would not have been recounted—this too would not affect window counts. For these reasons fish that descended via the ladder and were subsequently detected reascending, were not considered to potentially bias window count data and were not considered re-ascends for the purpose of determining recount bias.

The results of our analysis found between 1% and 11% of PIT-tagged adults re-ascend adult ladders after falling back (by routes other than the ladder) at these dams (Ice Harbor or Lower Granite Dam) in any given year (Table 5). Ice Harbor Dam typically had a lower re-ascension rate than Lower Granite Dam and subsequently lower proportion of fish would have been recounted at that site in most years. In 2009 a higher proportion of PIT-tag adults re-ascended the adult ladder at Lower Granite than at Ice Harbor (8.8% compared to 5.3%) which means the difference in adult counts between Ice Harbor Dam and Lower Granite Dam observed in the

spring of 2009 cannot be explained by the pattern we observed in fallback recounts. If anything the data would suggest that Lower Granite adult counts would be biased higher by recounts than Ice Harbor, only decreasing the difference in estimated total adult passage between the two sites.

Table 5. Proportion of PIT-tag adult counts (number of total adults passing counting windows) that would represent recounts of fish re-ascending the adult ladder at Ice Harbor Dam compared to rates at Lower Granite Dam by year.

Year	Ice Harbor Dam			Lower Granite Dam		
	PIT-tag adult Count	Re-ascends	Recount rate	PIT-tag adult Count	Re-ascends	Recount rate
2004	2,360	74	3.1%	2,212	22	1.0%
2005	1,040	49	4.7%	937	35	3.7%
2006	527	45	8.5%	453	46	10.2%
2007	819	49	6.0%	719	29	4.0%
2008	2,015	116	5.8%	2,004	225	11.2%
2009 ^a	2,948	156	5.3%	2,746	241	8.8%

^a 2009 detection data was through June 25 and may not capture all re-ascending fish since all detection information may not be complete.



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e-mail us at fpcstaff@fpc.org

MEMORANDUM

TO: Mr. John Harrison, Northwest Power and Conservation Council

FROM: Fish Passage Center Staff

DATE: June 10, 2009

RE: Data Request

Your recent email inquiry dated May 26, 2009 requested that the FPC staff review and consider the adult passage count discrepancy for sockeye between John Day and McNary dams in 2008. The total 2008 count at McNary Dam is lower than the total count at John Day or at Columbia River projects upstream of McNary Dam. In addition, you asked why the difference between the John Day Dam count and McNary Dam count was 50,000 fish. The total project counts for sockeye are presented in the following table:

Sockeye 2008	
JDA	193,409
MCN	146,924
PRD	196,835
RIS	193,739

As you know, the Fish Passage Center is not responsible for the actual counting of adult fish at the dams or the reporting of the count data from the dams. The US Army Corps of Engineers, WDFW, and the Mid Columbia Public Utility Districts maintain the primary responsibility for the initial adult counting and reporting at their projects.

In order to investigate the count discrepancy, the FPC staff reviewed the counting procedures, and the daily passage counts. Our review of the count data and procedures resulted in the

following list of issues that could potentially contribute to adult count discrepancies among projects.

1. Adult counting procedures differ between the PUD and COE projects

The daily counting timeframe is longer at the PUD projects. They collect data via a video system that allows 24 hours of fish counting, whereas the COE projects make direct visual counts for 16 hours a day (0400-2000). The longer time monitored and the difference in count methods, visual versus video, could explain some of the discrepancy.

2. Adult sockeye passage through navigation locks has been documented

Adult sockeye could pass through the navigation locks at McNary and John Day, whereas there are no navigation locks at mid-Columbia River PUD projects.

There is not a navigation lock at Priest Rapids dam, and therefore, it is possible that a higher proportion of fish are counted at the PUD projects than at the federal projects.

In addition, FPC staff contacted COE and WDFW Adult Fish Count Personnel and asked if they could explain the adult sockeye discrepancies noticed between John Day, McNary, and Priest Rapids Dams. The WDFW and COE personnel also thought that count time/procedures and the use of navigation locks could explain some of the differences seen in adult sockeye numbers, but could not offer any other potential explanation.

