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: Liz Hamilton, NWSFI
Ron Boyce, ODFW

FROM: Michele DeHart

DATE: August 24, 2007

RE: Response to Comments from 6/21/07 Oregon Department of Environmental Quality Meeting

The Fish Passage Center received your data request to respond to several comments made by different presenters at the Oregon Department of Environmental Quality (DEQ) meeting on June 21, 2007. Specifically, we were asked to respond to comments made by James Buchal, representing himself, relative to the total dissolved gas program; by Shane Scott, Northwest River Partners, relative to the survival of juvenile salmonids through various routes of passage at Bonneville Dam and to an exchange between Ritchie Graves, NOAA Fisheries and Commissioner Williamson, Oregon Environmental Quality Commission, relative to the estimates of survival through turbines and spillways. In order to directly respond to the conversations that took place at the meeting, the FPC requested an audio transcript of the DEQ hearing. We have excerpted those specific conversations from the tapes and will present them here as best as possible.

I. **James Buchal Testimony**

"I have in my hands here a memorandum from the Fish Passage Center on their letterhead to the chairman of the Fish Passage Advisory Committee. It went to Miss Lut and it went up to Washington and it says we have a gas bubble disease problem, we have 36.6 percent of the fish have gas bubble trauma up at Little Goose and Lower Monumental dams and that is at levels of TDG that are in complete compliance like at 112 and 111 % and we've got these massive levels of gas bubble disease and I know that these GBT is not detected at such high levels downstream but elementary toxicology may tell you why – if you kill them all at the projects upstream then

the ones that are susceptible the ones downstream won't show as many symptoms. But the idea that we have in place, that there is some system that where when the fish managers see the high levels of symptoms that something is done- that's utterly false. Well what it says here is that there aren't that many fish left so let's just keep spilling. And I'll put that in the record too – here it is – it went to commission staff and every body ignores it and do you know what the number is today or yesterday, it is up to 46.9 percent of the fish are showing gas bubble trauma and the answer is, just keep on spilling."

The Fish Passage Center Staff provided information on the incidence of gas bubble trauma (GBT) in juvenile Snake River steelhead on June 8, 2007 and again on June 11, 2007. The GBT monitoring was observing large numbers of late migrating steelhead exhibiting signs of GBT. However, the implication made in Mr. Buchal's testimony, regarding the Salmon Manager's unwillingness to consider alterations to the spill program based on data are entirely false. The following summarizes the data that was taken into consideration regarding the GBT incident.

GBT Data

The GBT data of concern was collected at both Little Goose and Lower Monumental dams. As noted in the memos, the frequency of GBT monitoring was increased at these two projects in an effort to understand the implications of the high levels of TDG. Table 1 shows the % GBT for steelhead at Little Goose Dam and Table 2 shows that data for Lower Monumental Dam. A high proportion of steelhead were observed with signs of GBT, but at the same time the total dissolved gas levels were very low. The initial observations of the high levels of GBT were at Little Goose Dam and TDG was below the waiver criteria and, in fact with the exception of 6/5/2007, the TDG levels were below the state and federal standards of 110% and were not subject to the conditions of the waiver. Additionally, very few subyearling migrants exhibited these signs of GBT, so it was clearly a steelhead issue. The Salmon Managers were managing a situation where water quality standards were not being exceeded and there was a desire to maintain protection for the subyearling population, whose numbers were increasing.

Table 1. Observation of GBT in steelhead smolts observed at Little Goose Dam in 2007.

Date	Species	FishExams	TotalNumGBT	%GBT	TDG
6/5/2007	ST	94	14	14.9%	112.8
6/8/2007	ST	93	36	38.7%	108.2
6/10/2007	ST	50	13	26.0%	110.9
6/12/2007	ST	50	11	22.0%	109.3
6/19/2007	ST	61	35	57.4%	109.6
6/26/2007	ST	2	1	50.0%	109.3
7/3/2007	ST	4	1	25.0%	110.3
7/10/2007	ST	12	8	66.7%	109.2

Table 2. Observation of GBT in steelhead smolts observed at Lower Monumental Dam in 2007.

