Fall Chinook Work Group

Tuesday, 7 July 2011

Grant PUD Natural Resources Office

Ephrata, WA

Technical members

Paul Wagner, NMFS
Robert Heinith, CRITFC
Holly Harwood, BPA
Keith Truscott, CPUD
Bill Tweit, WDFW
Marcie Mangold, WDOE
Russell Langshaw, GCPUD
Steve Hemstrom, CPUD
Joe Skalicky/Don Anglin, USFWS
Paul Ward/Bob Rose, YN
Brett Swift, American Rivers
Tom Kahler, DPUD
Paul Hoffarth, WDFW
John Clark, ADFG
Todd Pearsons, GCPUD

Attendees: (*Denotes Technical member)

Joe Skalicky, USFWS* (on phone)
Paul Hoffarth, WDFW*
Geoff McMichael, Battelle
Steve Hays, CCPUD (on phone)
Dave Patterson, WDFW
Josh Hede, WDFW
Steve Haeseker, USFWS (on phone)
John Clark, ADFG*
Tom Kahler, DCPUD* (on phone)
Marcie Mangold, WDOE* (on phone)
Russell Langshaw, GCPUD*
Nicole Boettner, WDFW
Chris Murray, Battelle
Tracy Hillman, Chair

Action Items:

1. **Steve Hays will provide Battelle with bird predation data based on Chelan PUD sampling at Rocky Reach.**
2. **Russell Langshaw will discuss with Jeff Fryer, CRITFC, some of the recommendations offered by the Expert Panel (e.g., double-marking of juveniles).**
3. **Paul Hoffarth will contact Jeff Fryer about when and where he conducted his Chinook marking work. This may explain the large number of the**

hatchery Chinook that Paul observed stranded and entrapped below Vernita Bridge.

4. **Paul Hoffarth will send Chris Murray the stranding data in July.**
5. **Chris Murray will work with Steve Haeseker to determine the best method for analyzing stranding data.**
6. **Steve Haeseker will send Paul Hoffarth and Chris Murray an Excel file with column headings so the entrapment data can be compiled to suit the analysis.**
7. **Paul Hoffarth will generate fate estimates for entrapments.**
8. **Paul Hoffarth will send entrapment data to Steve Haeseker by the end of July.**
9. **Steve Haeseker will begin analysis on entrapment data in August.**

Meeting Minutes

I. **Welcome and Introductions** – Tracy Hillman welcomed attendees to the meeting.

II. **Agenda Review** – Attendees reviewed and accepted the agenda.

III. **Approval of Meeting Minutes**

- The June Meeting Minutes were approved.

IV. **Review of Action Items** – Action items identified during the June meeting were reviewed and discussed.

- Geoff McMichael will find out what “Mean RT” means and the number of samples used to calculate the mean. **Complete.**
- Russell Langshaw will discuss with Jeff Fryer, CRITFC, some of the recommendations offered by the Expert Panel (e.g., double-marking of juveniles). **Not Complete.**
- Geoff McMichael will talk with the hydrodynamic modelers about why certain entrapment sites seem to be selected repeatedly. **Complete.**
- Joe Skalicky will look into flow data gaps in the historic record. **Complete.**
- Russell Langshaw will provide WDFW with a more accurate GPS unit. **Not Complete.**
- Paul Hoffarth will provide updates on the stranding/entrapment sampling efforts in the Hanford Reach. **Complete.**
- Russell Langshaw will provide weekly e-mail HRFCPP operation updates to the FCWG/HRWG. **Complete.**

V. **Study Plan Updates**

A. Productivity Assessment

Geoff McMichael reported that pre-smolt abundances have been estimated using the CWT mark-recapture approach for years in which they have age data from carcass surveys (Table 1). Additionally, stock size has been estimated for years in which they have sex composition by age data from creel surveys. From these estimates, it appears pre-smolt abundances are over-estimated using the CWT mark-recapture approach. For example, in 2000, the estimated number of pre-smolts produced exceeded the estimated number of eggs in females.

Table 1. Estimated Hanford Reach fall Chinook salmon stock size by brood year, represented as numbers of females, numbers of age-4 and older females, and egg potential (numbers of eggs in females) and recruitment (numbers of pre-smolts) estimated from mark-recapture of coded-wire tagged groups of wild Hanford Reach fall Chinook salmon.

