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January 23, 2013

MEMORANDUM FOR: F/PR - James H. Lecky

FROM: F/NWC3 - Richard W. Zabel *Richard W Zabel*

SUBJECT: Estimation of Percentages for Listed Pacific Salmon and Steelhead Smolts Arriving at Various Locations in the Columbia River Basin in 2012

Each year your office requests a description of how the Fish Ecology Division calculates the percentages of listed wild and hatchery fish arriving at selected Columbia and Snake River projects. These estimates are necessary for evaluating the potential impacts of proposed research on listed species. Given new hatchery release estimates, we have computed percentages for 2012. The attached tables show our best estimates for the total numbers of protected juvenile Pacific salmon and steelhead arriving at Columbia River and Snake River dams during the 2012 outmigration, and the percentage of the total collection they will comprise at each dam. We have developed estimates based on transportation with spill conditions that have existed in the past and on a full transportation scenario (with no spill). Tables 1-6 show the development of the estimates, Tables 7-10 summarize the estimates for each listed species at each project, and Table 11 presents our estimates of the total run size for each listed group of fish.

Several Snake River species will have unmarked hatchery fish released for the 2012 outmigration. Because we have encountered unmarked hatchery spring/summer Chinook salmon in the past, we have adopted a practice of labeling any unclipped spring/summer Chinook salmon that is greater than 124-mm in fork length as hatchery-origin fish. To derive this fork length, we analyzed data from wild spring/summer Chinook salmon PIT-tagged in their natal streams (from our wild parr marking project; Permit #1406,

Study 1) that were subsequently captured and re-measured at one of the lower Snake River dams during slide-gate evaluations (1989-1994 and 1999-2004).

For several groups of fish, we could find no new information; therefore, our estimates for these groups are the same as last year.

Please discuss and distribute this memorandum with all interested parties.

#### Attachments

cc: F/NWC1 - Ford  
F/NWC2 - Dickhoff  
F/NWC3 - Dey  
F/NWC3 - Downing  
F/NWC3 - Fresh  
F/NWC3 - Roni  
F/NWR1 - Turner  
F/NWR3 - Griffin  
F/NWR3 - Rule  
F/NWR4 - Teehan  
F/NWR5 - Suzumoto  
NPCC - Ruff

## YEARLING CHINOOK SALMON ESTIMATES

### Snake River ESU

The estimate of wild spring/summer Chinook salmon arriving at Lower Granite Dam is based on Idaho Department of Fish and Game and Oregon Department of Fish and Wildlife redd counts for brood year 2010. Redd counts were grouped by drainages where fecundity rates were available: (Middle Fork of the Salmon River, South Fork of the Salmon River, Salmon River (excluding Middle and South Forks), Clearwater River, Imnaha River, and Grande Ronde River). The egg-to-smolt survival rate (to Lower Granite Dam) was set at 10%. We estimate that 1,296,901 wild/natural spring/summer Chinook salmon will reach Lower Granite Dam in 2012.

Under the 2005 listing guidelines, hatchery fish must now be tracked, not only by their listing status, but also by whether they have been adipose-fin clipped. We estimate that 13,875,592 hatchery spring/summer Chinook salmon smolts will be released from Idaho (12,722,592) and Oregon (1,153,000). Of these 13,875,592 hatchery spring/summer Chinook salmon smolts, 5,077,534 will be listed (3,875,088 with AD-clips and 1,202,446 without AD-clips) and 8,798,058 will be unlisted (7,175,154 with AD-clips and 1,622,904 without AD-clips).

In order to estimate how many hatchery smolts will reach Lower Granite Dam, we first estimated the percentage composition of Snake River spring/summer Chinook salmon arriving at the dam from listed hatcheries (Table 1). Using the mean survival estimates for the 1998-2011 outmigrations (excluding 2001, which was a record low flow year), we estimated the total number of hatchery fish that will arrive at Lower Granite Dam. The mean survival estimate for each hatchery from these Memo year years was applied to the 2012 projected release numbers for each hatchery. We estimate that 8,852,061 or 63.79592% of the 13,875,592 hatchery fish released will arrive at Lower Granite Dam. Of these 8,852,061 hatchery spring/summer Chinook salmon smolts, 2,652,707 will be listed (1,997,642 with AD-clips and 655,065 without AD-clips) and 6,199,354 will be unlisted (5,128,310 with AD-clips and 1,071,044 without AD-clips).