The FPC will continue to investigate the discrepancies in counts at the Columbia and Snake River sites in response to your data request, and other data requests that we have received regarding this issue. We will provide you with our detailed analysis when it is available.



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MEMORANDUM

TO: Jay Hesse (Nez Perce Tribe)

FROM: Michele DeHart

DATE: June 11, 2009

RE: Proportion of fall Chinook and steelhead adults passing LGR during evening non-counting hours

In response to your request, the FPC staff has reviewed PIT-tag detection data for adult fall Chinook and steelhead passing Lower Granite Dam (LGR). Specifically, the FPC staff reviewed five years of adult detection data (2004-2008) at LGR in order to determine what proportion of PIT-tagged adults pass LGR during times when counting occurs versus those times when counting does not occur (i.e., non-counting hours). Below is a brief summary of our findings, followed by a more detailed discussion.

- Overall, approximately 3.15% of PIT-tagged fall Chinook adults detected at LGR were detected during the non-counting times.
- The percent of fall Chinook adults passing LGR during the non-counting times seemed to increase as the season progressed.
- When adult fall Chinook counts were adjusted based on seasonal passage during non-counting hours, adult counts at LGR increased by 2-5%.
- Overall, approximately 3.21% of PIT-tagged steelhead adults detected at LGR were detected during the non-counting times.
- The percent of steelhead adults passing LGR during the non-counting times was highest for those adults passing LGR in the spring (March-April). However, for those steelhead adults passing LGR in the late summer and fall, the percent of adults passing during the non-counting times increased as the months progressed.
- When adult steelhead counts were adjusted based on seasonal passage during non-counting hours, adult counts at LGR increased by 5-8%.

Subsequent to your request, the FPC has received several additional data requests regarding counting discrepancies between projects. It is our intent to address each of these requests in a future memo. When this analysis is finished, we will forward it on to you as well.

Lower Granite Dam Adult Counts:

Each year, Lower Granite Dam (LGR) begins counting adult salmonids on March 1st and generally continues through December 15th. However, from March 1st to March 31st, these counts are based on video counts, which occur from 06:00 to 16:00. Direct counts of adult salmonids begin on April 1st and run through October 31st. During this time, counting takes place from 04:00 to 20:00. Finally, from November 1st to December 15th, counting goes back to video counts from 06:00 to 16:00. Therefore, depending on the period when adults are passing, adult counts at LGR are based on 10-hour (Mar. 1-Mar. 31 and Nov. 1 to Dec. 15) or 16-hour (Apr. 1 to Oct. 31) periods. This means that adults passing the counting station during non-counting times are being missed. It is thought that a negligible proportion of adult salmonids pass through the adult ladders during these non-counting times.

To estimate the proportion of fall Chinook and steelhead adults that pass through the adult ladder at LGR during non-counting times, FPC staff relied on PIT-tag data. Specifically, FPC staff reviewed five years of detection data (2004-2008) for PIT-tagged adult fall Chinook and steelhead passing LGR. Based on the criteria presented above, adults were categorized as having passed LGR during the counting period versus those that passed during the non-counting period. Passage time was based on the time of first detection, where the first detection site was either ISO East or ISO West. These two detection arrays are situated in the adult ladder, between the counting station and the adult trap.

Fall Chinook:

At LGR, Chinook adults passing the counting window in the adult ladder on or after August 18th are categorized as being fall Chinook. Based on this criterion, we only used PIT-tagged fall Chinook detected in the adult ladder on or after August 18th for each of the years analyzed (2004-2008). Jacks and mini-jacks were not excluded for this analysis.

Over the five years analyzed, about 3.15% of PIT-tagged adult fall Chinook detected in the LGR adult ladder were first detected during non-counting hours (Table 1). However, there was some variability between the years. Return year 2004 had the highest estimate of non-counting hour passage for adult fall Chinook (6.63%), whereas return year 2008 had the lowest estimate (2.15%) (Table 1).