Brood year	Females	Age-4+ females	Eggs in females	Pre-smolts	Pre-smolt SD
1986					
1987					
1988					
1989					
1990	25,710	25,292	116,338,336		
1991	20,340	20,238	92,970,973		
1992					
1993	13,470	13,107	59,883,025		
1994					
1995					
1996	16,673	15,080	72,891,149		
1997	20,482	20,285	91,229,702	49,356,500	9,659,381
1998				27,201,155	3,473,626
1999	11,452	10,568	50,014,542	23,468,187	1,894,182
2000	12,491	12,241	56,374,621	69,267,553	15,465,050
2001	17,985	16,268	78,897,030	61,513,566	12,812,035
2002	30,870	29,153	135,719,324	62,393,643	15,107,382
2003	44,279	43,880	198,646,449	138,583,757	46,159,154
2004	38,075	36,227	173,192,346	96,475,399	32,130,356

Battelle will continue to seek age data from WDFW carcass and creel surveys to estimate stock size and pre-smolts for the remaining years. Additionally, Dr. David Bernard was contacted about assisting with calculating conversion, ocean exploitation, survival, and maturation rates of Hanford Reach and Priest Rapids Hatchery CWT groups. He will help estimate pre-smolt abundances (for the residual analysis) and age-3 adult equivalents (for estimation of MSY) using the run-reconstruction methods outlined by the Expert Panel in Appendices 5 and 10 of the Expert Panel's Final Report. Dr. Bernard suggested that we contact Dr. Rishi Sharma for assistance. Dr. Sharma was contacted and is willing to perform these tasks as a consultant. He estimated 40-80 hours would be required to obtain all the necessary estimates.

B. Dam Passage Fallback

Geoff McMichael reported that the draft report titled, "Evaluation of Fallback and Reascension of Fall Chinook Salmon as it Relates to Escapement to the Hanford Reach" was submitted to Grant PUD on 23 June 2011.

C. Hydrodynamic Model Synthesis

Geoff McMichael noted that they received flow data at Priest Rapids Dam from 1964 to present from Grant PUD. They will use climate/meteorological data to estimate flows for the period 1917-1963.

Geoff indicated that they should have their super-duper computer running soon. This computer will greatly reduce model computing time.

D. Egg to Fry Survival

Geoff McMichael stated that over the course of three sampling days (November 7, 8, and 14), they collected roughly 100 eggs from each of 56 redds to evaluate the viability of in-redd eggs. Battelle has microscopically examined eggs from 28 of the 56 redds (3,200 eggs) and determined the status (whether fertilized and living or unfertilized or dead at the time of sampling) and the number of accumulated temperature units (i.e., degree days) since fertilization. The following preliminary results are based on these 28 redds.

On average (mean ± SE), 1.9% ± 0.4% of the eggs sampled were either not fertilized or dead at the time of sampling, 55.1% ± 8.6% were known to have been fertilized and alive, 1.3% ± 0.3% were of unknown status due to oil globules obstructing the view of cellular structure, and the remaining 41.6% ± 8.7% were at a stage of development (i.e., late morula) in which fertilized eggs could not be distinguished from unfertilized eggs (Figures 1 and 2). Geoff said it is reasonable to assume that nearly all (e.g., 98%) of the unknown status (due to oil globules and stage of development) eggs were fertilized and alive during the time of sampling. It is unclear whether the proportion of living eggs was positively related to the amount of accumulated temperature units over the range of development that they examined (Figure 3). This relationship (or lack thereof) may become clear as Battelle processes the remaining samples.