In June 2005, Snake River hatchery fall Chinook salmon were listed under the ESA. While most hatchery fall Chinook salmon are released as subyearlings, the Nez Perce Tribe and Washington Department of Fish and Wildlife release yearling fall Chinook salmon above Lower Granite Dam. Because these fish may not be distinguishable from yearling spring/summer Chinook salmon, they have been included in the yearling estimates detailed below.

Holdover fall Chinook salmon (wild fish that do not outmigrate as subyearlings and hatchery fish released as subyearlings that did not outmigrate as subyearlings) show extreme year-to-year variability in the numbers collected at the various dams. Also, based on PIT-tag detections of holdover fall Chinook salmon, it is known that these fish can stop migrating anywhere along their migration route and holdover to the next spring. These two characteristics of fall Chinook life history make it extremely difficult to estimate how many holdover fish will outmigrate in any given year. Therefore, no estimates of holdover yearling fall Chinook salmon are included.

In 2012, 233,500 AD-clipped and 264,500 Non-AD-clipped yearling listed hatchery fall Chinook salmon will be released above Lower Granite Dam. Using an average survival rate of 0.870, we estimate that 433,260 (203,145 AD-clipped and 230,115 Non-AD-clipped) yearling listed hatchery fall Chinook salmon will arrive at Lower Granite Dam.

Knowing the total number of hatchery fish, the number of listed hatchery fish, and the number of wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed hatchery fish and wild fish arriving at the dam as follows:

$$\begin{aligned} \text{total yearling smolts} &= \text{total hatchery fish} + \text{wild fish} = \\ 10,582,222 &= (8,852,061 + 433,260) + 1,296,901 \end{aligned}$$

$$\begin{aligned} \% \text{ wild fish to dam} &= \text{wild fish} / \text{total smolts} = \\ 12.25547\% &= 1,296,901 / 10,582,222 \end{aligned}$$

$$\% \text{ listed hatchery fish} = \text{listed hatchery fish} / \text{total smolts} =$$

AD-clip spring/summer	18.87734% = 1,997,642/10,582,222
Non-AD-clip spring/summer	6.19024% = 655,065/10,582,222
AD-clip yearling fall	1.91968% = 203,145/10,582,222
Non-AD-clip yearling fall	2.17454% = 230,115/10,582,222



We set fish guidance efficiencies (FGE) at Lower Granite and Little Goose Dams to 0.380 and 0.438, respectively. Using an FGE of 0.380, the total collection at Lower Granite Dam will be 4,021,245 (10,582,222 x 0.380), based on 10,582,222 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

<u>Listed groups</u>	<u>Total</u>	<u>Percent</u>
Wild spring/summer	492,822	12.2
AD-clip hatchery spring/summer	759,104	18.9
Non-AD-clip hatchery spring/summer	248,925	6.2
AD-clip hatchery yearling fall	77,195	1.9
Non-AD-clip hatchery yearling fall	87,444	2.2
<u>Unlisted groups</u>		
AD-clip hatchery spring/summer	1,948,751	48.5
Non-AD-clip hatchery spring/summer	407,004	10.1

Tucannon River fish, both hatchery and wild, are within the Snake River spring/summer Chinook salmon Evolutionarily Significant Unit (ESU) and are considered listed fish. In spring 2012, 29,429 wild and 197,000 non-AD-clipped hatchery spring/summer Chinook salmon are expected to outmigrate from the Tucannon River. The Tucannon River joins the Snake River between Little Goose and Lower Monumental Dams. Because of the short distance from the confluence to Lower Monumental Dam, we assumed no mortality of these fish prior to Lower Monumental

Dam. The estimates shown in Table 2 and Tables 7-8 reflect the addition of these fish above Lower Monumental Dam.