Table 1. Detections of PIT-tagged adult fall Chinook at LGR during counting and non-counting time periods and percent of adults passing LGR that passed during non-counting periods

Year	Counting Hour Passage	Non-Counting Hour Passage	Percent Passing During Non-Counting Hours
2004	503	36	6.63
2005	229	12	4.98
2006	287	7	2.38
2007	803	26	3.14
2008	2,046	45	2.15
2004 - 2008	3,868	126	3.15

In order to determine whether adult passage during non-counting times might change over the season, adult detections at LGR were broken into weekly time periods. Due to low numbers of detections during early and late periods, some weekly blocks were combined into a single time period. For example, all detections in the first three weeks (Aug. 18 through Sept. 7) were combined and all detections after October 13th were combined. There were no detections of PIT-tagged adults in December for any of the years we analyzed. Therefore, December was not included in any of the time periods. Based on this analysis, there appears to be a seasonal effect of the percent of adult fall Chinook that pass LGR during non-counting hours (Table 2). In general, this percentage of adults increases as the season progresses. On average, the percent of PIT-tagged adult fall Chinook detected at LGR that were detected during non-counting hours varied from 0.31% to 0.83% in the earlier periods (Aug. 18-Sept. 14) to nearly 13% in the later periods (>Oct. 13) (Figure 1). However, some of this seasonal effect could be explained by the fact that the non-counting time period is approximately 14 hours in the later portion of the season (after Nov. 1st), compared to a 8 hour non-counting period prior to Nov. 1st.

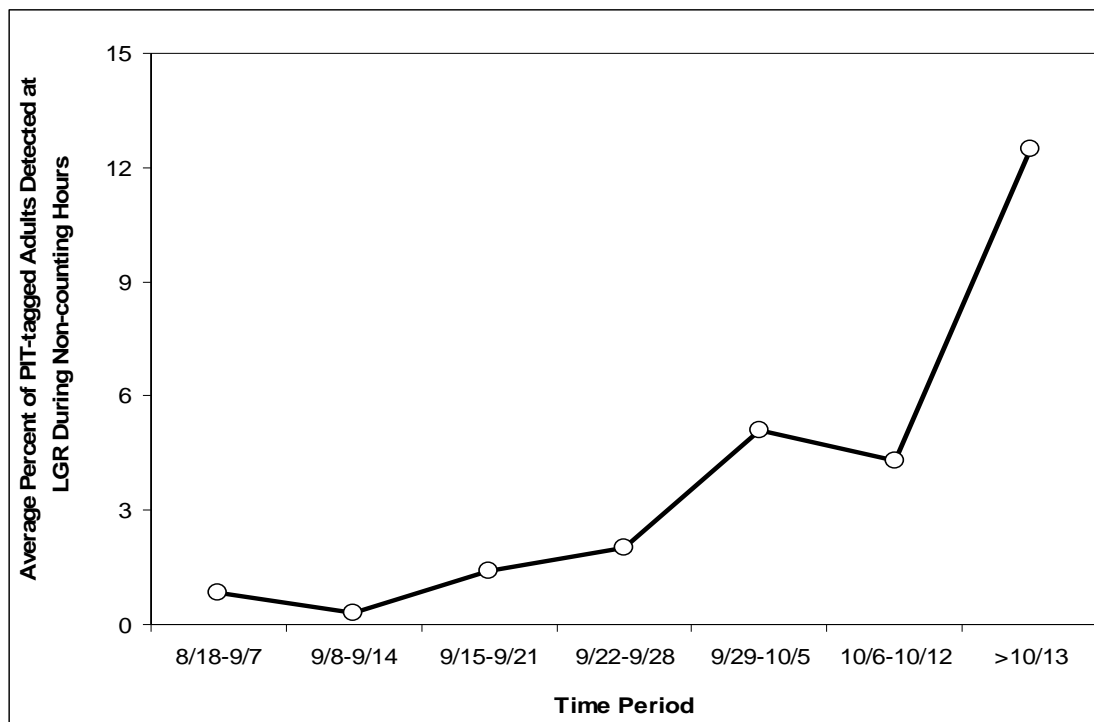


Figure 1. Average percent of PIT-tagged fall Chinook adults that were detected at LGR during non-counting hours. Averages were based on estimated from 2004 through 2008.