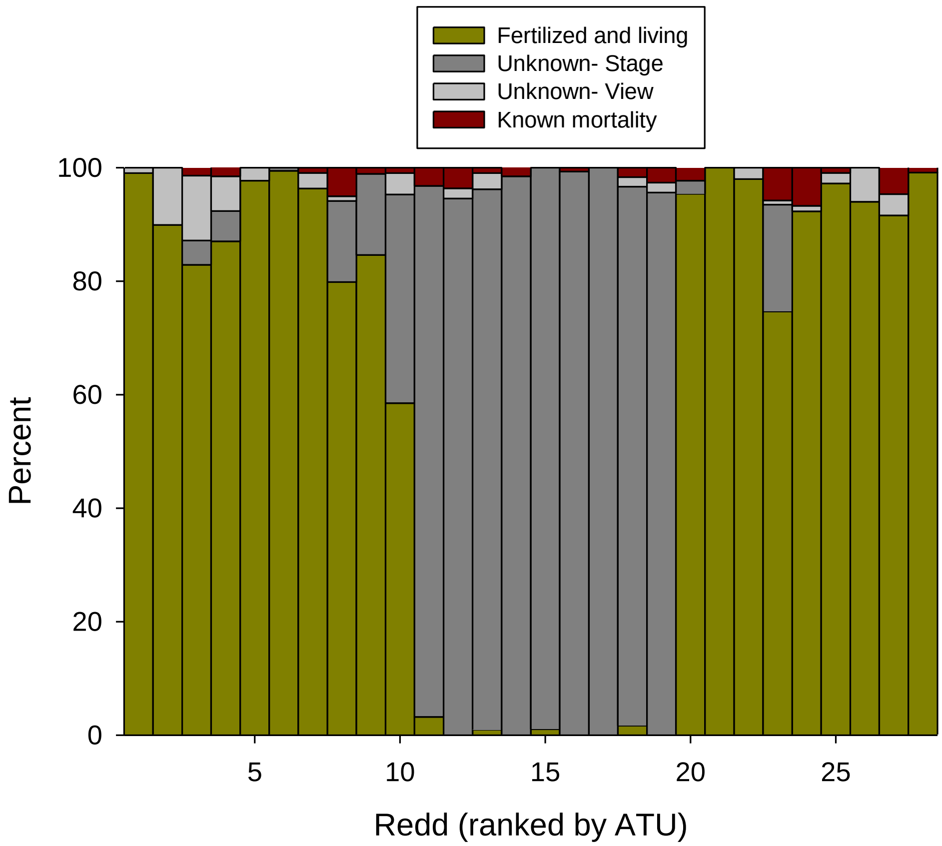

Figure 1. Percent of eggs that were fertilized and living at the time of sampling, at a stage of development in which status could not be determined (Unknown- Stage), of unknown status due to oil globules obstructing the view of cellular or embryonic structure, and known mortality or unfertilized eggs. Each bar represents an individual redd and redds were ranked from those with the fewest accumulated temperature units since fertilization to those with the most.

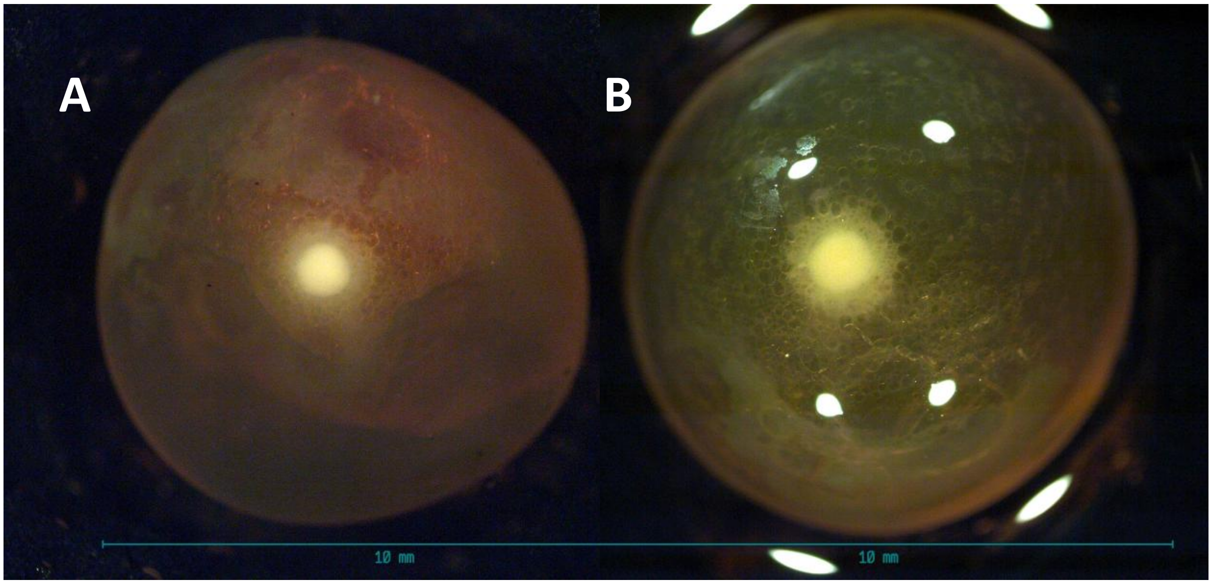

Figure 2. An unfertilized (A) and fertilized (B) egg 30 degree days (i.e., late morula stage in fertilized Chinook salmon eggs) after the start of incubation (and fertilization for B). Note: before this stage individual cells can be observed in fertilized eggs making it possible to distinguish between fertilized and unfertilized eggs. Fertilized eggs can be distinguished from unfertilized eggs at stages later than morula as cell differentiation and embryonic development begins.

