Annual Progress Report
Lower Snake River Compensation Plan
Confederated Tribes of the Umatilla Indian Reservation
Evaluation Studies for 1 January 2011 to 31 December 2011

Section I
Evaluation of Reestablishing Natural Production of Spring Chinook Salmon in Lookingglass Creek, Oregon, Using a Local Stock (Catherine Creek)

Section II
Assistance Provided to LSRCP Cooperators and Other Projects

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1.1 Abstract

The objective of this study is to evaluate reintroduction of spring Chinook salmon in Lookingglass Creek above the Lookingglass Hatchery weir using standard sampling methods for anadromous salmonids in the Columbia River Basin. Natural-origin returns to the Lookingglass Hatchery trap in 2011 totaled 164. Adults released above the Lookingglass Hatchery weir totaled 440 and spawning ground surveys yielded 212 redds. Brood year 2006 recruits per spawner were 2.5 for adults only. We estimated 12,279 (183/redd) brood year 2009 juveniles outmigrated from above Lookingglass Hatchery during migration year 2011. Fall 2010 outmigrants were 9% of the total, winter 2010 69%, and spring 2011, 22%. Survival probabilities to Lower Granite Dam ranged from 0.185-0.484 for summer, fall, winter, and spring PIT-tag groups. Smolt equivalents (outmigrants surviving to Lower Granite Dam) totaled 3,671. Brood year 2006 smolt-to-adult ratio was 3.8 for adults only. Median arrival dates at Lower Granite Dam of brood year 2009 outmigrants ranged from 27 April-5 May 2011. Life history and productivity metrics for spring Chinook salmon in the current reintroduction era have been generally similar to the endemic and Rapid River reintroduction eras and also to the Catherine Creek donor stock. Recruits per spawner have been above replacement for 2 of 3 completed brood years.

1.2 Introduction/Study Area/Methods

This is the latest in the series of 19 annual progress reports documenting the success of reintroducing spring Chinook salmon to Lookingglass Creek (LGC), tributary to the Upper Grande Ronde River in the Snake River Basin of northeastern Oregon. We focus this report on results and discussion, as there were no significant changes to the methods reported previously (Boe in review). Metrics are described by Hesse et al. (2006) and correspond to the basic categories of abundance, productivity, and diversity for viable salmon populations (McElhany et al. 2000). Results from the current reintroduction era were compared to those of the extirpated endemic stock (Burck 1993) and the Rapid River reintroduction era for brood years (BY) 1992-1994 and 1996-1997. Survival estimates for other populations in the Grande Ronde Subbasin were also used for comparison (Anderson et al. 2011).

This project is guided by the Confederated Tribes of the Umatilla Indian Reservation (CUITR) Department of Natural Resources (DNR) Mission Statement (Jones et al. 2008)

"To protect, restore, and enhance the First Foods - water, salmon, deer, cous and huckleberry – for the perpetual cultural, economic and sovereign benefit of the CTUIR. We will accomplish this using traditional ecological and cultural knowledge and science to inform: 1) population and habitat management goals and actions; and 2) natural resource policies and regulatory mechanisms.

and the CTUIR Department of Natural Resources, Research, Monitoring and Evaluation Mission Statement:

"We will accomplish (CTUIR DNR Mission Statement) by using traditional ecological and cultural knowledge and science to inform: 1) population and habitat management goals and actions, and 2) natural resource policies and regulatory mechanisms."

1.3 Results/Discussion

1.3.1 Adults

1.3.1.1 Abundance

NOR (natural-origin) returns to the Lookingglass Hatchery (LH) weir
NOR returns to the LH weir totaled 164 in run year (RY) 2011 (Table 1). Returns were 30 (18%) age 3, 120 (73%) age 4, and 14 (9%) age 5. Total returns included those caught at the LH trap and any unpunched, unclipped carcasses recovered above the LH weir. Age composition of NOR returns in past years has been dominated by age 4, but age 3 returns were high in 2009-2011, making up 11-24% of the catch each year.

Completed brood year (BY) 2006 returns totaled 162, the highest recorded for either the Rapid River or current reintroduction eras.

Table 1. NOR returns to LH weir for RY, completed BY and age at return.

Returns by RY					Returns by Completed BY				
	Age					Age			
RY	3	4	5	Totals	BY	3	4	5	Totals
2007	7			7	1992	9	101	17	127
2008	4	46		50	1993	3	79	25	107
2009	24	69	9	102	1994	0	32	5	37
2010	17	124	9	150					
2011	30	120	14	164	1996	5	51	15	71
					1997	5	34	5	44
					2004	7	46	9	62
					2005	4	69	9	82
					2006	24	124	14	162

Fish released above the LH weir in 2011 to spawn in nature totaled 505, including 440 adults and 65 jacks. Adults were 83% HOR and jacks 69%. Females were 60% of the total. Numbers released above the LH weir have increased substantially the past 2 years as total returns have increased (Figure 1). Releases since 2004 have been dominated by HOR; they were 100% of the adults released above the LH weir in 2004-2007 and 80-83% in 2008 and 2010-2011. HOR made up 34% of the adults released in 2009.

The numbers released during most years of the reintroduction eras were much lower than during the endemic era. In 1964 and 1965, the weir and trap was not operating effectively and a substantial number of returns made it past the weir without being trapped.

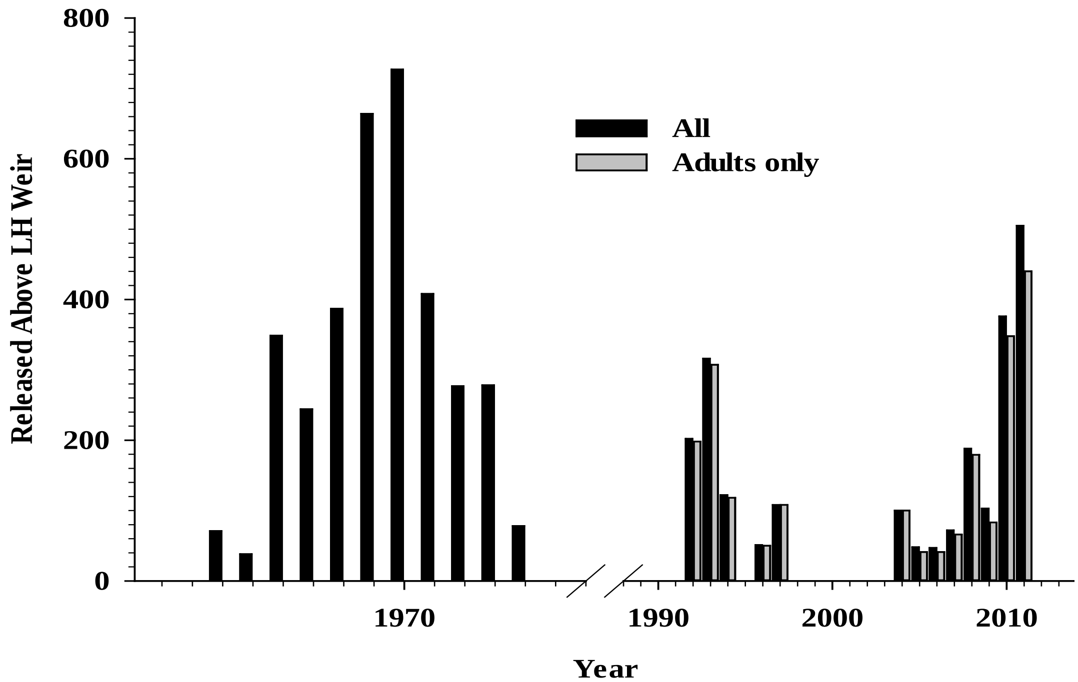

Figure 1. Spring Chinook salmon released above the LH weir to spawn in nature for the endemic, Rapid River, and current reintroduction eras.

Spawning Ground Surveys

We completed 31 spawning ground surveys on LGC from 22 July-20 September 2011 and counted 341 redds (Table 2). The first redd was observed on 11 August and the last on 13 September. Redds observed in Units 2, 3L, 3U, and 4 above the LH weir totaled 212 and made up 62% of the total redds. Redds in Units 3U and 3L combined were the same as Unit 3 of Burck (1993), and were 83% of the redds above the LH weir. Peak numbers of new redds above the LH weir were observed in late August and below the weir in late August and early September. Weather and visibility conditions were generally excellent during the survey period.