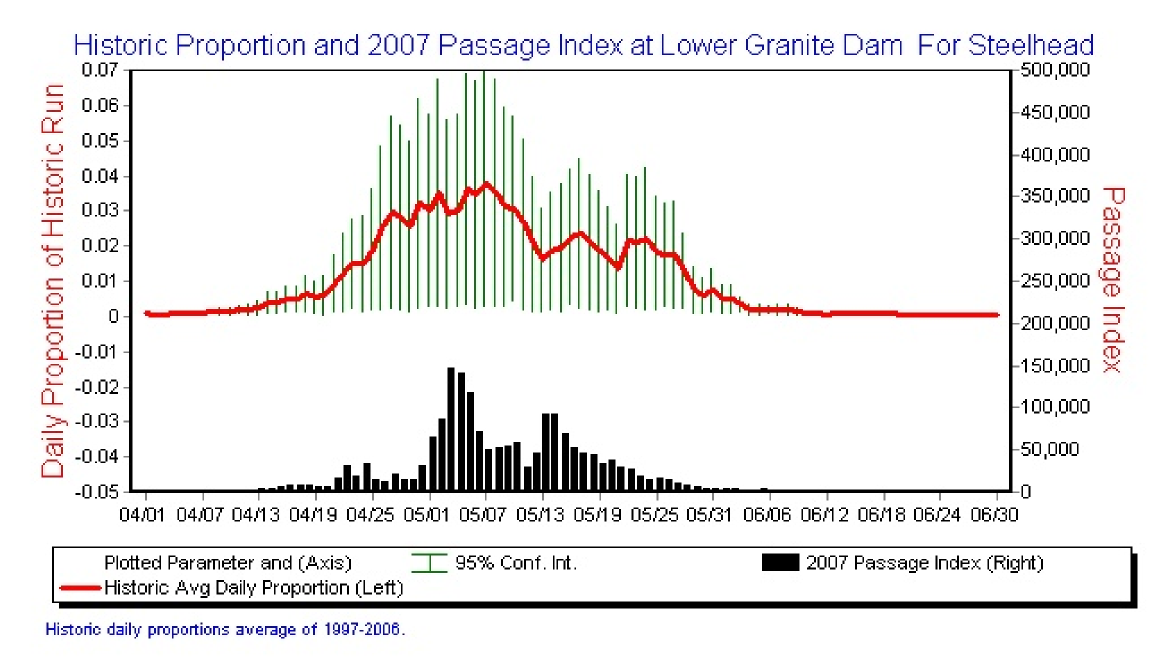
Date	Species	FishExams	TotalNumGBT	% GBT	TDG
6/4/2007	ST	64	13	20.3%	114.3
6/7/2007	ST	18	5	27.8%	109.0
6/11/2007	ST	33	16	48.5%	110.2
6/25/2007	ST	1	0	0.0%	106.9
7/1/2007	ST	2	1	50.0%	107.0
7/22/2007	ST	3	0	0.0%	

From the data it was apparent that the late migrating juvenile steelhead were disproportionately displaying the signs of GBT. In addition, the issue began high up in the system at Little Goose Dam. The Salmon Managers did not necessarily regard this as a TDG problem, but investigated the potential causes of this occurrence from a project operations and migration conditions issue.

Passage Timing

Historically steelhead smolt passage at Lower Granite Dam peaks in early May (50% passage date) with over 90% of steelhead migrants passing by late May, which was the migration pattern exhibited in 2007(see Figure 1). As the steelhead migration is diminishing, the subyearling migration is increasing steadily in early June, and in 2007 the magnitude of the subyearling population was ten times that of the steelhead migrants.

The Snake River GBT sampling program typically ended on June 20th (or earlier) in past years since until 1995 there was no summer spill program in the Snake River. It has been observed that typically the incidence of GBT in steelhead tends to increase slightly towards the end of the season, although not to the degree that occurred in 2007. The question then arose as to why this was being observed in 2007.



Flow and Fish Travel Time Conditions in 2007

From laboratory studies that had been conducted (Mesa et al., 2000) it had been shown that up to 80% of Chinook would display minor signs of GBT at low levels of TDG if left sufficiently long in the water at that exposure. There were no mortalities in this group throughout the duration of the experiment, which lasted for 22 days. Given this information the Salmon Managers began to investigate the flow and fish travel time conditions that existed in 2007.

The graph (Figure 1) shows the 2007 flow levels at Lower Granite Dam as compared to 2006 and the average over the past ten years. From the graph it can be seen that flow at Lower Granite Dam during June was significantly less than observed in 2006, or as represented by the ten year average. Steelhead juvenile migrants are particularly sensitive to changes in flow as expressed by their fish travel time estimates. The hypothesis was that steelhead travel time was longer during June of 2007 due to extremely low flows, and the few late migrating steelhead were displaying minor signs of GBT because of the long exposure to these sub-lethal levels of TDG.