Since 1995, some of the PIT-tagged fish bypassed at the collection dams (Lower Granite, Little Goose, Lower Monumental, and McNary Dams) have been returned to the river to continue migrating inriver. This return of fish to the river requires adjustment of our estimates of the number of listed fish that reach McNary Dam. We estimated the number of fish that will be PIT-tagged for 2012 and, as described in Appendix A, adjusted for fish diverted to transportation at each Snake River collector dam. If transportation occurs at McNary Dam, we also assumed that 100% of all PIT-tagged fish would be returned to the river. A detailed description of how we estimated the impact of returning PIT-tagged fish to the river is presented in Appendix A. We estimated that 38,778 PIT-tagged spring/summer Chinook salmon from the Snake River (including 15,014 wild and 9,689 listed hatchery fish) will be collected at McNary Dam because they were returned to the river at an upstream dam(s). These numbers represent collected fish. Dividing the collected number by the FGE at McNary Dam (0.364), we determined that 41,247 wild ( $15,014/0.364$ ) and 26,618 listed hatchery ( $9,689/0.364$ ) fish will arrive at McNary Dam and must be added to the number of fish that were estimated to reach McNary Dam as a result of not having been collected at an upstream dam (column "Listed fish to McNary", Table 2).

#### **Upper Columbia River ESU**

The Upper Columbia River ESU spring Chinook salmon is listed as endangered under the ESA. The ESU begins at the confluence of the Yakima and Columbia rivers and continues upstream to Chief Joseph Dam.

Adults that returned in 2010 produced the smolts that will outmigrate in 2012. We obtained 2010 redd counts for the major Columbia River tributaries in this ESU from Washington Department of Fish and Wildlife (WDFW) and the Yakama Indian Nation. Fecundity estimates for this ESU range from 4,000 to 5,500 eggs per female. Estimates for egg-to-smolt survival generally range up to 19%. Using the median egg count, 4,750, and an egg-to-smolt survival estimate (to the first dam encountered) of 7.5%, we estimated the number of smolts that each stream will produce.

We also have hatchery release estimates for this ESU from WDFW and the U.S. Fish and Wildlife Service. There are no survival estimates for these hatcheries. So, based on the distance from the hatchery to the first dam the fish will encounter, we assigned the same survival estimates for Snake River hatcheries, with similar distances to the first dam. Using this method, we assigned a survival rate of 0.800 (Dworshak Hatchery's survival estimate to Lower Granite Dam) to the fish from Winthrop, Methow, Entiat, and Leavenworth Hatcheries, a survival estimate of 0.732 (Rapid River Hatchery's estimate to Lower Granite Dam) to Cle Elum Hatchery, and a survival estimate of 100% to Eastbank and Ringold Hatcheries.

We used per-project survival estimates for spring Chinook salmon in the Columbia River above McNary Dam as summarized in the Mainstem Columbia River Hydropower Projects Recovery Plan Module. These survival estimates were: 0.962 for Wells Dam, 0.921 for Rocky Reach Dam, 0.934 for Rock Island Dam, 0.905 for Wanapum Dam and 0.905 Priest Rapids Dam.

In 2012, a total of 3,222,000 AD-clipped and 0 non-AD-clipped hatchery yearling summer Chinook salmon will be released in the Columbia River above McNary Dam. There are no listed summer Chinook salmon in the Columbia River. Because these fish may not be distinguishable from yearling spring Chinook salmon, they have been included in the yearling estimates detailed below. For the same reasons discussed under the Snake River section above, we were unable to estimate the number of holdover summer Chinook salmon outmigrating through the Columbia River.

Based on the assumptions stated above, we derived the estimates shown in Table 7a and 7b. Based on projected hatchery releases and the number of wild smolts we estimate will outmigrate from the various drainages along the Columbia River above McNary Dam, we estimate that 5,781,775 spring Chinook salmon will arrive at McNary Dam. The composition of fish arriving at McNary Dam will be as follows:

Listed wild spring	398,781
Listed AD-clip hatchery spring	219,662
Listed Non-AD-clip hatchery spring	755,470
Unlisted wild spring	1,148,194
Unlisted AD-clip hatchery spring	1,529,233
Unlisted Non-AD-clip hatchery spring	0
Unlisted AD-clip hatchery yearling summer	1,730,435

Note that the numbers shown for Columbia River dams above McNary Dam are numbers arriving at the dam and not the numbers collected at the dam. The reason for this is that fish guidance efficiency (FGE) for these dams is either unknown or is currently being evaluated.

#### **Estimate of Fish Arriving at McNary Dam**

McNary Dam is the first dam on the Columbia River below the confluence of the Snake River. To obtain an estimate of the number of spring/summer Chinook salmon smolts arriving at McNary Dam, we added the estimated numbers from the Columbia River above McNary Dam (5,781,775) and the Snake River (2,269,194).