Spawn timing and redd distribution above the LH weir were similar to the endemic era (Burck 1993). Burck (1993) noted the first redds appeared in Unit 3 in early to mid-August and seemed to appear later in Units 1 and 4 than Unit 3. Burck (1993) also observed redds at the lower end of Unit 3 appeared later than the upper reaches.

Table 2. New redds observed on surveys of LGC by date and unit, 2011.

	Unit				
Period	1	2	3U	3L	4
8/11-31	105	14	63	99	19
9/1-9/20	24	1	8	6	2
Totals	129	15	71	105	21
%	38	4	21	31	6

Densities of redds were low in most areas above the LH weir (Figure 2). A few areas of moderate density were present. An area of high density was below the weir near LH in 2011 and occurs most years.

Burck (1993) observed about 84% of the redds above the LH weir in what we designate as Units 3U and 3L, and about 13% in Unit 4 (Figure 3). The smaller numbers of redds we have observed in Unit 4 during some years may be due to releasing fish above the mouth of Little Lookingglass Creek at rkm 6.6.

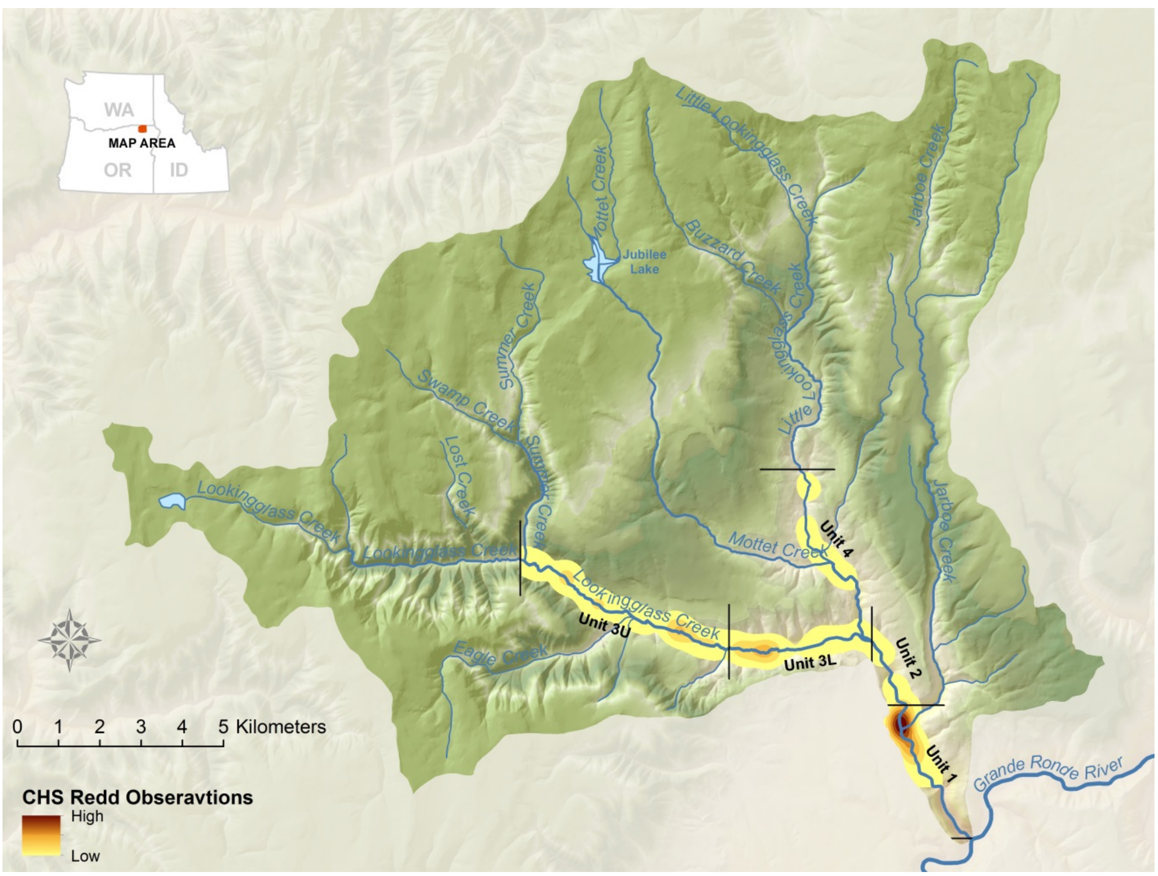

Figure 2. Distribution of spring Chinook salmon redds in LGC by unit, 2011

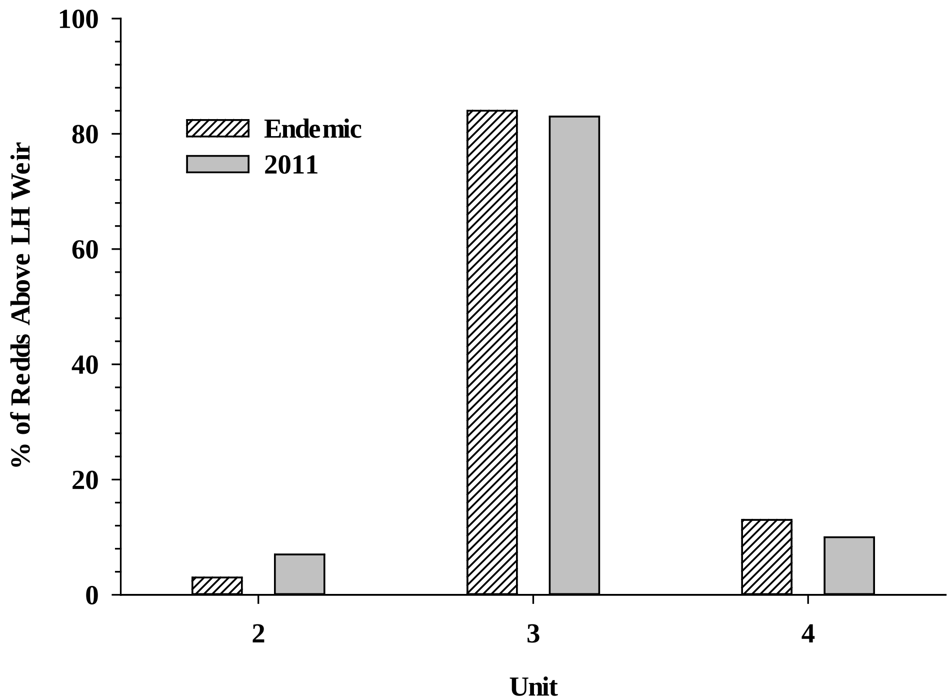

Figure 3. Percentages of spring Chinook salmon redds above the LH weir by unit for 1965-1969 (endemic era means) and 2011.

Redd numbers above the LH weir have varied widely during the current reintroduction era, but have generally been below the level seen during the endemic era (Figure 4).

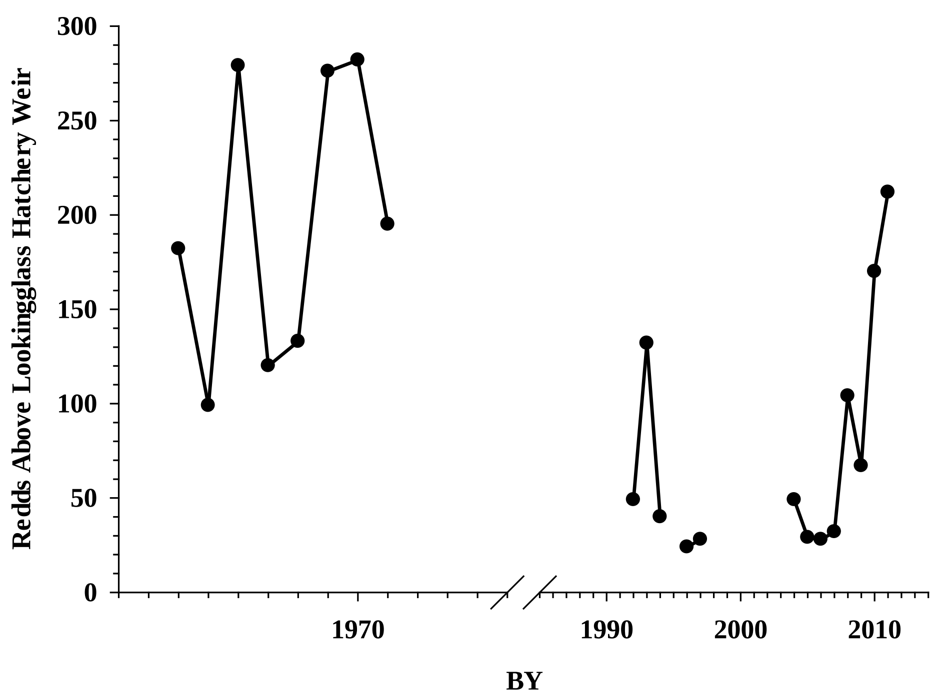

Figure 4. Spring Chinook salmon redds above the LH weir for 1965-1969 (endemic era), 1992-1994, 1996-1997 (Rapid River reintroduction era), and 2004-2011 (current reintroduction era).