Finally, based on the seasonal estimates of the percent of adult fall Chinook passing LGR during non-counting hours, we estimated an adjusted adult count (Table 2). These adjusted adult counts represented a 2-5% increase over the actual adult counts for each of the years analyzed.

Table 2. Detections of PIT-tagged adult fall Chinook at LGR during counting and non-counting time periods and percent of adults passing LGR that passed during non-counting periods

Year	Date Range	Counting Hour Passage	Non-Counting Hour Passage	Percent Passing During Non-Counting Hours	Adult Fall Chinook Counts ^A	Adjusted Adult Fall Chinook Counts
2004	8/18 - 9/7	23	1	4.17	1,931	2,015
	9/8 - 9/14	90		0.00	4,984	4,984
	9/15 - 9/21	125	2	1.57	5,878	5,972
	9/22 - 9/28	91	1	1.09	4,106	4,151
	9/29 - 10/5	63		0.00	2,365	2,365
	10/6 - 10/12	38		0.00	1,458	1,458
	>10/13	73	32	30.48	1,838	2,644
	Total Counts				22,560	22,589
2005	8/18 - 9/7	3		0.00	1,131	1,131
	9/8 - 9/14	35		0.00	2,953	2,953
	9/15 - 9/21	60	1	1.64	3,613	3,673
	9/22 - 9/28	58	1	1.69	3,155	3,209
	9/29 - 10/5	33	5	13.16	1,620	1,865
	10/6 - 10/12	30	3	9.09	1,057	1,163
	>10/13	10	2	16.67	896	1,075
	Total Counts				14,425	15,070
2006	8/18 - 9/7	10		0.00	1,462	1,462
	9/8 - 9/14	32		0.00	2,515	2,515
	9/15 - 9/21	51		0.00	2,759	2,759
	9/22 - 9/28	45	1	2.17	1,933	1,976
	9/29 - 10/5	44	4	8.33	2,034	2,219
	10/6 - 10/12	67	1	1.47	2,278	2,312
	>10/13	38	1	2.56	1,784	1,831
	Total Counts				14,765	15,074
2007	8/18 - 9/7	24		0.00	1,442	1,442
	9/8 - 9/14	64	1	1.54	2,361	2,398
	9/15 - 9/21	187	4	2.09	4,650	4,749
	9/22 - 9/28	175	5	2.78	3,750	3,857
	9/29 - 10/5	187	3	1.58	3,930	3,993
	10/6 - 10/12	81	6	6.90	1,905	2,046
	>10/13	85	7	7.61	1,903	2,060
	Total Counts				19,941	20,545
2008	8/18 - 9/7	224		0.00	5,876	5,876
	9/8 - 9/14	269		0.00	5,902	5,902
	9/15 - 9/21	299	5	1.64	4,968	5,051
	9/22 - 9/28	505	12	2.32	4,370	4,474
	9/29 - 10/5	333	8	2.35	2,007	2,055
	10/6 - 10/12	234	10	4.10	1,654	1,725
	>10/13	182	10	5.21	2,077	2,191
	Total Counts				26,854	27,274

^A Adult fall Chinook counts do not include any adults counted in December. Therefore, adjusted counts were only made for adults counted from March 1st to November 30th of each year

Steelhead:

Steelhead adults are counted at LGR during the entire period of adult counting (Mar. 1 to Dec. 15). Typically there are two periods of high steelhead adult passage. The first period is in the spring (March and April) when steelhead adults that held-up in the Lower Columbia River the previous winter make their way into the Snake River. There second period of high steelhead adult passage is in the late summer through early fall (September through November). Minimal passage of adult steelhead does occur from May to August. Given that adult steelhead pass the LGR adult ladder throughout this whole period, we used PIT-tagged adult steelhead detected in the adult ladder from March 1st to December 15th, for each of the years analyzed (2004-2008).

