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MEMORANDUM

TO: Fish Passage Advisory Committee

FROM: Michele DeHart

DATE: April 18, 2010

RE: Initiation of Transportation in 2010

At the April 13, 2010 meeting, the Fish Passage Advisory Committee requested that the Fish Passage Center review historic passage data to inform the Committees discussions of the date to initiate smolt transportation in 2010, in order to implement the spread the risk strategy, with the objective of achieving 50% of the population of spring Chinook and steelhead to migrate in-river and 50% to be collected and transported. The dates specified in the Fisheries Operation Plan for 2010 for the initiation of transportation are from April 20 to May 1. These dates are based upon the NOAA Biological Opinion and the determination that smolt to adult return rates for Chinook yearlings transported in prior to May 1 indicate that transportation is not beneficial during this time period. The relatively high in-river (C1) SARs early in the season provide one possible reason that current strategies that maximize transportation of collected fish over the entire migration season are likely not optimizing overall wild Chinook SAR. The results also suggest that previously observed increasing trends in wild Chinook TIRs (where C1 fish are used in the denominator) over the migration season are a result mainly of the dramatic decline in C1 SARs over the season, rather than dramatically increasing survival of transported fish late in the migration season (Schaller et al.2007, Chapter 4).

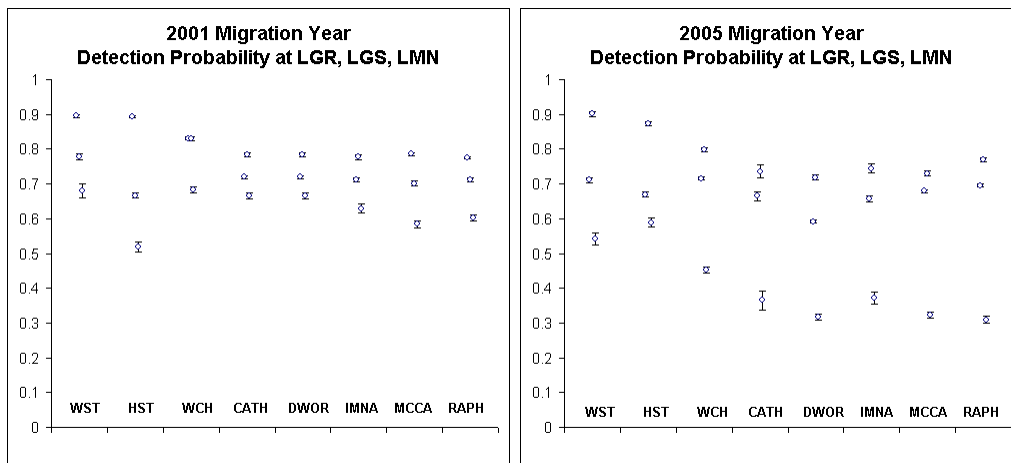
The determination of the initiation of the start date of transportation presents a mixed stock fish management question complicated by the fact that a long time series of historic data is not available to provide a basis for predicting a start date that will accomplish the management objective.

The FPC reviewed historic passage data, including the start dates of transportation and the resulting proportion of steelhead and Chinook transported. The FPC reviewed Smolt Monitoring Program (SMP) data and Comparative Survival Study (CSS) data. Each year the FPC estimates the proportion of each species transported after the migration season is completed. Several variables impact the proportion of fish transported, most importantly, detection probability of PIT tagged fish and migration timing and duration. Migration timing and duration are affected by flow and also hatchery release schedules. These variables are known at the end of the migration season. These variables must be assumed prior to the migration season. The historic record only includes one year, 2007, in which spill for fish passage was provided in a low flow year. However, in 2007, flow and downstream passage occurred in a pattern that affected the migration timing and as a result the proportion of Chinook and steelhead transported. Even at this early point in the downstream migration, the 2010 migration timing is not similar to 2007. Following are our summary points from review of the historic record.