We estimate that 8,050,969 (5,781,775 + 2,269,194) spring/summer Chinook salmon smolts will arrive at McNary Dam in 2012, and that 2,930,553 fish will be collected (FGE = 0.364). The collection at McNary Dam will be comprised of the following:

	Snake R. ESU	Upper Col. R. ESU	Total	Percent
<u>Listed groups</u>				
Wild spring/summer	99,081	145,156	244,237	8.3
AD-clip hatchery spring/summer	129,543	79,957	209,500	7.1
Non-AD-clip hatchery spring/summer	81,181	274,991	356,172	12.2
AD-clip hatchery yearling fall	65,121	0	65,121	2.2
Non-AD-clip hatchery yearling fall	65,038	0	65,038	2.2
<u>Unlisted groups</u>				
Wild spring (from Mid-Columbia)	0	417,943	417,943	14.3
AD-clip hatchery spring/summer	321,762	556,641	878,403	30.0
Non-AD-clip hatchery spring/summer	64,260	0	64,260	2.2
AD-clip hatchery yearling Col. R. summer	0	629,878	629,878	21.5
Non-AD-clip hatchery Yearling Col. R.				



Summer 0 0 0 0.0  
 The ratio of Upper Columbia River ESU wild spring Chinook salmon to Snake River ESU wild spring/summer Chinook salmon at McNary, John Day, and The Dalles Dams will be 0.594:0.406 (398,781:272,201). The proportion of Upper Columbia River ESU listed hatchery fish and Snake River ESU listed hatchery fish arriving at McNary, John Day, The Dalles, and Bonneville Dams will be as follows:

	Ad-clipped	Non-AD-clipped
Snake R spring/summers	0.472 (355,887)	0.193 (223,024)
Snake R yearling falls	0.237 (178,903)	0.154 (178,676)
Upper Columbia R springs	<u>0.291</u> (219,662)	<u>0.653</u> (755,470)
	1.000	1.000

We received some redd information from Oregon Department of Fish and Wildlife (ODFW) for the John Day River. Using the same redd to smolt calculation as described above (Upper Columbia River ESU, paragraph 2), we added 79,395 wild unlisted fish arriving between McNary and John Day Dams. Hatchery releases between McNary and John Day Dams will total 810,000 (660,000 AD-clipped and 150,000 non-AD-clipped) unlisted spring and 480,000 (240,000 AD-clipped and 240,000 non-AD-clipped) unlisted yearling fall Chinook salmon. We received 2010 redd count data for the Deschutes River from ODFW (Streamnet), which resulted in an estimated 54,150 wild unlisted fish being added between John Day and The Dalles Dams. Based on data from WDFW (Streamnet), we estimate that 41,325 wild unlisted spring Chinook salmon will be added (from the Klickitat River) between The Dalles and Bonneville Dams. Hatchery releases between John Day and The Dalles Dams will total 741,251 (721,751 AD-clipped and 19,500 non-AD-clipped) unlisted spring Chinook salmon. Hatchery releases between The Dalles and Bonneville Dams will total 2,908,500 (all AD-clipped) unlisted spring Chinook salmon.

#### Lower Columbia River ESU

The Lower Columbia River ESU extends from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. This ESU includes wild and hatchery spring-run and fall-run Chinook salmon. The fall-run

fish will be discussed below under the subyearling fall Chinook salmon section. We have received information that spawning is occurring in the Wind River, however, these spring Chinook are not considered to be part of the ESU even though they are naturally produced. We estimate that 30,112 wild spring Chinook salmon will be produced above Bonneville Dam. Also, 2,908,500 unlisted AD-clipped hatchery spring Chinook salmon will be released above Bonneville Dam. This ESU will introduce 2,361,445 wild, 3,157,882 listed hatchery (3,007,882 AD-clipped and 150,000 non-AD-clipped), and 1,500,000 (all AD-clipped) unlisted hatchery spring Chinook salmon to the Columbia River below Bonneville Dam.

### **Estimate of Fish Arriving at Bonneville Dam**

At Bonneville Dam, the ratio of Upper Columbia River ESU, Snake River ESU, and Lower Columbia River ESU listed wild fish will be 0.560:0.382:0.058 (290,712:198,435:30,112).