Over the five years analyzed, about 6.21% of PIT-tagged adult steelhead detected in the LGR adult ladder were first detected during non-counting hours (Table 3). However, there was some variability between the years. Return year 2004 had the highest estimate of non-counting hour passage for adult steelhead (7.82%), whereas return year 2008 had the lowest estimate (4.98%) (Table 3).

Table 3. Detections of PIT-tagged adult steelhead at LGR during counting and non-counting time periods and percent of adults passing LGR that passed during non-counting periods

Year	Counting Hour Passage	Non-Counting Hour Passage	Percent Passing During Non-Counting Hours
2004	908	77	7.82
2005	568	45	7.34
2006	597	40	6.28
2007	1,408	94	6.26
2008	1,851	97	4.98
2004 - 2008	5,332	353	6.21

In order to determine whether adult passage during non-counting times might change over the season, adult detections at LGR were broken into monthly time periods. Due to low numbers of detections during early months, some monthly blocks were combined into a single time period. For example, all detections in March and April were combined and all detections from May through August were combined. There were no detections of PIT-tagged adults in December for any of the years we analyzed. Therefore, December was not included in any of the time periods. Based on this analysis, there appears to be a seasonal effect of the percent of adult steelhead that pass LGR during non-counting hours (Table 4). In general, the percentage of adult steelhead that pass LGR during non-counting hours starts out relatively high in the March-April period, begins to fall from May through September, and then begins to increase again as adults pass in October and November (Table 4, Figure 2). On average, the percent of PIT-tagged adult steelhead being detected during non-counting hours was 27% for the March-April period. This average percentage decreased to 7.12% for the May-August period and further decreased to 3.93% in the September period (Figure 2). As adults were detected in October and November, the average percentage being detected during non-counting hours increased to 5.98% and 13.27%, respectively (Figure 2).

As with the fall Chinook adults, some of this seasonal effect could be explained by the fact that the non-counting time period is approximately 14 hours in the later portion of the season (after Nov. 1st), compared to a 8 hour non-counting period prior to Nov. 1st.

Table 4. Detections of PIT-tagged adult fall Chinook at LGR during counting and non-counting time periods and percent of adults passing LGR that passed during non-counting periods

Year	Month	Counting Hour Passage	Non-Counting Hour Passage	Percent Passing During Non-Counting Hours	Adult Steelhead Counts ^B	Adjusted Adult Steelhead Counts
2004	Mar.-Apr.	46	23	33.33	7,464	11,196
	May-Aug.	62	1	1.59	6,294	6,396
	September	500	34	6.37	78,020	83,325
	October	267	15	5.32	55,626	58,751
	November	33	4	10.81	6,480	7,265
	Total Counts					153,884
2005	Mar.-Apr.	22	9	29.03	4,683	6,599
	May-Aug.	16		0.00	6,084	6,084
	September	211	9	4.09	57,231	59,672
	October	300	23	7.12	79,926	86,054
	November	19	4	17.39	6,882	8,331
	Total Counts				154,806	166,739
2006	Mar.-Apr.	19	9	32.14	7,391	10,892
	May-Aug.	3	1	25.00	3,041	4,055
	September	253	5	1.94	50,958	51,965
	October	260	16	5.80	68,063	72,251
	November	62	9	12.68	14,958	17,129
	Total Counts				144,411	156,293
2007	Mar.-Apr.	15	5	25.00	10,371	13,828
	May-Aug.	30	2	6.25	5,778	6,163
	September	629	22	3.38	58,983	61,046
	October	658	39	5.60	71,535	75,775
	November	76	26	25.49	8,269	11,098
	Total Counts				154,936	167,910
2008	Mar.-Apr.	75	14	15.73	7,224	8,572
	May-Aug.	214	6	2.73	18,551	19,071
	September	989	40	3.89	83,413	86,787
	October	572	37	6.08	56,851	60,528
	November	1		0.00	8,322	8,322
	Total Counts				174,361	183,281

^B Adult steelhead counts do not include any adults counted in December. Therefore, adjusted counts were only made for adults counted from March 1st to November 30th of each year

Finally, based on the seasonal estimates of the percent of adult steelhead passing LGR during non-counting hours, we estimated an adjusted adult count for each of the years analyzed (Table 4). These adjusted adult counts represented a 5-8% increase over the actual adult counts for each of the years analyzed.