Carcass recoveries

There were 13 carcass recoveries above the LH weir from 14 July-8 August 2011, including 15 HOR and 1 NOR. Twelve had been opercle-punched and punch status was unknown for three. Eleven were females and one had spawned.

Carcass recoveries above the LH weir on or after 11 August 2011 totaled 183 jacks and adults. Carcass recovery efficiency for opercle-punched fish released above the LH weir was 35%. Carcasses recovered below the LH weir totaled 370 and included 2 precocials.

The population estimates above the LH weir just prior to the start of regular spawning ground surveys on 11 August 2011 were 431 adults and 69 jacks. Fish per redd was 2.03 for adults and 2.36 for adults and jacks combined (Table 3). There were 100 females sampled above the LH weir during regular spawning ground surveys and 6.00% were prespawn mortalities. Prespawning mortality was 5.48% below the weir. The slightly higher prespawn mortality above the weir may have been due to handling at the trap. Burck (1993) reported prespawning mortality rates of 0-4.7%. He observed “sorehead” or what is now called “headburn” on some Chinook, and this was a particular problem in 1969. This condition has been also been observed occasionally since the current reintroduction began, but has not been significant.

Table 3. Fish/redd and prespawning mortality for natural spawning spring Chinook salmon above the LH weir, 2004-2011.

	Fish/redd		
BY	Adults only	Jacks and Adults	Prespawning mortality
2004	2.04	2.04	0.00
2005	1.45	1.72	8.33
2006	1.95	2.13	0.00
2007	2.06	2.25	8.33
2008	1.73	1.83	0.00
2009	1.25	1.63	12.50
2010	2.01	2.18	2.27
2011	2.03	2.36	6.00
Mean	1.82	2.02	4.68

Snouts from carcasses recovered above the LH weir totaled 139 and 215 from below. Raw counts of CWT recovered above the weir totaled 111 with 7 codes represented. Two CWT codes were from BY 2008 and 109 from BY 2007. There were 55 CWT from LGC conventional broodstock, 49 from Catherine Creek (CC) captive broodstock released into LGC and the remainder from CC conventional broodstock and the Lostine River. CWT recovered from carcasses below the LH weir totaled 172 and 18 CWT codes were present. BY 2007 CWT totaled 135, including 35 from BY 2008 and 2 from BY 2009. There were 67 CWT from LGC conventional broodstock, 81 from CC captive broodstock released into LGC and the remaining 24 CWT were from the Upper Grande Ronde River (18), CC conventional broodstock (4), and Lostine River (2).

1.3.1.2 Life History

Length at age
Mean FL at age were greater for HOR than NOR at ages 3 and 4, using sexes combined data (Table 4). At age 4, mean FL was greater for HOR males than females, but NOR females were larger than males. Burck (1993) observed mean FL-at-age of NOR males and females equal at age 4 and 5 mm greater for females at age 5.

Table 4. Mean FL (mm) at age by sex and origin of LGC spring Chinook salmon, 2011.

Origin	Sex	Age	$\bar{X}$ FL	Range	SE	N
NOR	M	3	492	415-595	11	18
NOR	M	4	703	650-750	10	12
NOR	F	4	723	640-800	10	16
NOR	Both	4	716	640-800	7	28
HOR	M	3	504	310-785	3	292
HOR	F	3	695			1
HOR	Both	3	504	310-785	3	295
HOR	M	4	765	415-910	6	145
HOR	F	4	733	485-815	3	253
HOR	Both	4	746	415-910	2	405
HOR	F	5	821	782-851	20	3
HOR	M	5				0
HOR	Both	5	821	782-851	20	3

NOR FL at age has been similar for the LGC current reintroduction era and CC donor stock and both have been greater than during the endemic era at all 3 ages (Figure 5).

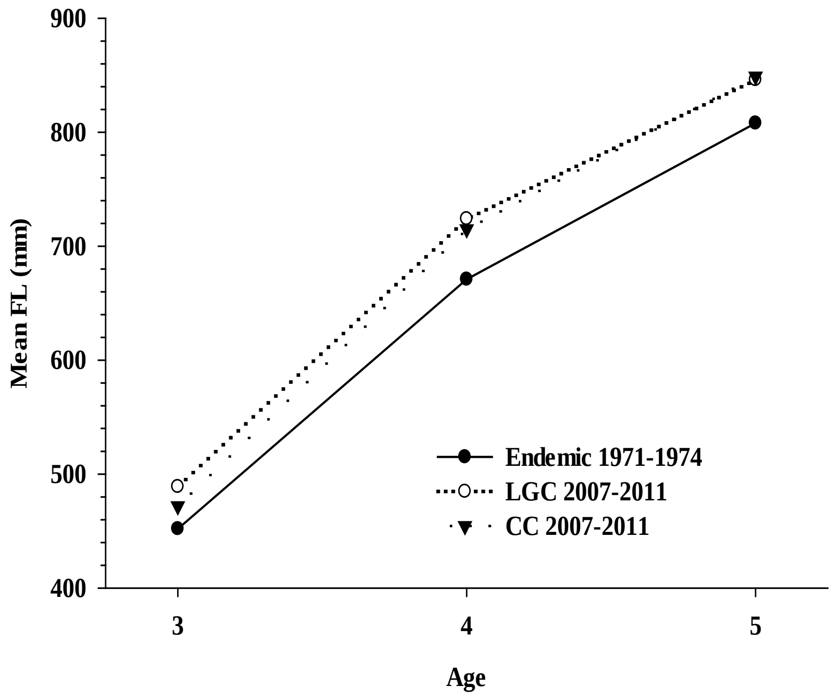

Figure 5. Mean FL (mm) at age for NOR spring Chinook salmon from LGC caught at the LH trap, 1971-1974 (endemic era), 2007-2011 (current reintroduction era), and CC NOR.

1.3.1.3 Productivity

Recruits per spawner (R/S)
R/S has been greater than replacement for 2 of 3 completed BY and BY 2006 R/S for adults (excluding jacks) was higher than the 3 BY average of 1.7 (Table 5).

Table 5. Population estimates, spawners, and R/S for LGC NOR spring Chinook salmon.

	Population[a]		Spawners[b]		R/S Spawners	
BY	All	Adults	All	Adults	All[c]	Adults[d]
2004	100	100	100	100	0.6	0.6
2005	50	42	46	39	1.8	2.0
2006	60	55	60	55	2.7	2.5
2007	72	66	66	61		
2008	190	180	190	180		
2009	109	84	95	74		
2010	371	342	363	334		
2011	500	431	470	405		

[a] *Fish present above LH weir prior to start of regular spawning ground surveys*
[b] *Adjusted for prespawning mortality*
[c] *(Sum of BY X returns at ages 3, 4, and 5)/BY X All spawners;* [d] *(Sum of BY X returns at ages 4 and 5)/BY X Adult spawners*

1.3.2 Juvenile Spring Chinook Salmon

1.3.2.1 Abundance

Outmigrants

The rotary screw trap was operated for 81% of the possible days during January-June 2010, 73% during July-December 2010, and 41% of days during January-June 2011. May 2010 flows were very high and the trap was not fished much during that time. We began catching BY 2009 outmigrants as sac fry in February 2010. We counted 3 fry in February, 28 in March, 109 in April (including 23 mortalities), 15 in May, and 21 from June 1-15. Mean FL was 53.2 mm for 9 outmigrants measured during June 1-15.