Fish transported from Snake River dams and McNary Dam are released below Bonneville Dam. Transportation at McNary Dam does not occur during the spring migration; therefore, all transported fish are from the Snake River ESU. The number of listed transport fish returned to the river will be 3,281,689. The composition of these fish will be as follows:

Snake River ESU (Total number = 3,281,689)	
Listed wild spring/summers	920,124
Listed AD-clip hatchery spring/summers	1,404,638
Listed Non-AD-clip hatchery spring/summers	515,572
Listed AD-clip hatchery yearling falls	212,311
Listed Non-AD-clip hatchery yearling falls	229,044

A total of 7,640,751 (3,281,689 listed + 4,359,062 unlisted fish) transported yearling Chinook salmon will be released below Bonneville Dam.

### **Upper Willamette River ESU**

The Upper Willamette River ESU contains spring Chinook salmon populations above Willamette Falls. This ESU will introduce 671,117 listed wild, 6,174,020 listed hatchery (6,074,020 AD-clipped and 100,000 non-AD-clipped), and no unlisted hatchery

spring Chinook salmon to the Columbia River below Bonneville Dam.

The ratio of Upper Columbia River ESU, Snake River ESU, Lower Columbia River ESU, and Upper Willamette River ESU listed wild fish at Tongue Point will be 0.050:0.192:0.412:0.346 (290,712:1,118,559:2,391,557:2,009,457). The proportion of Upper Columbia River ESU, Snake River ESU, Lower Columbia River ESU, and Upper Willamette River ESU listed hatchery fish at Tongue Point will be as follows:

	Ad-clipped	Non-AD-clipped
Upper Columbia R spring	0.014 (160,133)	0.300 (550,738)
Snake R spring/summer	0.148 (1,664,079)	0.369 (678,157)
Lower Columbia R spring	0.267 (3,007,882)	0.082 (150,000)
Upper Willamette R spring	0.540 (6,074,020)	0.054 (100,000)
Snake R yearling fall	<u>0.031</u> (342,732)	<u>0.195</u> (359,298)
	1.000	1.000

The per-project survival estimate remained the same (0.900) (Table 2).

### Summary

Tables 7a, 7b, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2012. This information is derived from the data shown in Tables 1-2 and Appendix Table A1. Table 11 shows the estimated number of listed spring, spring/summer, and yearling fall Chinook salmon expected to outmigrate from each ESU.

## COHO SALMON ESTIMATES

Lower Columbia River coho salmon were listed under the Endangered Species Act in June 2005. The Lower Columbia River ESU extends from the mouth of the Columbia River to the Big White Salmon River on the Washington State shore and the Hood River on the Oregon shore. It includes the Willamette River to Willamette Falls, Oregon. This ESU includes both wild and hatchery-origin coho salmon.

Hatchery coho salmon are released in the Snake River and the Columbia River above the Lower Columbia River ESU. At this time we have no estimates of wild coho salmon from these areas; therefore, we have included no wild information in Table 7c. As with yearling and subyearling Chinook salmon, hatchery fish must be tracked based on whether they have an adipose-fin clip.

We assigned coho salmon the same survival rates as yearling Chinook salmon in all our calculations. Enough coho have been released over the past couple years that we are able to estimate FGE at Lower Granite Dam at 0.380. Also, as with the other species discussed here, all our calculations are based on the "Transportation with Spill" scenario.

Based on hatchery outplanting records, we estimate that 850,000 hatchery coho salmon (all non-AD-clipped) were released into the Snake River drainage. We estimate that 6,898,665 hatchery coho salmon (4,798,811 AD-clipped and 2,099,854 non-AD-clipped) were released into the Columbia River drainage above the Lower Columbia River ESU. From these releases, we estimate that 6,655,814 hatchery coho salmon (4,531,710 AD-clipped and 2,124,104 non-AD-clipped) will reach Tongue Point.

### Lower Columbia River ESU

With the June 2005 change in ESU listing status, all hatchery coho in this ESU are now listed (except those released at Youngs Bay, Tongue Point, and Blind Slough in Oregon and Deep River in Washington). We obtained wild and hatchery coho salmon production estimates for 2012 from the various agencies involved in the lower Columbia River system. From the information provided, we estimate that 95,496 listed wild coho salmon will

arrive at Bonneville Dam. No listed hatchery fish are released above Bonneville Dam.