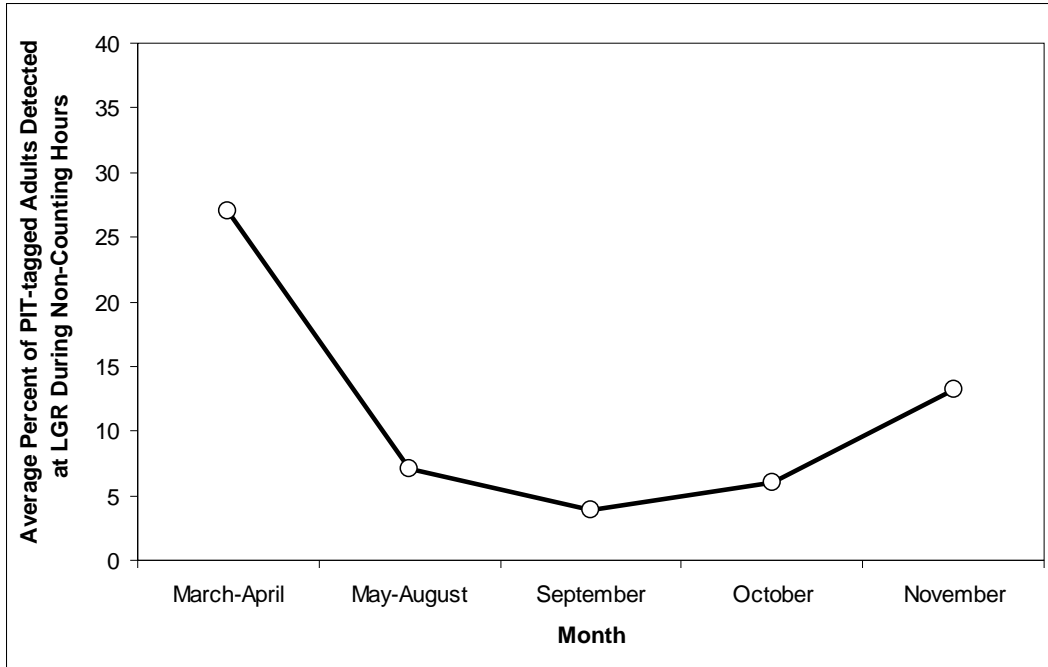


Figure2. Average percent of PIT-tagged steelhead adults that were detected at LGR during non-counting hours. Averages were based on estimated from 2004 through 2008.



FISH PASSAGE CENTER

1827 NE 44th Ave., Suite 240, Portland, OR 97213

Phone: (503) 230-4099 Fax: (503) 230-7559

<http://www.fpc.org/>

e-mail us at fpctstaff@fpc.org

MEMORANDUM

TO: FPAC

FROM: FPC Staff

DATE: June 22, 2009

RE: Update of Spring Chinook adult passage in Snake River in May and June 2009

In response to your request FPC updated our analysis of PIT-tag data for 2009 to determine if there were signs within the PIT-tag data of adult spring Chinook delaying below Little Goose Dam in 2009. We compared PIT-tag daily average travel time between Ice Harbor and Lower Granite dams as well as conversion rates in 2009 to similar data for the years 2006 to 2008.

Our conclusions based on this updated analysis of PIT-tag data are as follows:

- PIT-tagged spring/summer Chinook adult conversion proportion (number detected at LGR of the original fish detected at Ice Harbor) for 2009 was 95% through June 13.
- Conversion proportion for adults passing Ice Harbor May 15 to June 13, 2009 was 97.2%
- Travel times for PIT-tagged adult Chinook between Ice Harbor Dam and Lower Granite Dam in 2009 were similar to those of adult Chinook in other recent years during May and early June.