First-time captures of BY 2009 fish in the screw trap from 16 June 2010-31 March 2011 totaled 5,178 and mortalities were 0.8%. Outmigrants from 16 June 2010-31 May 2011 totaled 12,279 (SE 617). Outmigrants per redd were 183. The MY 2011 total was less than the mean for the current reintroduction era (Table 6), and estimates have varied about 4-fold during the same period. The mean for the current reintroduction era is slightly less than mean of 340 seen during the endemic era.

Table 6. LGC NOR spring Chinook salmon outmigrant summary[a].

BY	MY	Outmigrants	Redds AW[b]	Outmigrants/Redd
1965	1967	48,374	99	489
1966	1968	93,625	279	336
1967	1969	40,166	120	335
1968	1970	42,031	133	316
1969	1971	61,987	276	224
1992	1994[c]	8,713	49	178
1993	1995	65,082	132	493
1994	1996	6,707	40	168
1996	1998	14,713	24	613
1997	1999	14,140	28	505
2004	2006	9,404	49	192
2005	2007	14,091	29	486
2006	2008	12,208	28	436
2007	2009	7,847	32	245
2008	2010	30,289	104	291
2009	2011	12,279	67	183
Means*		14,353	52	306

[a]*PIT tags only used for estimates*
[b]*AW=above the LH weir,* [c] *Trapping began in November 1993, *BY 2004-2009*

A scatterplot of outmigrants/redd and redds above the LH weir showed high variability over the endemic, Rapid River reintroduction, and current reintroduction eras, but the pattern suggested negative density-dependence (Figure 6). BY 1992 was omitted from Figure 6 since a late start to trapping likely missed a substantial part of the outmigration.

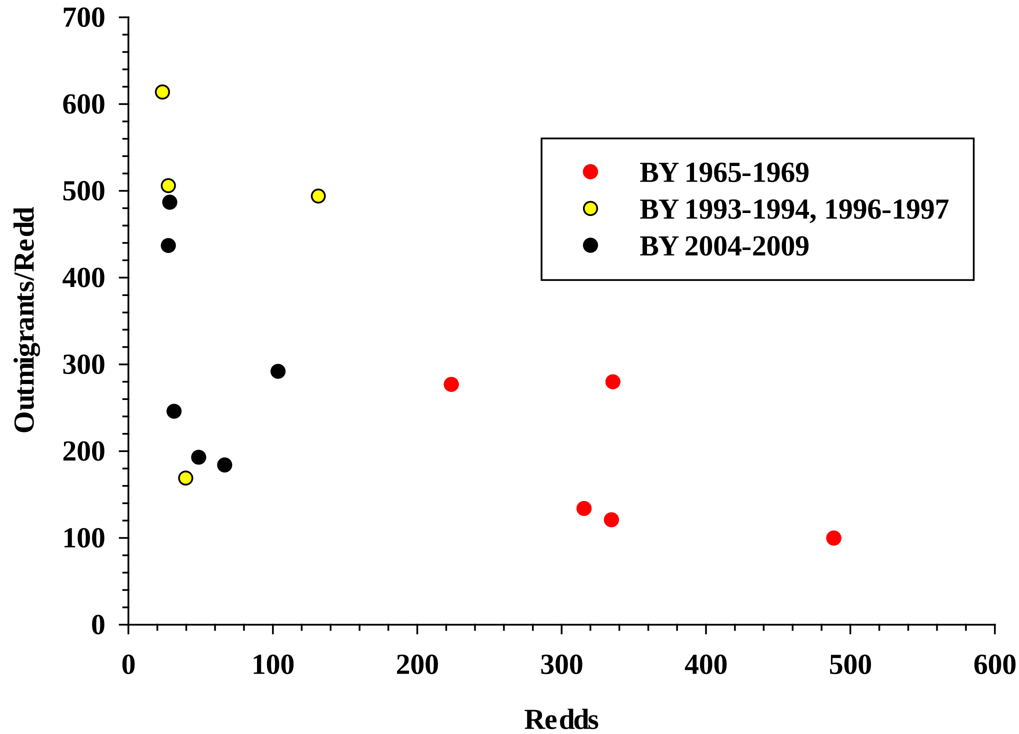

Figure 6. Scatterplot of outmigrants/redd and redds above the LH weir for BY 1965-1969 (endemic era), 1993-1994 and 1996-1997 (Rapid River reintroduction era), and 2004-2009 (current reintroduction era).

1.3.2.2 Life History

Monthly sampling

BY 2009 parr were sampled at 4 mainstem LGC sites during July-September 2010. Mean FL for a given sampling month was usually greatest at rkm 0.4 (Figure 7). Mean FL increased linearly for the summer at rkm 0.4 and 8.9 sites. Mean FL increased sharply from July to August at the rkm 10.5 site. Burck (1993) observed smaller fish in upstream areas and larger fish downstream on a given sampling date.

Mean K values generally increased from July-September at all 4 sites sampled. Mean K ranged from 1.14-1.39 across all site/date combinations. Burck (1993) reported that mean K increased from April-September, then decreased. Most means for a given site and sampling date combination were from 1.0-1.1 (Burck 1993). The larger K values seen in 2012 may be related to density, as BY 2009 outmigrants were much less abundant than the average reported by Burck (1993).

Precocials

We collected 25 precocials during the summer parr PIT-tagging with a mean FL of 121.4 mm. Precocials caught in the screw trap totaled 32 from 23 July-20 September 2011 and mean FL was 121.4 mm. Two were tagged as part of the 2009 field group of parr and one was caught and tagged as part of the spring 2010 group from the screw trap. Burck (1993) typically caught precocials from early August through early October at FL from 77-152 mm.

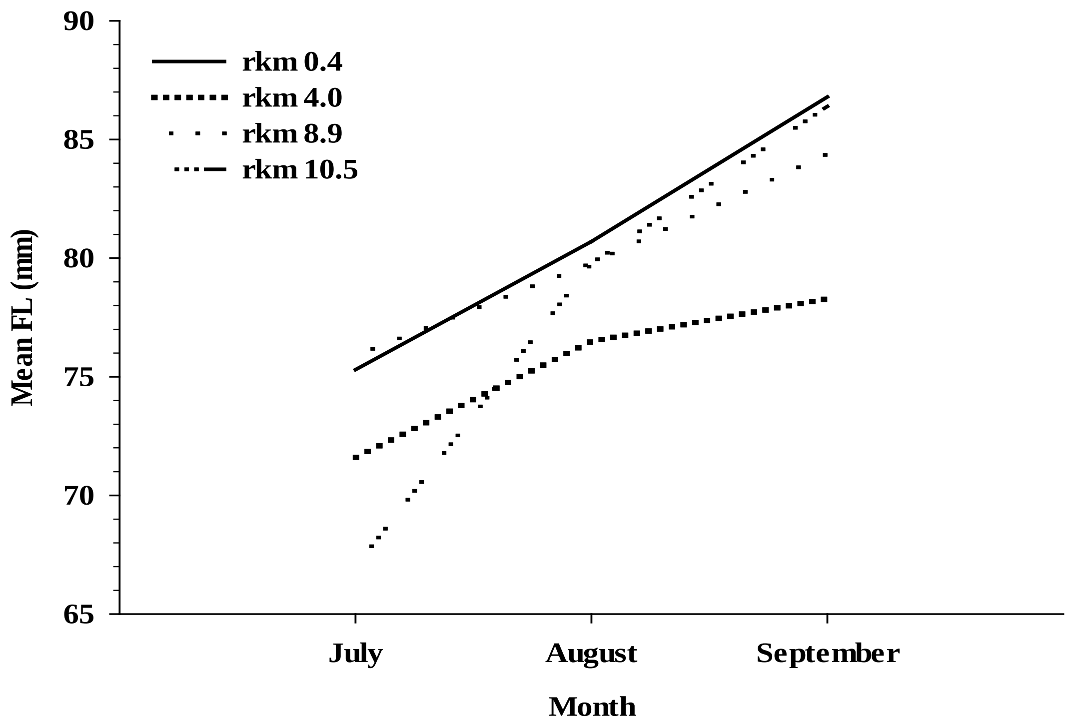

Figure 7. Mean FL (mm) of LGC BY 2009 NOR spring Chinook salmon, 2010.