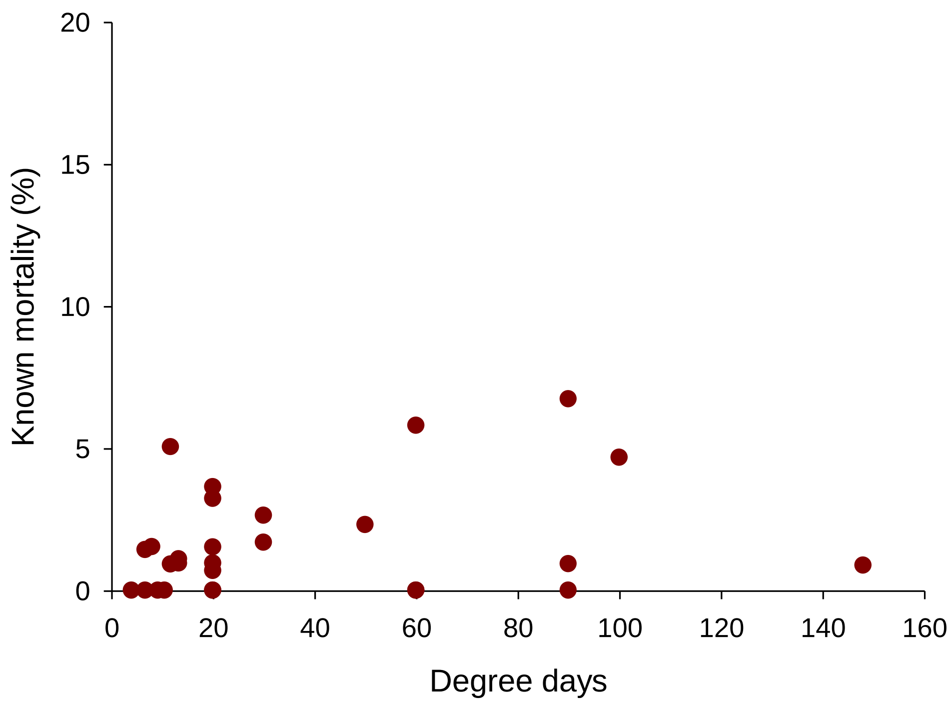

Figure 3. Percent of known mortality (including unfertilized) among eggs within each redd by accumulated temperature units (degree days).

E. Production Simulation Model

Geoff McMichael indicated that in June they continued to parameterize the predation and free-swimming life stage submodels, completed integrating the particle tracker within MASS2 with the egg/in-gravel life stage (i.e., so that hydrologic variables of an individual organism can be recorded through time), and have been programming the free-swimming life stages that have already been parameterized (i.e., growth, downstream movement, baseline mortality, stranding mortality). Battelle explored different methods of implementing predation and decided on using a constant Z (instantaneous mortality rate of juvenile fall Chinook) for each predator per day. The “constant Z” method will allow a functional response to be incorporated into the model such that as juvenile fall Chinook salmon abundance increases or decreases in the model, predation will subsequently be density-dependent. They considered using bioenergetics models to drive predator growth in order to account for consumption-demand increases during the predator growing season, which coincides with the fall Chinook emigration season. However, growth data in the Hanford Reach are not available for any of the three piscine predators they are modeling and thus realistically growing predators within the model are not feasible at this time.

Battelle also completed parameterization of the downstream movement submodel of the free-swimming life stage and are in the process of parameterizing a vertical/horizontal component to fish distribution within the river cross section. Downstream movement rate will be based on the equation presented in Giorgi et al. (1997). The vertical/horizontal distribution component will be parameterized based on data from Dauble et al. (1989); before coding they will need to determine how to incorporate individual variability into the distribution.