- The determination of the initiation date of transportation requires consideration of smolt-to-adult return data concurrently with consideration of the spread-the-risk objective.
- Migration timing is largely determined by flow. Increases in flow will move fish downstream.
- In 2001 the 10% point of passage for yearling Chinook occurred on April 26. In 2005 the 10% point of passage occurred on April 24, in 2007 the 10% point of passage occurred on April 18.
- Passage timing in 2007 was earlier for spring Chinook than occurred in past years, and than is occurring in 2010. The earlier timing pattern contributed to the total lower proportion transported in 2007 because detection probabilities are lower in the earlier portion of the migration. Later migration timing will result in a higher total proportion of spring Chinook being transported. At this point migration timing in 2010 appears later than 2007.
- The low transportation proportions for yearling Chinook in 2007 are likely a combination of: 1) high spill proportions at LGR and LMN (due to low flows and set spill volumes), 2) earlier passage timing for yearling Chinook, 3) later start of transportation operation, and 4) night-time gas cap spill at LGS from April 29th to May 12th.
- Over 10 million hatchery salmonids are scheduled for release above LGR between April 1st and April 21st of this year. These hatchery salmonids are primarily yearling spring Chinook, yearling fall Chinook, and summer steelhead.
- For the period between April 1st and April 21st, about 1.5 million more yearling spring Chinook are planned for release in 2010 than the average of what was released during this same time period from 2005 to 2009. Planned steelhead releases for this time period in 2010 are about 1 million less than the average for the same time period from 2005 and 2009. Yearling fall Chinook releases for this time period are similar to what had been seen in 2006 to 2009, with significantly fewer yearling fall Chinook in 2005.
- Key assumptions of variables required to predict an initiation of transportation date, such as detection probability and migration timing are highly variable. This variability is present among species, among stocks and among years. Small difference in detection probability will have a large affect on the predicted proportion transported resulting from various start dates of transportation. Therefore confidence ranges of predicted start dates of transportation encompass the entire April 20-May period being considered for start of transportation.

- The proportion transported for spring Chinook was close to 50% in 2009 and 2008 when transportation was initiated on May 1. In 2006 transportation was initiated on April 20, resulting in more than 50% of yearling Chinook being transported. In 2007 with earlier yearling Chinook migration timing, less than 50% of the Chinook were transported.
- Within-season transportation SARs after May 1, are usually at their highest for both Chinook stocks, and have the least risk of being detrimental for wild Chinook. (FPC memo: Fish Passage Plan, transportation dates and spill, February 18, 2009)
- In summary, the historic data reviewed suggests that there is a complexity of interactions among species, stocks, migration timing and environmental variables that does not allow the prediction of a specific date to accomplish the spread the risk objective. However, review of the existing data, together with the review of the current years' information should provide the Salmon Managers with some technical basis for choosing a date within the April 20 to May 1 time frame.

Detection Probabilities Vary Considerably. Annual detection probabilities at Lower Granite (LGR), Little Goose (LGS), and Lower Monumental (LMN) were estimated as part of the CSS. This calculation was performed for these Snake River originating study groups: wild steelhead, hatchery steelhead, wild Chinook, and hatchery Chinook at Catherine Creek, Dworshak, Imnaha, McCall's, and Rapid River. These estimates are plotted in the following Figure 1 with their 90% bootstrap confidence interval.