Mean FL of parr sampled at the rkm 8.9 site in July was negatively related to density as represented by redds above the LH weir (Figure 8). Burck (1993) reported a similar negative relationship between summer parr growth and density.

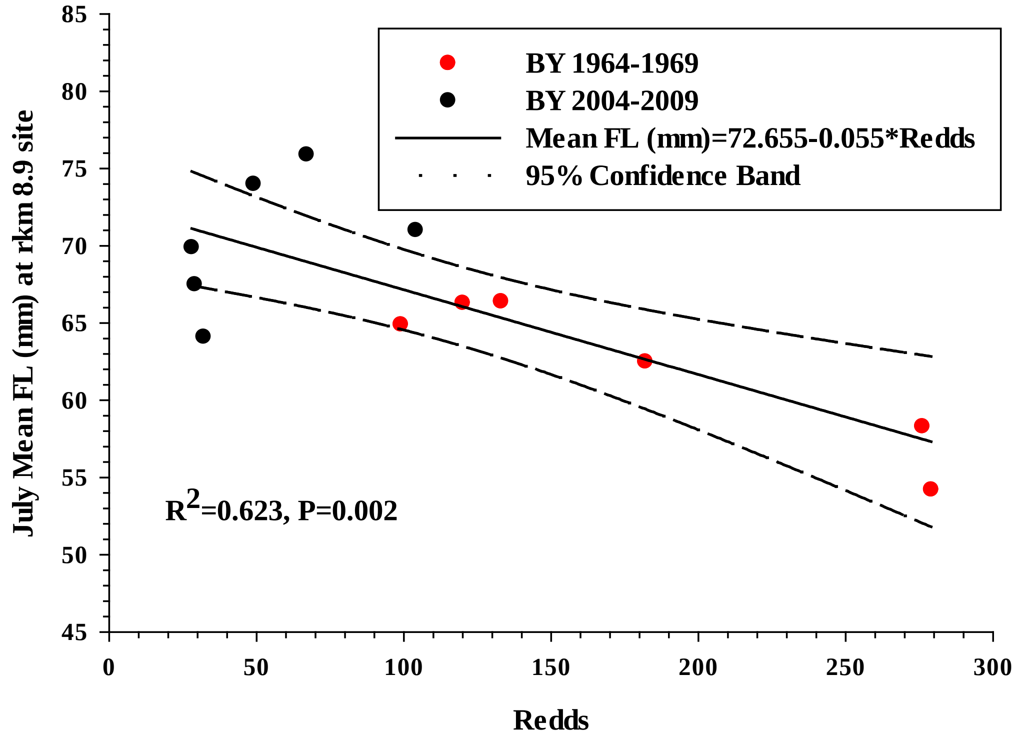

Figure 8. Regression of mean FL (mm) of LGC NOR spring Chinook salmon parr and redds above the LH weir for BY 1964-1969 (endemic era) and 2004-2011 (current reintroduction era).

Outmigration timing from LGC

Outmigrants by season estimated from the screw trap catch were 9% for fall 2010, 69% winter 2010 and 22% spring 2011. Burck (1993) observed outmigration beginning shortly after emergence and continuing for up to 18 months, and a similar pattern has been observed for both reintroduction eras. Using Burck's data from June to the following June, higher percentages left during the fall season of June-September (Table 7), than winter (October-December) or spring (January-June), For both reintroduction eras, higher percentages left during winter. When fall and winter were combined, the percentages were similar for the endemic and both reintroduction eras. A similar pattern of most outmigrants leaving in the July-January period occurs for Catherine Creek outmigrants (Anderson et al. 2011).

Table 7. Summary of seasonal outmigration of LGC NOR spring Chinook salmon from screw trap estimates.

BY	MY	Jun-Sept %	Oct-Dec %	Jan-Jun %
1965	1967	62	30	8
1966	1968	67	25	8
1967	1969	75	19	6
1968	1970	66	21	13
1969	1971	83	12	5
	Means	71	21	8
1992	1994		72	28
1993	1995	59	29	12
1994	1996	39	59	3
1996	1998	24	36	40
1997	1999	46	43	11
	Means	42	48	19
2004	2006	43	47	10
2005	2007	33	64	2
2006	2008	36	44	20
2007	2009	16	64	21
2008	2010	21	55	24
2009	2011	9	69	22
	Means	26	57	17

Obtaining an accurate estimate of January-June outmigrants is difficult because of high flow and debris during the spring and the small size of fish limiting the marking options available. Numbers leaving LGC during June, July and August are relatively low as flows decrease and water temperatures increase. Low flows make screw trapping difficult, as the cone may turn very slowly, or become "hung up" on rocks in the shallow water. We used deflectors on the bank to direct as much flow as possible into the cone. The bypass trap Burck (1993) used may have been more efficient during May-August, or perhaps the pattern we have observed is more characteristic of the donor Catherine Creek stock and how progeny have performed in Lookingglass Creek.

Burck (1993) suggested density dependent movement of outmigrants, with more leaving early as fry or small parr in BY when there were more redds. He suggested that this movement was habitat-related and a tradeoff of higher growth for the risk of higher mortality, since outmigrants moving into the Grande Ronde River encountered higher water temperatures and more predators and competitors. A similar pattern seems to be present during the current reintroduction era, although based only on raw counts (see comments in paragraph above).

Recaptures of the BY 2009 summer parr group totaled 240. Percentages of recaptures by season were 9% fall 2010, 86% winter 2010, and 7% spring 2010 (Figure 9).

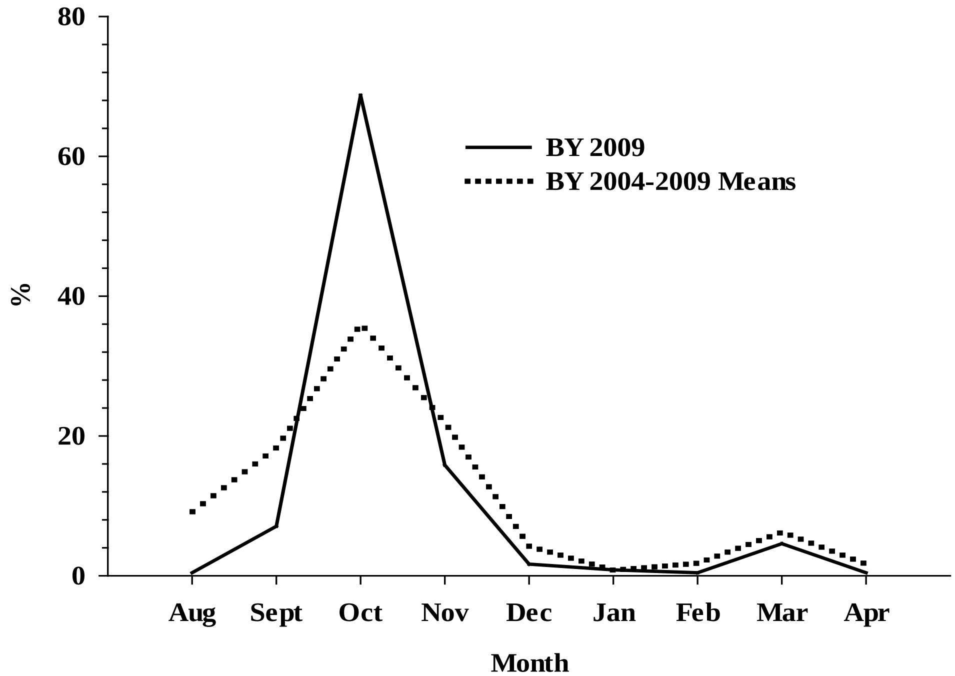

Figure 9. Percentages of recaptures in the LGC screw trap by month and MY of PIT-tagged NOR spring Chinook salmon summer parr.

Size of outmigrants in the screw trap catch by season

Median FL of outmigrants sampled increased from fall 2010 to spring 2011 (Figure 10). The increase was substantial from fall 2010 to winter 2010 but less so from winter 2010 to spring 2011.