To explore the possibility of incorporating avian predation into the model, Battelle did a literature search and talked to bird biologists about the birds most likely to be the main predators of juvenile fall Chinook salmon in the Reach. Based on this exercise, it was determined that American white pelican, double-crested cormorant, common merganser, Caspian tern, California gull, and ring-billed gull are the most likely predators in the Reach from April through July of each year. Battelle found no abundance data by bird species in the Reach. All that is available are relative abundance data from some historic waterfowl surveys and the North American Breeding Bird Survey. Thus, providing information in the model’s user guide, to guide the user in setting avian predator abundances, is not available. A few data sources on diets of birds in the mid-Columbia downstream of the

Hanford Reach and in the Yakima River are available as grey literature and will be explored in the near future. However, bird diet data specific to Hanford Reach fall Chinook salmon is unavailable and thus making presumptions about avian predation on this run-type will require some yet-to-be-determined assumptions.

Steve Hays indicated that Chelan PUD may have some bird predation data from Rocky Reach that may be useful in the simulation model. He will send the information to Geoff.

VI. HRWG Activities

HRFCPP Operations – Russell Langshaw noted that they exceeded HRFCPP constraints on three different occasions. Two were less than 0.6 kcfs and the other was to support retrieval of test fish and equipment for the egg-to-fry survival study. For the latter, Russell explained that they exceeded constraints to minimize the amount of time that fish would be entrapped, while maximizing retrieval of equipment and fish.

Russell reported that rearing period constraints (i.e., daily or weekend delta constraints) ended on 20 June. He indicated that the spreadsheets worked well in predicting end dates. Russell also explained that TDG management was the biggest concern this year. Flow constraints were not an issue.

A. Stranding and Entrapment Update – Paul Hoffarth reported results from sampling stranding and entrapment sites in 2011. During the survey year, they visited 799 entrapment sites. Flow fluctuations were not sufficient to create entrapments or no entrapments were present in 596 of the 799 locations. A total of 573 entrapments were sampled from the remaining 203 sites. A total of 61 sampled entrapments have contained Chinook. During the study, 802 Chinook have been collected from entrapments. Collection efficiency averaged 89.4% (range, 33.3-100.0%). Entrapment summaries are provided below.

Entrapment Summary, February 28 - June 20, 2011

Segment	Sites Visited	Entrapments Present		Entrapments Sampled	Entrapments w/ Chinook	Entrapment Fates			
		No	Yes			Unknown	Reflood	Drain	Temp >27C
1	200	136	64	158	11	97	19	39	3
2	117	90	27	91	8	50	11	27	3
3	76	53	23	67	10	37	3	21	6
4	54	43	11	43	6	23	9	9	2
5	62	46	16	32	14	12	10	9	1
6	52	42	10	26	3	15	7	3	1
7	134	100	34	122	8	77	9	27	9
8	104	86	18	34	1	17	2	14	1
Totals	**799**	**596**	**203**	**573**	**61**	**328**	**70**	**149**	**26**

Entrapment Summary, February 28 - June 20, 2011

Segment	Chinook			Collection Efficiency			Chinook per Entrapment
	Total	Live	Dead	Mark	Recap	%	
1	97	72	25	55	39	70.9%	0.6
2	18	13	5	7	7	100.0%	0.2
3	41	7	34	3	1	33.3%	0.6
4	42	35	7	16	12	75.0%	1.0
5	474	449	25	259	240	92.7%	14.8
6	32	24	8	15	14	93.3%	1.2
7	97	90	7	79	75	94.9%	0.8
8	1	1	0	0	0		0.0
Totals	**802**	**691**	**111**	**434**	**388**	**89.4%**	**1.4**

Paul then provided the following table, which compares the entrapment results among the different sampling years.

Week*	Entrapments w Chinook (%)					Chinook per Entrapment				
	2011	**2007**	**2005**	**2004**	**2003**	**2011**	**2007**	**2005**	**2004**	**2003**
Feb 28-Mar 13	0%					0.0				
Mar 14 - 27	4%					0.2				
Mar 28-Apr 3	19%	4%	23%		40%	4.9	0.2	15.6		35.8
April 4-10		7%	10%		48%		0.4	13.9		129.6
April 11-17	13%	4%	26%		37%	2.4	0.9	30.6		20.5
April 18-24		2%	53%	18%	17%		0.03	20.6	20.7	166.7
Apr 25-May 1	5%	12%	19%	12%	33%	0.9	0.6	29.7	4.4	7.2
May 2-7		6%	9%	15%	37%		0.2	4.2	2.5	37.6
May 8-15	24%	10%	14%	17%	8%	1.2	21	0.9	18.2	1.4
May 16-23		11%	13%	7%	5%		6.7	3.9	1	0.5
May 24-30	7%	5%		4%	7%	1.4	0.6		1.8	8.9
May 31-Jun 6		2%		5%	4%		0.5		0.1	6.4
June 7-13	13%	1%			0%	0.5	1.7			0
June 14-20		2%			3%		2.1			0.3
Overall	11%	5%	18%	12%	18%	1.4	2.3	13.4	7.1	35.5