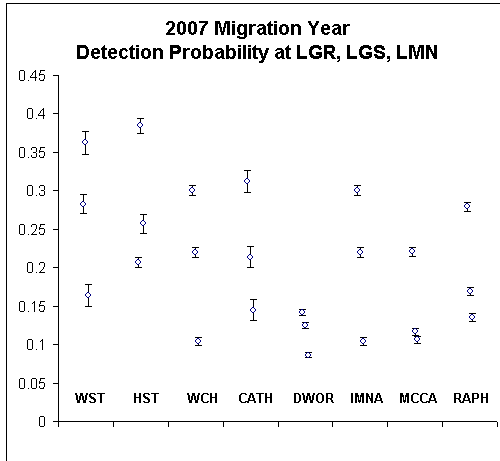


Figure 1. Detection probabilities at LGR, LGS, and LMN for seven CSS study groups from relatively low flow years (2001, 2005, and 2007). The study groups are wild steelhead (WST), hatchery steelhead (HST), wild Chinook (WCH) and 5 Chinook hatcheries (CATH= Catherine Creek, DWOR = Dworshak, IMNA = Imnaha, MCCA = McCalls, and RAPH = Rapid River). Each detection probability is from the Cormack Jolly Seber model shown with its 90% non parametric bootstrap confidence interval. Note the difference in scale for the y-axis in the 2007 Migration Year figure.

Detection probabilities varied within a migration year across species, across stocks, and across dams. Detection was higher in 2001 and 2005 than for 2007, which reflects the lack of spill for fish passage in these years. In general steelhead detection was typically higher than for Chinook. Within a species, wild stocks usually had higher detection probability than for hatchery stocks. However, this was not always the case (See steelhead 2007) Estimates of detection probability with the Cormack Jolly Seber model are likely affected by variations in out-migration timing, behavior, or other factors such as project operations. These estimates may be as uniquely associated with a particular stock and species within a year as survival estimates.

Recent Transportation Operations:

For perspective, the FPC staff reviewed transportation and spill operations from 2005 to 2009 at FCRPS transportation projects. In addition, FPC staff reviewed historic SMP timing data and estimates of transportation proportion for yearling Chinook and steelhead at these projects. A brief summary of this review is presented below in Table 1.

In 2005, transportation began at Lower Granite Dam (LGR) as soon as the Smolt Monitoring Program (SMP) began sampling, on March 25th. Transportation began as every-other-day, switched to every-other-day barging on April 8th, and switched to every-day barging on April 24th. Transportation from Little Goose, and Lower Monumental dams on April 20th. Transportation at Little Goose and Lower Monumental dams also started when the SMP began sampling on April 2nd. As with LGR, transportation started out with every-other-day trucking and switched to every-other-day barging and every-day barging at the same times as LGR. There was no voluntary spill in 2005. However, there was some involuntary spill in mid- to late May due to flows in excess of hydraulic capacity. As a result of these operations, the proportion

of the yearling Chinook and steelhead populations that were destined for transportation in 2005 were 0.92 and 0.94, respectively.

In 2006, there was a staggered start to transportation and transportation began later than it historically started. Instead of starting in early April, transportation in 2006 began on April 20th at LGR, April 24th at LGS, and April 27th at LMN. There was voluntary spill throughout the spring of 2006, as well as a large amount of involuntary spill due to flows in excess of hydraulic capacity. As a result of these operations, the proportion of the yearling Chinook and steelhead populations that were destined for transportation in 2006 were 0.58-0.61, and 0.76-0.79, respectively.

Transportation in migration year 2007 also had a staggered and later start than historic years. Collections for full transportation began on April 30th at LGR, May 8th at LGS, and May 11th at LMN. For experimental purposes, a limited number of yearling Chinook and steelhead were collected for transportation at LGR prior to May 1st. During this experiment, barges left LGR on April 12th, 21st, 26th, and 30th. As with 2006, there was voluntary spill throughout the spring of 2007. However, due to the low flows in 2007, there was no involuntary spill in the spring of 2007. As a result of these operations, the proportion of the yearling Chinook and steelhead populations that were destined for transportation in 2007 were 0.17-0.24, and 0.44-0.47, respectively. The low transportation proportions for yearling Chinook in 2007 are likely a combination of: 1) high spill proportions at LGR and LMN (due to low flows and set spill volumes), 2) earlier passage timing for yearling Chinook, 3) later start of transportation operation, and 4) night-time gas cap spill at LGS from April 29th to May 12th.