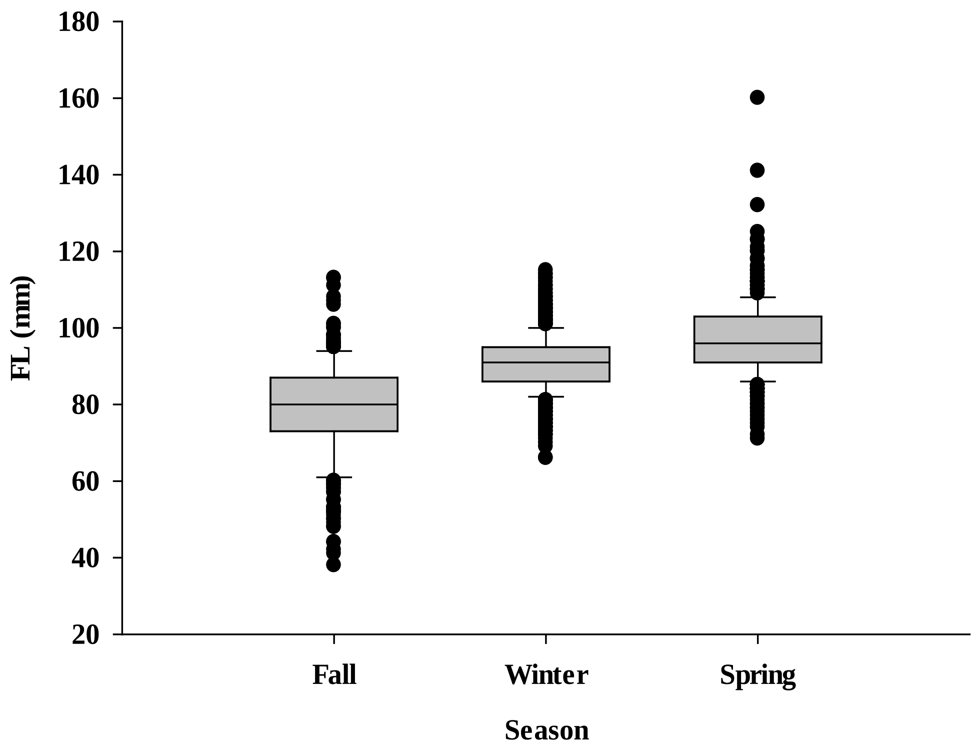

Figure 10. Box plots of FL (mm) by seasonal group for NOR BY 2009 spring Chinook outmigrants caught in the LGC screw trap, MY 2011.

Size, survival, smolt equivalents, smolt-to-adult ratios, arrival timing, and travel time by PIT-tag group
Mean FL were 73.8, 81.6, 90.9, and 97.8 mm for summer parr and fall, winter and spring outmigrants PIT-tagged and released. Mean weights increased from 5.4-10.9 g from summer to spring. Mean K was 1.21 for the summer group, 1.06 for the fall and winter groups, and 1.13 for the spring 2011 group. Sample sizes for PIT-tagged outmigrants were 998 for summer parr PIT-tagged from 8-12 August 2010 and ranged from 244-493 for fall winter, and spring groups of outmigrants caught at the screw trap. Median tagging dates were 7 September, 26 October, and 22 February, respectively, for the fall, winter, and spring groups from the screw trap.

Trends in mean FL for seasonal groups during the current reintroduction era have been consistent with mean FL (mm) smallest for the summer groups and largest for the spring groups (Figure 11). Larger fish caught in the trap during October and November appeared to be disproportionate to the general population sampled by seining (Burck 1993), due to more large fish outmigrating during that period, or a shift in habitat use by larger fish affecting seining results.

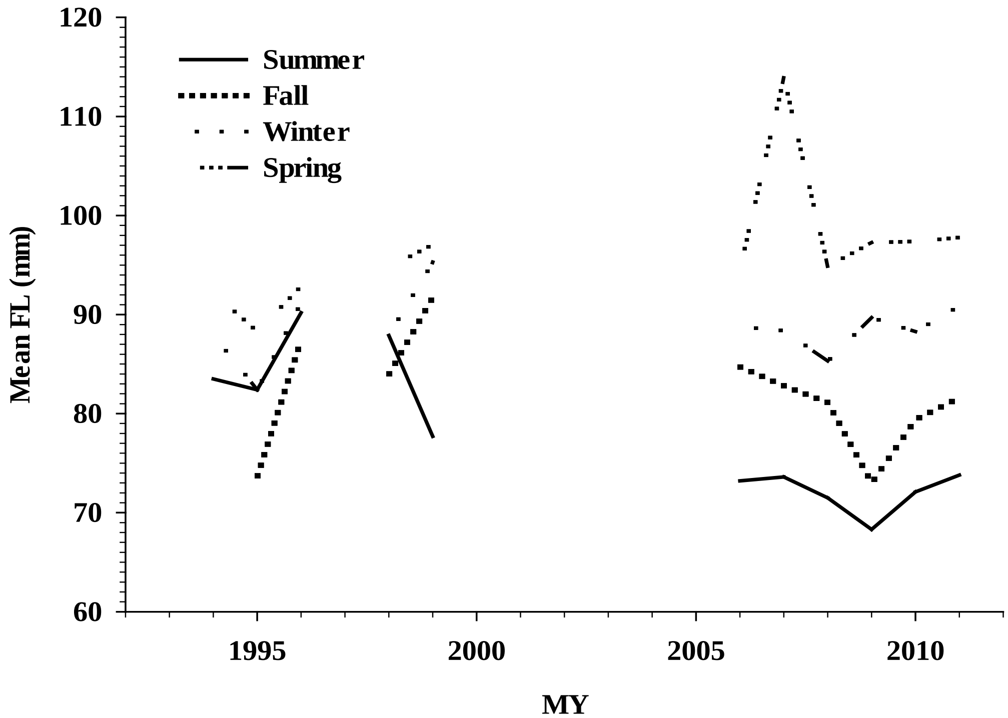

Figure 11. Size of LGC juvenile spring Chinook salmon captured by snorkel-seining or screw trapping, PIT-tagged, and released, MY 1994-1996, 1998-1999, and 2006-2011.

Survival probabilities (SE) to Lower Granite Dam (LGD) were 0.185 (0.022), 0.229 (0.029), 0.249 (0.023), and 0.484 (0.036) respectively for the summer, fall, winter, and spring groups of MY 2011.

Survival probabilities for summer parr of several Grande Ronde Subbasin populations showed a decreasing trend from 1992 through 2004, then increased in recent years (Figure 12). Survival was more variable between populations for fall/winter and spring groups (Figures 13 and 14). Survival for the CC stock was usually lowest. Population differences likely result from the distances outmigrants must travel, and varying habitat and environmental conditions faced for different populations as they outmigrate.

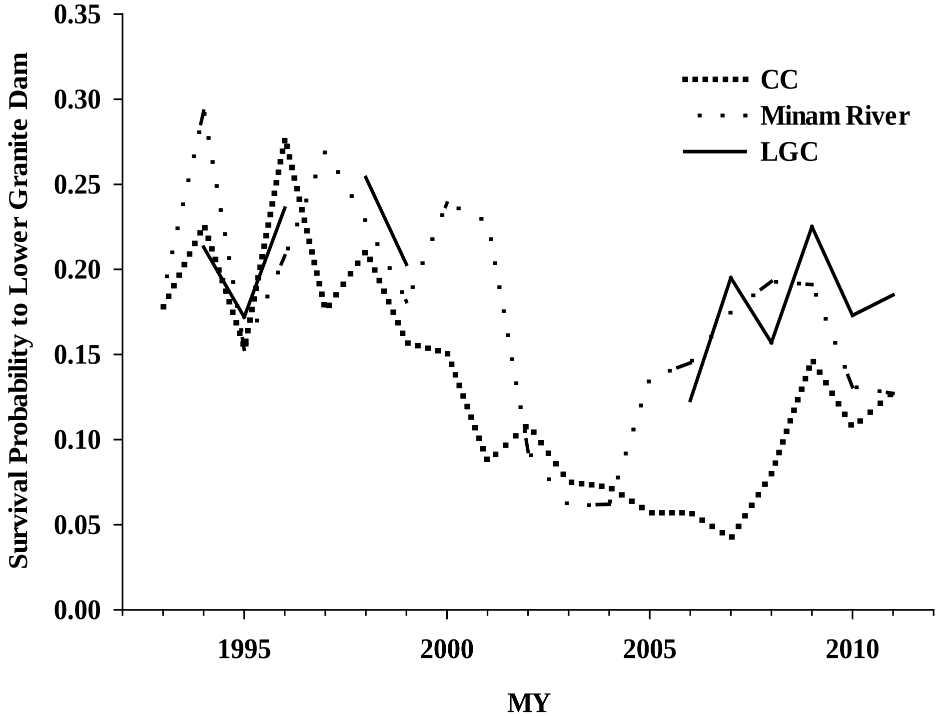

Figure 12. Survival probabilities of Grande Ronde River Subbasin NOR spring Chinook salmon parr captured by snorkel-seining, MY 1993-2011.