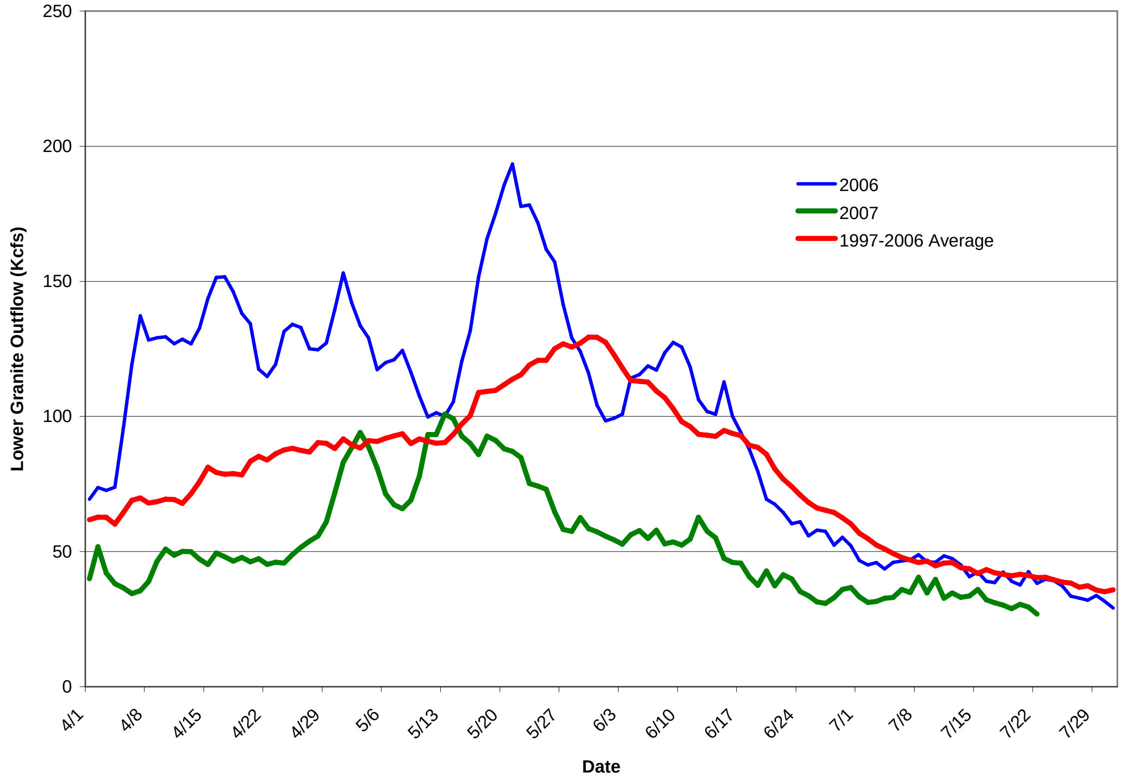


Figure 1. Daily average flows at Lower Granite Dam for 2007, 2006 and a ten year average daily flow for 1997-2006.

The hypothesis was evaluated by plotting travel time of steelhead smolts between Lower Granite and Little Goose dams as a function of their arrival timing at Little Goose Dam. From the graph (Figure 2) it can be seen that the later arriving fish in 2007 have much longer travel times in 2007, consistent with the hypothesis that a higher incidence of signs of GBT in steelhead juveniles at Snake River projects in 2007 as a result of long travel times between projects, due to low flows.