The transportation schedule in migration 2008 was similar to that in 2007. Collections for full transportation began on May 1st at LGR, May 10th at LGS, and May 12th at LMN. As with 2007, some yearling Chinook and steelhead were transported prior to May 1st from LGR, as part of an experiment. During this experiment, barges left LGR on April 10th, 17th, 21st, 24th, 28th, and May 1st. There was voluntary spill throughout the spring of 2008, as well as a large amount of involuntary spill due to flows in excess of hydraulic capacity. As a result of these operations, the proportion of the yearling Chinook and steelhead populations that were destined for transportation in 2008 were 0.49, and 0.41-0.45, respectively.

Collections for full transportation in 2009 began on May 1st at LGR, May 5th at LGS, and May 8th at LMN. As with 2007 and 2008, some yearling Chinook and steelhead were transported prior to May 1st from LGR, as part of an experiment. During this experiment, barges left LGR on April 9th, 16th, 23rd, and April 30th. There was voluntary spill throughout the spring of 2009, as well as a large amount of involuntary spill due to flows in excess of hydraulic capacity. As a result of these operations, the proportion of the yearling Chinook and steelhead populations that were destined for transportation in 2008 were 0.36-0.40 and 0.46-0.48, respectively.

Table 1. Historic transportation and spill operations at Snake River transportation projects. LGR passage timing is for Chinook and steelhead are hatchery and wild combined.

Migration Year	Spring Spill Operation	Beginning of Transportation	Transportation Proportion(s)	LGR Timing Dates		
				10%	50%	90%
2005	LGR - No voluntary spill LGS - No voluntary spill LMN - No voluntary spill	LGR – March 25 LGS – April 2 LMN – April 2	CH1 – 0.92	Apr 24	May 5	May 11
			ST – 0.94	Apr 27	May 9	May 19
2006	LGR – 20 Kcfs/20 Kcfs LGS – 30%/30% LMN – Gas Cap/Gas Cap	LGR - April 20 LGS – April 24 LMN – April 27	CH1(H) -0.61 CH1(W) – 0.58	Apr 20	May 5	May 16
			ST(H) – 0.76 ST(W) – 0.79	Apr 21	May 4	May 20
2007	LGR – 20 Kcfs/20 Kcfs †LGS – 30%/30% LMN – Gas Cap/Gas Cap	LGR – April 30 LGS – May 8 LMN – May 11	CH1(H) -0.24 CH1(W) – 0.17	Apr 18	May 3	May 13
			ST(H) – 0.47 ST(W) – 0.44	Apr 26	May 7	May 21
2008	LGR – 20 Kcfs/20 Kcfs LGS – 30%/30% LMN – Gas Cap/Gas Cap	LGR – May 1 LGS – May 10 LMN – May 12	CH1(H) -0.49 CH1(W) – 0.49	Apr 26	May 9	May 19
			ST(H) – 0.41 ST(W) – 0.45	Apr 27	May 10	May 23
2009	LGR – 20 Kcfs/20 Kcfs LGS – 30%/30% LMN – Gas Cap/Gas Cap	LGR – May 1 LGS – May 5 LMN – May 8	CH1(H) -0.36 CH1(W) – 0.40	Apr 23	May 8	May 21
			ST(H) – 0.46 ST(W) – 0.48	Apr 22	May 6	May 25

† 2007 operations called for 14 nights of gas cap spill at LGS. Night-time gas cap spill at LGS began on April 29th and ran through May 12th

Migration Timing and Hatchery Releases:

Hatchery releases can have a significant impact on the timing of smolts at the transportation collection sites. Later hatchery releases will typically translate to a later migration timing. However, the flows that these hatchery fish experience also can affect passage timing, with lower flows typically resulting in later passage timing. The FPC staff reviewed the hatchery releases that are scheduled to begin between April 1 and April 21, 2010 versus historical hatchery release schedules during this same period. The FPC staff limited this review to releases of migrating salmonid smolts to the Snake River Zone, above Lower Granite Dam (LGR).