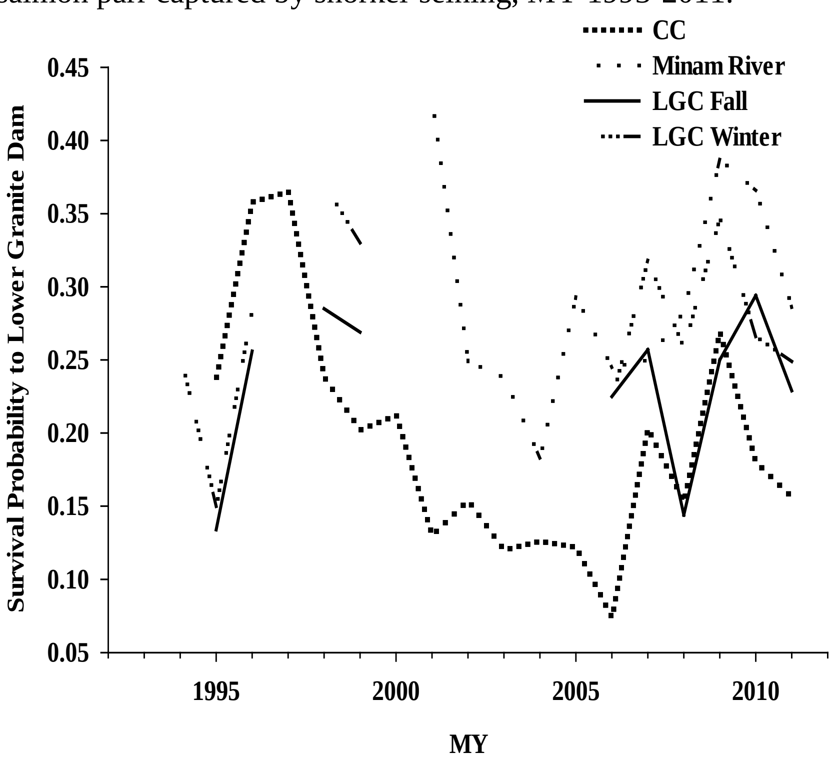

Figure 13. Survival probabilities of Grande Ronde River Subbasin NOR spring Chinook salmon fall and winter outmigrants, MY 19942011.

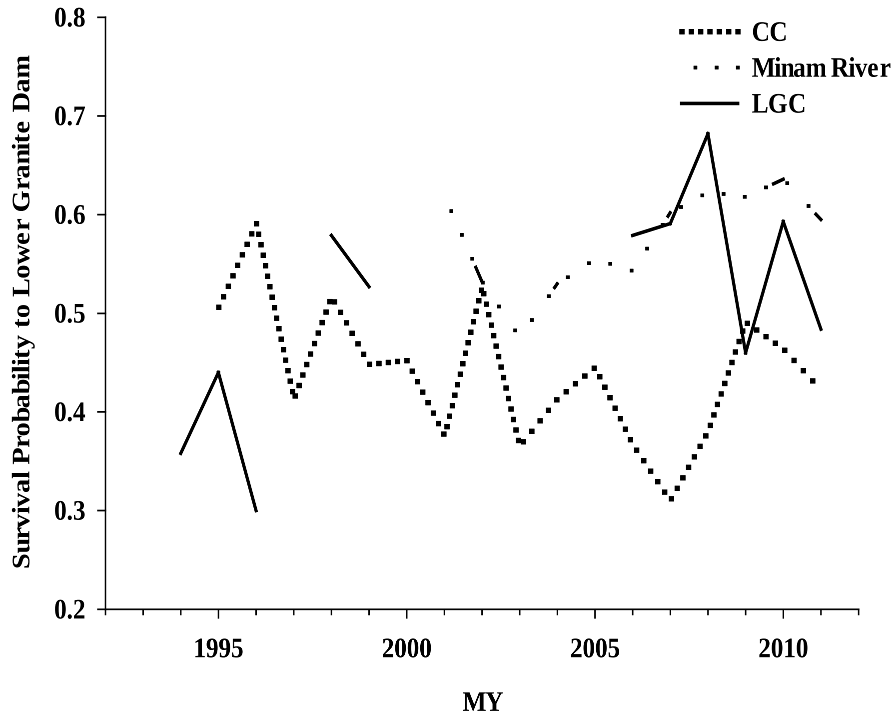

Figure 14. Survival probabilities of Grande Ronde River Subbasin NOR spring Chinook salmon spring outmigrants, MY 1994-2011.

Smolt equivalent (S_{eq}) estimates (outmigrants for each group surviving to LGD) for fall 2010, winter 2010 and spring 2011 were 242, 2,122, and 1,307, respectively, for a BY 2009 total of 3,671. BY 2009 S_{eq} was less than the BY 2004-2008 mean, and the S_{eq}/spawner was third lowest (Table 8).

BY 2009 NOR smolt-to-adult ratios (SAR) were above the BY 2004-2006 means. The BY 2004-2006 adult only mean of 2.6% is at the low of the range (2-6%) and below the average (4%) recovery objective for Snake River Chinook and steelhead (NPCC 2014). SAR in recent years for NOR CC spring Chinook salmon were lower at approximately 0.5-1% (Carmichael et al. 2010).

Table 8. S_{eq} to LGD and SAR for LGC NOR spring Chinook salmon.

			SAR (%)	
BY	S_{eq}	S_{eq}/spawner[a]	All[b]	Adults[c]
1992	2,454		5.2	4.8
1993	11,380		0.9	0.9
1994	1,839		2.0	2.0
1996	6,371		1.1	1.0
1997	4,584		1.0	0.9
2004	2,446	24	2.5	2.2
2005	4,280	110	1.9	1.8
2006	3,669	67	4.4	3.8
2007	2,784	46		
2008	10,620	59		
2009	3,671	50		
Means	4,578*	59*	2.9**	2.6**

[a] *Adult spawners from Table 5,*
[b] *(Sum of BY X returns at ages 3, 4, and 5)/S_{eq} BY X*
[c] *(Sum of BY X returns at ages 4 and 5)/S_{eq} BY X*
**BY 2004-2012, **BY 2004-2009*

Median arrival dates at LGD were 30 April for the summer 2010 group, 3 May for fall 2010, 27 April for winter 2010, and 5 May 2011 for spring 2011 . Expanded detections at LGD ranged from 51 for the fall 2010 group to 128 for summer 2010. Median arrival dates were in late April or early May for most MY, with spring groups usually arriving earliest and fall groups latest during the current reintroduction era (Figure 15). Travel times were generally similar for MY 2004-2011 within the 4 seasonal groups (Figure 16).