Paul noted that the stranding field crews visited 388 transects in 2011. Of these, 182 transect did not have sufficient flow fluctuations to assess stranding. From the remaining 198 transects, 374 plots were sampled. This year, 22,997 m^2 have been sampled with 41 Chinook collected (see table below).

Stranding Summary, February 28 - June 5, 2011

Segment	Sites Visited	Plots Sampled		Plots (#)	Area sampled	Fish Collected			
		No	Yes			**Chinook**	**NPM**	**STB**	**COT**
1	86	41	43	63	3,329	5	0	0	0
2	54	23	31	64	3,966	0	0	0	7
3	44	27	17	30	1,705	2	0	0	0
4	13	9	4	14	974	21	0	0	0
5	33	15	18	37	2,338	1	0	0	0
6	37	20	17	32	2,014	2	0	0	0
7	71	34	35	82	5,327	8	0	0	0
8	50	13	33	52	3,344	2	0	0	0
Totals	**388**	**182**	**198**	**374**	**22,997**	**41**	**0**	**0**	**7**

Paul noted that he had one crew mapping high elevation entrapments and found hundreds of hatchery fall Chinook entrapped in transects 20-26, just downstream from Vernita Bridge. The fish were between 60-90 mm. All fish appeared to be fin clipped, probably from Priest Rapids Hatchery. Paul noted that hundreds of pikeminnow fry and sticklebacks were also stranded and entrapped. Russell suggested that Paul contact Jeff Fryer about when and where he conducted his Chinook marking work.

Joe Skalicky asked Paul how they sampled entrapments with vegetation. Paul indicated that they use visual counts, seines, and electrofishing techniques. However, some entrapments with vegetation could not be sampled. Sites that were partially sampled (based on visual observations) were included in the results in the above tables.

B. **Summary of the Stranding and Entrapment Work Group Meeting (1:00-3:30 pm)** – The Stranding and Entrapment Work Group met in the afternoon. What follows is a summary of the discussions.

- Field crews found that for some sites, there was a long lag in the timing of the flow fluctuation. There was sometimes a lag of three-four hours.
- There were some transects that did not have stranding sites. The work group thought that these sites could be blocked out.
- The use of transects was a good approach. The spacing and number of transects was also good.
- Rain did not greatly affect the sampling of stranding sites. Crews looked for debris lines and turned rocks to see if they were dry. Rocks that were dry on the underside were considered outside the fluctuation zone.
- Improving real-time information would reduce travel-time between sites. Providing cells phones and accurate GPS units to field crews will help them better identify flow drops and specific sampling locations.
- Crews did not observe fluctuations in the lower reaches, probably because of effects from the Yakima River and Snake River (as affected by operations at McNary Dam).
- It is important to continue to conduct collection efficiency trials.
- Chris Murray will analyze stranding sites. Paul will send stranding data to Chris in two weeks.
- Chris Murray proposed to use Monte Carlo bootstrap analyses. Steve Haeseker noted that the data should be analyzed

according to a two-stage sampling design. Chris and Steve will work together to resolve the analysis.

- Steve Haeseker will analyze the entrapment data beginning in August. Steve will send Battelle and WDFW an Excel file with headers so the data can be compiled to suit the analyses.
- Will need to run MASS 1 or MASS 2 to determine how many times entrapments were formed. Paul will generate fate estimates.
- Grant PUD and Battelle will send entrapment data to Steve by the end of July.
- Draft analyses will be completed by 1 October. The work group will review the analyses and reconvene in early December to discuss final analyses and preparation of the draft report.

VII. **Next Meeting**: Thursday, 2 August 2011 at the Grant PUD Natural Resources Office in Ephrata, WA.