April 1 to April 7:

During the week of April 1 to April 7, just over 3.2 million salmonids were expected to be released above LGR (Table 2). Of these, nearly 1.9 million were yearling spring Chinook. Nearly 1.24 million of these yearling spring Chinook were scheduled for release into the Clearwater River and its tributaries, all beginning on or around April 1st. Approximately 266,000 of these spring Chinook juveniles were scheduled for release into Lookingglass Creek, a tributary of the Grande Ronde River, beginning April 1st. The remaining 396,000 spring

Chinook juveniles were scheduled for release from the Imnaha Acclimation Pond into the Imnaha River. This volitional release was scheduled to begin on April 1st. On April 5th, nearly 50,000 yearling summer Chinook were released into Johnson Creek, a tributary of the South Fork Salmon River. Finally, nearly 1.3 million of the salmonids released above LGR during this week were summer steelhead. Of these, over 1.1 million were scheduled for release into the Salmon River and its tributaries. The remaining 160,000 summer steelhead that were scheduled for release during this week were to be released from the Cottonwood Acclimation Ponds, into the Grande Ronde River.

April 8 to April 14:

During the week of April 8 to April 14, a total of just over 4.0 million salmonids were expected to be released above LGR (Table 3). Of these, nearly 295,000 are yearling fall Chinook. Nearly 155,000 of these yearling fall Chinook were released from Captain Johns Acclimation Pond into the Snake River on April 9th. The remaining 140,000 yearling fall Chinook are scheduled for release from Pittsburg Landing Acclimation Pond (into the Snake River) on April 14th. Nearly 1.6 million yearling spring Chinook were scheduled for release above LGR during this period. Of these, nearly 1.5 million were to be released from Sawtooth Hatchery into the Salmon River, beginning on or around April 14th. The remaining 124,000 were scheduled to be released from the Lostine Acclimation Pond into the Wallowa River on April 10th.

Over 2.1 million of the salmonids scheduled for release during this period were summer steelhead. Nearly 904,000 of these summer steelhead were scheduled for release into the Salmon River, beginning around April 12th. In addition, 830,000 summer steelhead were scheduled for release into the Pahsimeroi River, beginning around April 12th. Nearly 343,000 summer steelhead from Clearwater Hatchery were scheduled for release into tributaries of the Clearwater River during this period. Finally, about 50,000 of the summer steelhead scheduled for release during this period were to be released into Big Sheep Creek, a tributary of the Imnaha River.

April 15 to April 21:

During the week of April 15 to April 21, nearly 2.8 million salmonids are expected to be released above LGR (Table 4). Of these, about 150,000 are yearling fall Chinook that are being released from the Big Canyon Creek Acclimation Pond on the Clearwater River. These fall Chinook are scheduled for release on April 15th. Approximately 404,000 of the salmonids scheduled for release during this period are yearling spring Chinook that are to be released into Yankee Fork of the Salmon River on April 19th.

The remaining 2.2 million salmonids scheduled for release during this period are all summer steelhead. Of these, about 1.75 million are scheduled for release into the Clearwater River and its tributaries. About 1.24 million of these Clearwater River steelhead were reared at Dworshak NFH and are to be released on April 19th, either directly from the hatchery or into nearby tributaries. These Dworshak Hatchery steelhead releases are slightly later than previous years. The remaining 508,000 of the Clearwater River steelhead were reared at Clearwater Hatchery and are scheduled to be released on or around April 15th. About 325,000 of the summer steelhead scheduled for release during this period are to be released into the Salmon River. This Salmon River release is scheduled to begin on or around April 19th. Finally, about 156,000 of the

summer steelhead scheduled for release during this period are to be released into the Grande Ronde River, beginning April 16th.