Listed wild coho salmon estimates from below Bonneville Dam to Tongue Point are 518,230, while listed hatchery releases in this area are 7,762,215 (7,487,215 AD-clipped and 275,000 non-AD-clipped) and 1,740,000 unlisted (all AD-clipped).

In addition, another 5,850 listed wild and 1,138,000 hatchery (28,000 listed AD-clipped and 1,110,000 unlisted AD-clipped) coho salmon will enter the Columbia River below Tongue Point.

### Summary

Tables 7c, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving, at various locations during 2012. Table 11 shows the estimated number of listed coho salmon expected to outmigrate from the Lower Columbia River ESU.



## SUBYEARLING FALL CHINOOK SALMON ESTIMATES

To estimate the 2012 collection number at Lower Granite Dam, we used the 2011 collection number and the adult returns over the dam for 2010 and 2011. In 2011, a total of 1,456,000 unmarked hatchery subyearling fall Chinook salmon were released above Lower Granite Dam. Assuming a survival rate of 0.887 (the estimated survival rate of hatchery subyearling fall Chinook salmon released above Lower Granite Dam in 2011), a total of 1,291,957 (1,456,000 x 0.887) of these fish would have arrived at Lower Granite Dam. Assuming an FGE of 0.176 (derived from PIT-tagged hatchery subyearling fall Chinook salmon in 2011), a total of 227,384 (1,291,957 x 0.176) would have been collected at Lower Granite Dam. Through December 31, 2011 a total of 344,682 unclipped (and without a coded-wire tag) subyearling Chinook salmon had been collected at Lower Granite Dam. By removing the estimated 227,384 unmarked hatchery subyearling fall Chinook salmon, we estimate that 117,298 (344,682 - 227,384) wild subyearling fall Chinook salmon were collected at Lower Granite Dam in 2011. These wild subyearling fall Chinook salmon were from the 2010 adult return. The adult count over Lower Granite Dam in 2010 was 42,077. Of these, 2,789 were hatchery fish that were returned to Lyons Ferry Hatchery and 39,288 adults were passed above Lower Granite Dam. The 2012 outmigration will be the result of the 2011 adults that passed over Lower Granite Dam. Through December 31, 2011, a total of 25,978 adults had been counted in the adult ladder. Of these, 2,302 fish were returned to Lyons Ferry Hatchery, leaving 23,676 adults that were passed above Lower Granite Dam. The 2011 count of 23,676 adults represents only 60.3% of the 2010 count (39,288). We applied this decrease (60.3%) to the 2011 subyearling collection number to arrive at the estimated 2012 collection number.

$$\left( \begin{array}{l} \text{total wild fall} \\ \text{Chinook} \\ \text{collected at} \end{array} \right) = \left( \begin{array}{l} \text{wild fall} \\ \text{Chinook} \\ \text{collected in} \end{array} \right) \times \left( \begin{array}{l} \% \text{ change between adult} \\ \text{counts for 2011 and 2012} \\ \text{outmigrations} \end{array} \right) =$$

$$70,731 = 117,298 \times 0.603$$

We estimated the total number of wild subyearling fall Chinook salmon arriving at Lower Granite Dam by dividing the number of wild fish collected by the FGE at Lower Granite Dam. The average estimated FGE for PIT-tagged hatchery subyearling fall

Chinook salmon arriving at Lower Granite Dam from 2006-2011 (after onset of court ordered spill) is 0.192. Therefore, the total wild fall Chinook = total wild fall Chinook collected/FGE, or 368,391 fish (70,731/0.192).

The Nez Perce Tribe along with WDFW will release 5,850,000 listed subyearling fall Chinook salmon in the Clearwater and Snake Rivers in 2012. Of these fish, 2,428,000 will be AD-clipped and 3,422,000 will be non-AD-clipped. Assuming a survival rate of 0.558 (the average estimated survival rate of PIT-tagged hatchery subyearling fall Chinook salmon released above Lower Granite Dam from 1995-2011 (excluding 2001)), 3,264,300 (5,850,000 x 0.558) of the 5,850,000 hatchery fish will arrive at Lower Granite Dam. Of these fish, 1,354,824 will be AD-clipped and 1,909,476 will be non-AD-clipped. In 2012, NMFS, the U.S. Fish and Wildlife Service, and the Nez Perce Tribe will be conducting research using 326,330 hatchery subyearling fall Chinook salmon (all non-AD-clipped). Based on survival to Lower Granite Dam (0.558), 182,092 (326,330 x 0.558) will arrive at Lower Granite Dam. Combining the production and research non-AD-clipped fish, the total number of non-AD-clipped hatchery fish will be 2,091,568 (1,909,476 + 182,092). By adding the non-AD-clipped fish to the total number of wild fall Chinook salmon (368,391), we estimate that 2,459,959 non-AD-clipped subyearling fall Chinook salmon will arrive at Lower Granite Dam. The percentage of non-AD-clipped subyearling fall Chinook salmon that are wild will be 14.9755% (368,391/2,459,959). We added the total AD-clipped hatchery fish (1,354,824), the total non-AD-clipped hatchery fish (2,091,568), and the total wild fish (368,391) to determine the total number of subyearling fall Chinook salmon arriving at Lower Granite Dam (3,814,783).