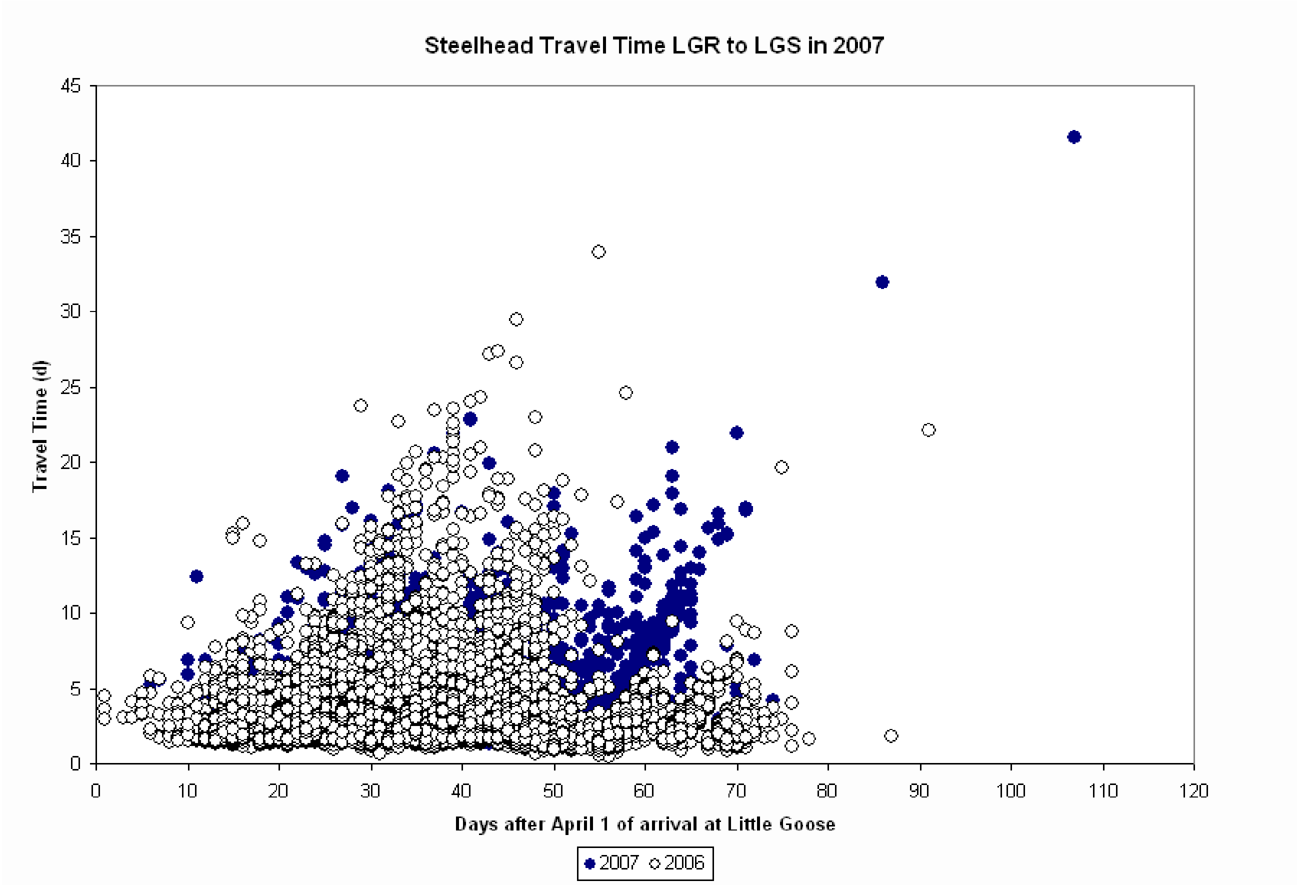


Figure 2. Travel time of steelhead juveniles migrating between Lower Granite and Little Goose Dam in 2007 as a function of arrival time at Little Goose Dam.

In conclusion, the following information was considered when the decision was made to continue Snake River spill in 2007 during the month of June:

1) TDG levels were below standards, not just below waiver limits;
2) Steelhead smolts represented a small proportion of the overall migrant population passing Lower Granite Dam, priority was instead focused on protecting subyearling migrants which predominated in the river.
3) Signs of GBT in steelhead were mostly minor, and few, if any, subyearling Chinook displayed signs of GBT;
4) The incidence of GBT signs in steelhead smolts at the low TDG concentrations were likely a function of very long travel times as flows were so low.
5) Laboratory studies indicated that mortality due to GBT was minimal (or nil) under the conditions that prevailed in 2007.

II. Shane Scott Testimony

"The recent improvements at Bonneville Dam include the corner collectors which is a surface bypass system (EQC then asks Scott to identify himself) Shane Scott formerly with Washington Department of Fish and Wildlife now I'm with Northwest River Partners. The COE, Bonneville and federal family have installed two real significant fish passage facilities at Bonneville Dam: one is the corner collector, it's another surface bypass system, and the other is a juvenile bypass system. Together those are about 200 million dollars in concrete fish passage improvements at that dam to safely pass fish through that project, demonstrated with test fish to have the highest route survival through that dam. Spillway has the lowest route survival so you simply look at numbers. I would put my fish through the corner collector which has a survival of 100%, it is just a long channel you can see it when you are on the Washington side of the dam and then the juvenile bypass system you see it puts fish about two miles downstream back into the river, usually you see a lot of birds hanging around there. Those two routes of passage are much higher than the spillway and we question first the lost generation, plus just putting small fish through that spillway which is demonstrated for all species that have been adequately evaluated to have a higher mortality through that spillway. This is independent science paid for by the Bonneville Power Administration and COE through a regional independent process and the agencies don't do this research themselves it is by independent folks outside of those agencies."