Table 2. Hatchery releases above Lower Granite scheduled to begin between April 15 and April 21, by species-race and release river.

Start Date	End Date	Species – Race	Hatchery	Release Site	Agency	Release River	Number Released	Comment
4/1	4/4	CH1-SP	Kooskia NFH	Kooskia Hatchery	NEZP	Clearwater River M F	633,000	443000 AD Only; 162000 AD/CWT; 10000 PIT
4/1	4/15	CH1-SP	Nez Perce Tribal Hatchery	Nez Perce Tribal Hatchery	NEZP	Clearwater River M F	200,000	100% Unmarked; 600 PIT; Incubated and transferred from Clearwater Hatchery
4/1	4/14	CH1-SP	Lookingglass Hatchery	Lookingglass Creek	ODFW	Grande Ronde River	266,000	100% AD/CWT
4/1	4/14	CH1-SP	Lookingglass Hatchery	Imnaha Acclim Pond	ODFW	Imnaha River	396,000	100% AD; 48% CWT
4/1	4/10	CH1-SP	Clearwater Hatchery	Meadow Creek - SELW	NEZP	Selway River	402,300	252100 AD/CWT; 16800 AD Only; 133400 Unmarked; 18200 PIT
4/5	4/5	CH1-SU	McCall Hatchery	Johnson Cr Idaho	NEZP	South Fork Salmon River	49,930	100% CWT/VIE (LE Yellow); 2232 PIT
4/5	4/16	ST-SU	Lyons Ferry Hatchery	Cottonwood Acclim Pond	WDFW	Grande Ronde River	160,000	87.5% AD Only; 12.5% AD/LV
4/1	4/8	ST-SU	Niagara Springs	Little Salmon River	IDFG	Salmon River (ID)	275,000	100% AD; 30000 CWT; 4300 PIT; Rel @ Stinky Springs
4/5	4/16	ST-SU	Magic Valley Hatchery	Little Salmon River	IDFG	Salmon River (ID)	315,000	100% AD; 120000 CWT; 5600 PIT; Rel @ Stinky Springs
4/5	4/16	ST-SU	Magic Valley Hatchery	Little Salmon River	IDFG	Salmon River (ID)	187,550	100% AD; 19000 CWT; 3400 PIT; Rel @ Stinky Springs
4/5	4/7	ST-SU	Magic Valley Hatchery	Salmon River (ID)	IDFG	Salmon River (ID)	124,373	100% AD; 80000 CWT; 2082 PIT; Rel in Section 16 @ Red Rock
4/5	4/9	ST-SU	Magic Valley Hatchery	Salmon River (ID)	IDFG	Salmon River (ID)	152,000	100% AD; 60000 CWT; 2600 PIT; Rel into Section 17 @ Colston Corner
4/6	4/6	ST-SU	Magic Valley Hatchery	Shoup Br (Salmon R)	IDFG	Salmon River (ID)	61,562	100% AD; 20000 CWT; 989 PIT
April 1 - April 7 Total							3,222,715	

Table 3. Hatchery releases above Lower Granite scheduled to begin between April 8 and April 14, by species-race and release river.