Based on continued differences between adult counts at Lower Monumental Dam and Little Goose dams (Table 1) FPC was asked to analyze conversion rates of adult salmon passing in the Snake River in 2009. For PIT-tag analysis detection arrays exist in the adult ladders at Ice Harbor and Lower Granite dams (but are not present at Lower Monumental or Little Goose dams). FPC compared 2009 data on daily travel time and seasonal conversion proportions to the years 2006 to 2008. We compared data for the period mid-April to June 13 in those years to see if the proportion of adults detected at Ice Harbor Dam that successfully passed through the Snake River dams and were subsequently detected at Lower Granite Dam differed from year to year.

We compared average travel time by date as well as total number detected. We updated PIT-tag detection data through June 22. We included conversion proportion results from the previous memo as well as updated travel time and conversion rates to show how those changed since last month.

Results

The updated analysis of conversion proportion shows that Chinook adult conversion proportion from mid-May to June 13 was relatively high (Table 2). The overall conversion rate from April 22 to June 13 was 95.3%; this seasonal conversion rate was comparable with other recent years (Table 2). The lowest conversion rates to date in 2009 were during April at (84.6%) but that number was based upon only 26 PIT-tagged adults detected at Ice Harbor. The calculated daily and seasonal conversion proportions were curtailed on June 13 since a portion of PIT-tag adults passing Ice Harbor after that date were likely still in transit when this analysis was completed (see Figure 1).

Table 1. Summary of Adult spring/summer Chinook passage counts at Snake River dams through June 13, 2009.

Dam	Chinook Adult	Chinook Jack	Total Chinook
IHR	65,487	32,801	98,288
LMN	77,528	23,119	100,647
LGS	59,241	27,117	86,358
LGR	53,793	33,467	87,260

Table 2. Summary of PIT-tag adult spring/summer Chinook conversion proportions between Ice Harbor and Lower Granite dams April to June 13 (jacks not included).

Year	Ice Harbor Count	Lower Granite Count	Conversion Proportion
2006	326	303	92.9%
2007	335	318	94.9%
2008	1027	987	96.1%
2009 ^a	1159	1104	95.3%
'09 April 22 to 30	26	22	84.6%
'09 May 1 to 14	488	452	92.6%
'09 May 15 to 31	402	391	97.3%
'09 June 1 to 13	269	261	97.0%

^a The seasonal 2009 conversion data presented was for the period April 22 to June 13.

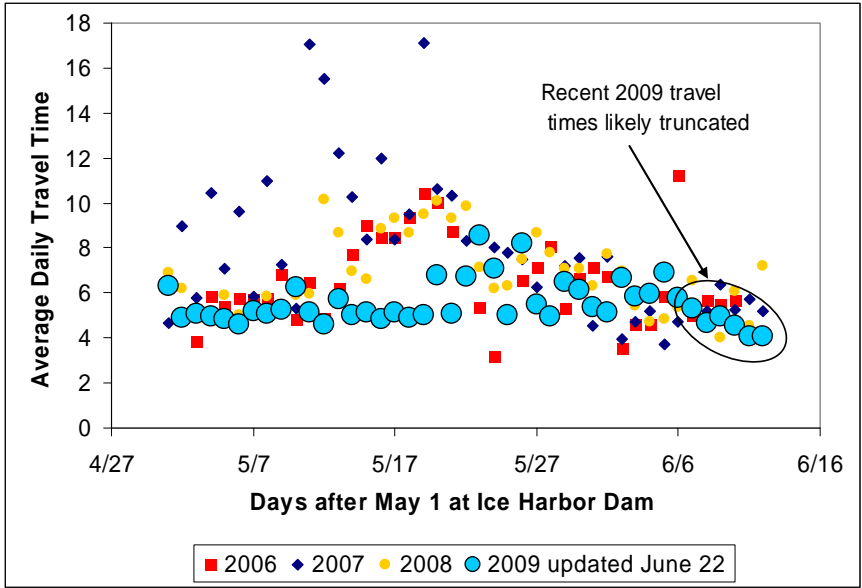


Figure 1. Average Daily Travel Time for PIT-tag adult Chinook (no jacks included) between Ice Harbor and Lower Granite dams between May 1 and May 31 in the years 2006 to 2009.