Mr. Scott makes general statements regarding the corner collector and bypass system at Bonneville Dam. These statements primarily relate to <u>direct</u> survival estimates from studies conducted in 2004 and 2005. Direct survival studies measure immediate dam survival only. Direct survival estimates do not account for any delay or mortality incurred in either the tailrace or forebay as a result of the route of passage.

It is incomplete to only refer to direct project survival estimates that do not take into consideration the impact that a passage route can have on subsequent survival. In fact, in his own testimony Mr. Scott refers to the fact that many "birds hang out at the downstream outlet of the bypass pipe". The predation caused by the birds can be a significant source of mortality, and concentrating juveniles and releasing them from one point source that drops water and fish into the tailrace does exacerbate that mortality and should be part of the accounting of mortality due to a specific passage route.

It is important to note that the spillway survival values Mr. Scott refers to were collected in 2004 and 2005 under different project operations than previously existed. The spillway survival estimate for the 1995 to 1999 studies was 98%. Specifically, for the studies conducted in 2004 and 2005 the COE states in the "Structural and Operational Changes at FCRPS Dams to Improve Fish Survival", June 19, 2007, the addition of spillway deflectors and new spill patterns likely caused the decrease in spillway survival and evaluation of their impact on survival is underway.

Most importantly, survival to adulthood relative to the route of passage is the ultimate measure of a passage routes' benefit. It is true that a considerable amount of money was spent on the corner collector based on its being a beneficial surface route of passage. However, as with all routes of passage the use of a specific route of passage must produce adults. The Bonneville Second Powerhouse corner collector had not been tested for Spring Creek Hatchery subyearling migrants released in March nor have spillway releases been tested for these fish. Various survival studies for these routes of passage have been conducted at different times of year or for different species/stocks of fish. The Spring Creek March release is generally responsible for 46% of the returning adults from this hatchery and, while not necessary to protect these fish from an ESA perspective, the stock is of utmost importance to international and national fisheries. In 2004 (the first year of corner collector operation) the USFWS proposed to do a three year study under varying operations comparing spill to corner collector passage. Only one year of the study was implemented, and while the study was designed and conclusive results would have been drawn based on the data if the study had been implemented for all three years, the data suggests that fish that passed via the corner collector did not survive as well as those that passed the project via spill.

Given the importance of this fish stock and the role that spill may have relative to the long term survival of this stock, as well as the research data, it was important for the USFWS to procure the waiver for the March Spring Creek Hatchery release.

Also, the distribution of predators would change if spill passage were reduced. Likely concentrating more predators at the bypass and corner collector outfall locations recommended by Mr. Scott, where a little over 5 Kcfs of water would deliver most of the juvenile fish, would likely greatly reduce the survival through those routes of passage.

III. Interchange between Ritchie Graves, NOAA National Marine Fisheries Service (RG) and Commissioner Ken Williamson (CW) with input from Mark Schneider, NOAA NMFS (MS). This interchange was excerpted from testimony that occurred during hearing.

(CW) What is your read on the comparative survival rates – turbines versus spill?
(RG) It is my experience sir that that is a very dam specific question.
(CW) Well, give me a range.
(RG) A range of survival through uh?
(CW) Turbines.
(RG) Turbines, it is a result of several factors, one of which is tailrace egress conditions, if you have poor tailrace egress conditions even though the fish may survive a particular passage route, there may be predators lurking downstream, but for direct survival.
(CW) For direct survival, forget the predators.
(RG) I think your looking somewhere in the range of 4-5 % up to 10-12 % is pretty common for turbine passage routes.
(CW) Mortality?