Knowing the total number of hatchery fish, the number of listed hatchery fish, and the number of wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed hatchery fish and wild fish arriving at the dam as follows:

% listed fish = listed fish/total smolts =

Wild subyearling fall	9.6569% = 368,391/3,814,783
AD-clip subyearling fall	35.5151% = 1,354,824/3,814,783
Non-AD-clip subyearling fall	54.8280% = 2,091,568/3,814,783

We set FGEs at Lower Granite and Little Goose Dams to 0.192 and 0.284, respectively. Using an FGE of 0.192, the total collection at Lower Granite Dam will be 732,438 ( $3,814,783 \times 0.192$ ), based on 3,814,783 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

Listed wild subyearling fall	70,731
Listed AD-clip hatchery subyearling fall	260,126
Listed Non-AD-clip hatchery subyearling fall	401,581

NMFS has conducted subyearling fall Chinook salmon survival tests since 1995. As part of these tests, we estimated actual FGEs for McNary Dam (factoring in effects of spill). To more accurately estimate the collection number at McNary Dam, we averaged these actual FGEs for 2006-2011, since the onset of court ordered spill. We also averaged the number of fall Chinook salmon adults crossing McNary Dam for each of the brood years (1999-2011) and the number of juvenile subyearling fall Chinook salmon collected at McNary Dam (1999-2011). The 2011 count of 162,191 adults represents 130.7% of the average for 1999-2011 count (124,091). We applied this change (130.7%) to the average 1999-2011 subyearling collection number (4,835,324) to arrive at an estimated 2012 collection number of 6,319,768 ( $4,835,324 \times 1.307$ ).

Based on the NMFS subyearling fall Chinook salmon survival studies conducted from 2006-2011, per-project survival was set at 75%. We set the FGEs at Little Goose, Lower Monumental, and McNary Dams, based on 2006-2011 NMFS fall Chinook salmon survival study results (since court ordered spill was initiated), to 0.284, 0.137, and 0.186, respectively.

#### **Lower Columbia River ESU**

The Lower Columbia River ESU includes both wild and hatchery tule and late-run bright fall Chinook salmon, including fall Chinook salmon from the Clackamas River.

To determine the number of wild outmigrants from this ESU, we assumed that 50% of the adults counted in the spawning areas were female and that every female spawned successfully. We used

average fecundity and set the egg-to-smolt survival rate at 15%, the same used for spring/summer Chinook salmon.

Based on these assumptions, we estimate that 354,464 tule fall Chinook salmon will outmigrate from above Bonneville Dam. No late-run bright fish will enter the Columbia River above Bonneville Dam. Additionally, we estimate that 7,127,311 tule fall Chinook salmon and 2,940,965 late-run bright fall Chinook salmon will enter the Columbia River below Bonneville Dam.

The ratio of Snake River ESU and Lower Columbia River ESU (tule fall Chinook salmon) listed wild fish at Bonneville Dam will be 0.072:0.928 (27,487:354,464).

With the June 2005 change in ESA listing status, most hatchery fish released in this ESU are now listed. In 2012, hatchery releases above Bonneville Dam will total 12,750,000 listed tule (12,049,000 AD-clipped and 701,000 non-AD-clipped) and 10,300,000 unlisted (7,800,000 AD-clipped and 2,500,000 non-AD-clipped) subyearling fall Chinook salmon. Below Bonneville Dam releases totaled 19,978,271 listed tule (19,778,271 AD-clipped and 200,000 non-AD-clipped) and 9,341,500 unlisted (7,946,500 AD-clipped and 1,395,000 non-AD-clipped) subyearling fall Chinook salmon.