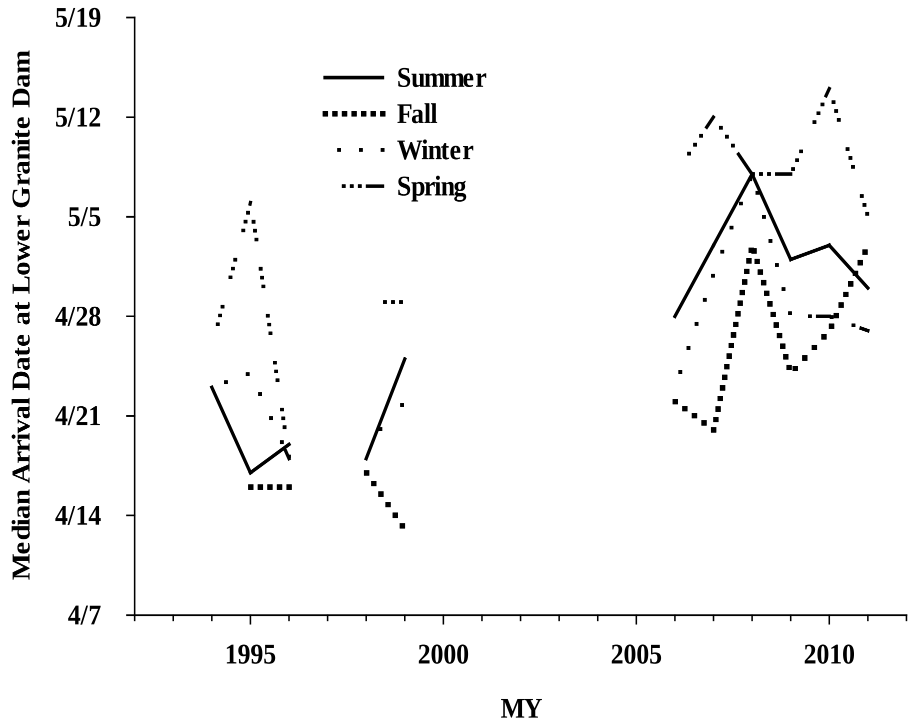

Figure 15. Median arrival dates at LGD for LGC NOR spring Chinook salmon summer parr and fall, winter, and spring outmigrants, MY 1994-2011.

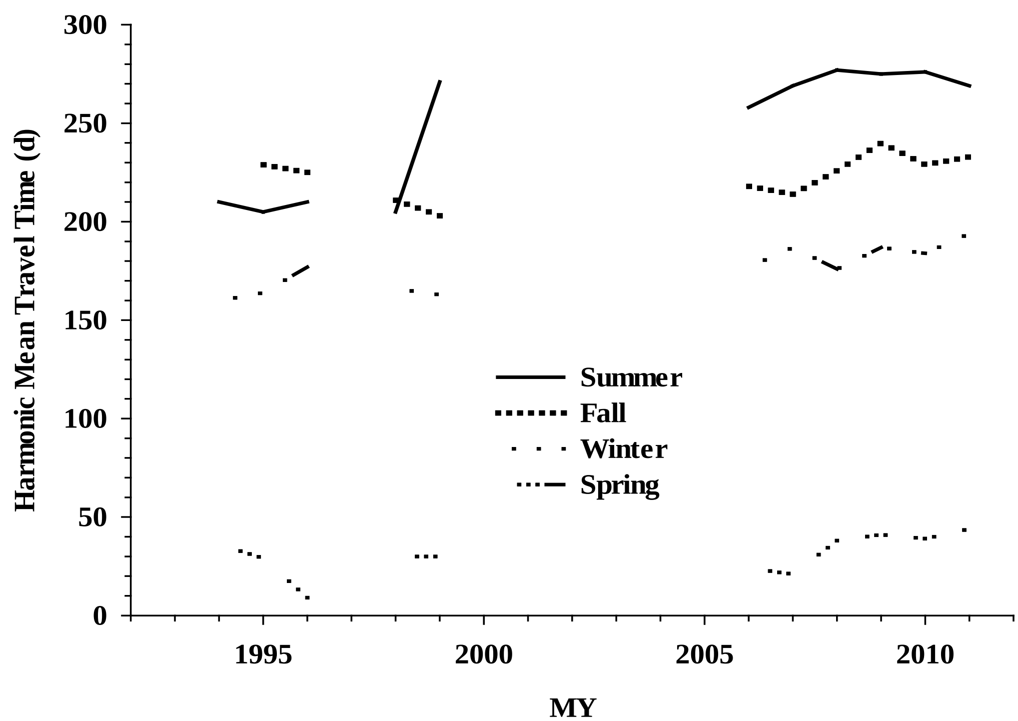

Figure 15. Harmonic mean travel time (d) to LGD for LGC spring Chinook salmon summer parr and fall, winter, and spring outmigrants, MY 1994-2011.

1.4 Summary

Life history metrics for spring Chinook salmon in the current reintroduction era were generally similar to the endemic and Rapid River reintroduction eras and also to the CC donor stock. Some differences have been seen in juvenile outmigration timing and adult FL-at-age between the LGC endemic and the current reintroduction eras. Density-related patterns in growth of parr have been observed. Productivity expressed as recruits per spawner has been above replacement for the 2 of first 3 BY of the current reintroduction era, and higher than for the CC donor stock. This is a positive result, but sustained productivity above replacement will be needed to rebuild and sustain a naturally-reproducing population above the LH weir.

1.5 Literature Cited

Note: Annual progress reports for the Lookingglass Creek Spring Chinook Reintroduction Project for all years, including the Rapid River reintroduction era, are available at the U. S. Fish and Wildlife Service Lower Snake River Compensation Plan website (http://www.fws.gov/lsnakecomplan/reports.html).

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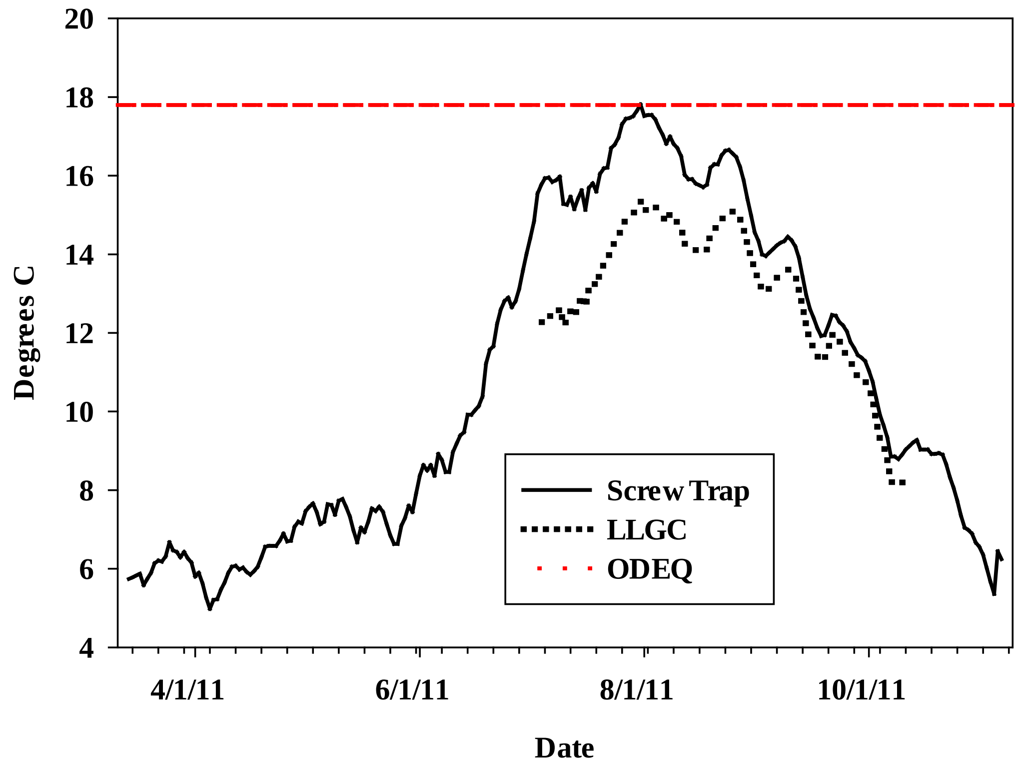
1.6 Appendix Figure A. Water temperatures in Lookingglass and Little LGCs during 2011.



2 SECTION II ASSISTANCE PROVIDED TO LSRCP COOPERATORS AND OTHER PROJECTS

We provided assistance to Lower Snake River Compensation Plan (LSRCP) cooperator Oregon Department of Fish and Wildlife (ODFW) in 2011 for ongoing hatchery evaluation research, spawning ground surveys, PIT-tagging of hatchery production groups, mark retention and prerelease sampling of smolts, and data collection at LH.

We assisted Bonneville Power Administration projects with data collection in 2011. Tissues taken with the opercle punch on adult returns to LGC weir were preserved in

90% ethanol or dried on filter paper for a study of relative reproductive success. We assisted ODFW personnel who have been collecting data on bull trout (*Salvelinus confluentus*) in the Grande Ronde River Subbasin. We have collected estimated fork length data from bull trout captured in the LGC screw trap.

3 ACKNOWLEDGMENTS

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