Start Date	End Date	Species – Race	Hatchery	Release Site	Agency	Release River	Number Released	Comment
4/9	4/9	CH1-FA	Lyons Ferry Hatchery	Cpt John Acclim Pond	NEZP	Snake River	154,637	47% AD/CWT; 53% CWT Only; 19000 PIT
4/14	4/15	CH1-FA	Lyons Ferry Hatchery	Pittsburg Landing Acclim Pond	NEZP	Snake River	140,000	70000 AD/CWT; 70000 CWT Only; 19000 PIT
4/9	4/9	CH1-SP	Sawtooth Hatchery	Salmon River (ID)	IDFG	Salmon River (ID)	1,459,800	1367200 AD Only with 17000 PIT; 92600 AD/CWT (no PIT)
4/10	4/11	CH1-SP	Lookingglass Hatchery	Lostine Accim Pond	NEZP	Wallowa River	124,000	50% AD/CWT (Conventional Broodstock); 50% CWT Only (Captive Broodstock); 2400 PIT
4/9	4/9	ST-SU	Irrigon Hatchery	Big Sheep Creek	ODFW	Imnaha River	50,000	100% AD
4/12	5/3	ST-SU	Niagara Springs	Pahsimeroi River	IDFG	Pahsimeroi River	830,000	100% AD; 90000 CWT; 13000 PIT
4/10	4/20	ST-SU	Clearwater Hatchery	Red River	NEZP	S Fk Clearwater River	153,500	100% Unmarked; 4200 PIT
4/10	4/20	ST-SU	Clearwater Hatchery	Crooked River	NEZP	S Fk Clearwater River	85,600	100% Unmarked; 2400 PIT
4/13	4/17	ST-SU	Clearwater Hatchery	Newsome Creek	NEZP	S Fk Clearwater River	103,700	100% Unmarked
4/12	4/12	ST-SU	Hagerman NFH	Salmon River (ID)	USFW	Salmon River (ID)	69,869	100% AD; 20476 CWT; 983 PIT; Rel @ Tunnel Rock
4/13	4/28	ST-SU	Hagerman NFH	Salmon River (ID)	USFW	Salmon River (ID)	833,919	100% AD; 84146 CWT; 13282 PIT
April 8 - April 14 Total							4,005,025	

Table 4. Hatchery releases above Lower Granite scheduled to begin between April 15 and April 21, by species-race and release river.

Start Date	End Date	Species – Race	Hatchery	Release Site	Agency	Release River	Number Released	Comment
4/15	4/15	CH1-FA	Lyons Ferry Hatchery	Big Canyon Creek Acclim. Pond	NEZP	Clearwater River M F	150,000	70000 AD/CWT; 80000 CWT Only; 19000 PIT
4/19	4/23	CH1-SP	Sawtooth Hatchery	Yankee Fk (Salmon R)	IDFG	Salmon River (ID)	404,000	201900 CWT only with 2200 PIT; 202100 AD Only with 2200 PIT
4/15	4/26	ST-SU	Clearwater Hatchery	S Fk Clearwater River	IDFG	Clearwater River M F	176,400	128750 AD Only; 47650 AD/CWT; 5000 PIT; Rel @ Peasley Creek
4/15	4/26	ST-SU	Clearwater Hatchery	Clear Creek	IDFG	Clearwater River M F	144,900	100% AD Only; 4100 PIT
4/19	4/19	ST-SU	Dworshak NFH	Dworshak Hatchery	USFW	Clearwater River M F	1,030,000	100% AD/LV; 16.5% CWT; 40630 PIT
4/19	4/19	ST-SU	Dworshak NFH	Lolo Creek	NEZP	Clearwater River M F	60,000	100% Unclipped; 1400 PIT
4/19	4/19	ST-SU	Dworshak NFH	S Fk Clearwater River	NEZP	Clearwater River M F	150,000	100% Unclipped; 3470 PIT; Rel into Peasley Creek
4/16	4/16	ST-SU	Irrigon Hatchery Complex	Big Canyon Acclim.Pd	ODFW	Grande Ronde River	156,000	100% AD; 16% LV/CWT
4/15	4/26	ST-SU	Clearwater Hatchery	Redhouse	IDFG	S Fk Clearwater River	186,600	114000 AD Only; 72600 AD/CWT; 5300 PIT
4/19	4/21	ST-SU	Magic Valley Hatchery	East Fk Salmon River	IDFG	Salmon River (ID)	325,000	100% AD; 60000 CWT; 4200 PIT
April 15- April 21 Total							2,782,900	