(RG) Yes, mortality
(CW) And for spill?
(RG) For spill it can be as high as 99% and as you have heard today it can be as low as 92% or even 89%.
(CW) That's survival now?
(RG) Yes, survival.
(CW) Your talking about 1-11%, that's what your are telling me.
(RG) Yes.
(CW) So the ranges are about the same?
(RG) The ranges are overlapping, and in general.
(CW) They're not overlapping. They're about the same, isn't that what you are telling me?
(RG) Well, up to 99% survival through spillways, up to 95-96% survival through turbines units, direct survival.
(CW) So if we are talking about 4 million acre feet here, so what are talking about in terms of total spill for one season.
(RG) I have not brought those numbers with me, we do not try to calculate that as some of the other parties here are, we tend to view the success or failure of the program as the success of how well you meet the program developed in the fish passage plans.
(MS) Was you question
(CW) Well my question was you have a number here of 100 million dollars, and your telling me we are spending 100 million dollars for a 2-3% difference between spill and turbines.
(RG) I would ask you to consider that that is a cumulative effect.
(CW) Cumulative, what does that have to do with it?
(RG) If you're looking at survival through one dam, maybe it is not a big deal, but you have to remember that each of these fish are going through 7 to nine dams.
(CW) But comparing survival rates, it doesn't make a difference if it is one dam or twelve dams, it's a cumulative process so.
(RG) But it makes a difference, the survival estimates I gave you are for one dam.
(CW) I understand that…
(RG) And you multiply that by eight.
(CW) and they are roughly the same.
(MS) But, one of the calculations you saw the result of earlier today is a 4-6 % improvement in spill and that is in the ball park. And I believe that is a cumulative number that represents the system effect.
(CW) Okay, so what you are saying is 4-6 % for 100 million dollars. Is that what we are saying.
(MS) That is a lot of fish.
(CW) That is a lot of money
(MS) No one is arguing that, these numbers, we are getting into a lot of numbers here. There are reports that cover that and what I am saying is that I can get you those reports.

The conversation changes subjects here as other commissioners begin to ask questions on other topics covered.

The information that Mr. Graves gave the Commissioner was not completely incorrect and Mr. Graves did try to caution Commissioner Williamson regarding the limitations of using direct survival estimates. This interchange that took place between Mr. Graves and Commissioner Williamson again highlights the difficulty of interpreting direct juvenile project route specific survival estimates and their relation to adult productivity. The specific language that confused the interchange was when Mr. Graves referred to survivals through a passage route based on the high values obtained from studies for turbine passage. This lead Commissioner Williamson to draw a conclusion based on comparing a mortality value of 4-5 % versus 10-12%, and the impression was that the numbers overlap.

The comparison between spill and turbine survival should be done on a project by project basis. Point estimates of survival via spill or turbine passage are displayed in the table below using the data for spring Chinook to illustrate. Spill survival can be anywhere from 4.9% to 16.5% higher at a specific project and with the exception of Lower Granite Dam, are consistently higher via the spill route of passage. Numbers overlap when the range for all projects are considered – on when considering the confidence intervals or ranges of data on a project by project basis. As can be seen from the table the estimates vary widely and represent among other things, different flow, spill and temperature conditions among years and among tests.

The following table summarizes the estimates adopted by NOAA National Marine Fisheries in their COMPASS modeling efforts under the Biological Opinion Remand Program. These data are for spring Chinook.

Project	Spill Survival Estimate	Turbine Survival Estimate
LGR	93.1 (81.5–104.6)[1]	94.5 (88.1–100.9)[1]
LGO	97.2 (94.3 – 100.1)[1]	92.3 (85.8 – 97.4)[1]
LMN	96.1 (92.4 – 99.9)[1]	88.1 (78.8 - 97.3)[1]
IHR	96.5 (95.8 – 97.1)[1]	87.1 (83.2 – 91.3)[1]
MCN	96.2 (93.3 – 99.3)[2]	90.3 (86.9 - 95.4)[2]
JDA	96.4 (93.4 – 99.3)[2]	79.9 (77.8 – 82.0)[2]
TDA	92.4 (90.9 – 93.8)[2]	81.8 (79.7 – 83.8)[2]
BVL	83 – 100[3]	87- 98.1[3]

[1] Average and 95% Confidence Interval.
[2] Average of data and data range.
[3] Data Range of point estimates 1995 -2005.

In summary, the particular amount of spill at a project is related to the survival via different passage routes at that project and the overall adult production that results from various passage route configurations.

Cc:
Lauri Aunan, OR-DEQ
Gene Foster, OR-DEQ
Agnes Lut, OR-DEQ
Ed Bowles, ODFW