The ratio of Snake River ESU and Lower Columbia River ESU (tule fall Chinook salmon) listed hatchery AD-clipped fish at Bonneville Dam will be 0.009:0.991 (106,838:12,049,000), while the ratio for hatchery non-AD-clipped fish at Bonneville Dam will be 0.139:0.861 (113,465:701,000).

Fish transported from Snake River dams and McNary Dam are released below Bonneville Dam. The number of listed transport fish returned to the river will be 171,609 wild, 638,965 AD-clipped, and 916,252 non-AD-clipped fish, all from the Snake River ESU. A total of 7,912,384 transported subyearling fall Chinook salmon will be released below Bonneville Dam.

The ratio of Snake River ESU, Lower Columbia River ESU (tule fall Chinook salmon), and Lower Columbia River ESU (late-run bright fall Chinook salmon) listed wild fish at Tongue Point will be 0.019:0.704:0.277 (199,096:7,481,775:2,940,965). The proportion for hatchery fish at Tongue Point will be as follows:

	Ad-clipped		Non-AD-clipped	
Snake R. subyearling fall	0.023	(745,803)	0.533	(1,029,717)
Lower Columbia R. subyearling fall - Tule	0.977	(31,827,271)	0.467	(901,000)
Lower Columbia R. subyearling fall - Late run			<u>0.000</u>	(0) <u>0.000</u>
	1.000		1.000	

#### Summary

Tables 7a, 7b, 8a, and 8b present a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2012. This information is derived from the data shown in Table 2. Table 11 shows the estimated number of subyearling fall Chinook salmon expected to outmigrate from each ESU.



## SOCKEYE SALMON ESTIMATES

The sockeye salmon collection count at Lower Granite Dam was based on IDFG's estimate of wild and hatchery-reared sockeye salmon smolts exiting the upper Salmon River in 2012 and IDFG and NOAA Fisheries estimates of survival to Lower Granite Dam. IDFG estimates that 13,466 wild fish and 80,199 hatchery fish will survive to Lower Granite Dam in spring 2012. All of these fish are listed as endangered.

listed sockeye (wild and hatchery) to Lower Granite Dam =  
IDFG's estimated wild fish + estimated hatchery fish =  
93,665 = 13,466 + 80,199

To determine the percentage of wild sockeye salmon collected at Lower Granite Dam, we estimated the number of kokanee arriving at Lower Granite Dam. In 2011, WDFW staff at Lower Granite Dam estimated that 43,561 kokanee were collected. With an FGE of 0.241 (the 2011 estimate), 180,751 (43,561/0.241) kokanee reached Lower Granite Dam. Assuming the same amount of spill from Dworshak Dam in 2012 with a release of the same number of kokanee, we estimated the total number of wild *O. nerka* arriving at Lower Granite Dam to be 194,217 (180,751 + 13,466). We then estimated the percentage of wild *O. nerka* arriving at Lower Granite Dam that will be listed Snake River sockeye salmon.

% listed wild sockeye =  
listed wild sockeye/total wild *O. nerka* to Lower Granite Dam =  
6.9% = 13,466/194,217

A total of 274,416 (93,665 listed sockeye + 180,751 kokanee) *O. nerka* will arrive at Lower Granite Dam.

% total listed sockeye =  
total listed sockeye/total *O. nerka* to Lower Granite Dam =  
34.1% = 93,665/274,416

An FGE of 0.277 (average for 1998-2011 (excluding 2001)) was used to estimate the number of *O. nerka* smolts reaching Lower Granite Dam that will be collected.

*O. nerka* salmon collected = total *O. nerka* salmon x FGE =  
76,013 = 274,416 x 0.277

Because of extreme year-to-year variability, the count used at McNary Dam for 2012 is based on the average of the counts at the dam from 1990 to 2011 (394,162). Project survival was set at the yearling Chinook salmon level (Table 2).

### Summary

Table 7c presents a summary of the estimated number of fish that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the dams during 2012. This information is derived from the data shown in Table 2. Table 11 shows the estimated number of sockeye salmon expected to outmigrate from the Snake River ESU.

## STEELHEAD ESTIMATES

### Introduction

Because of the time of year that steelhead spawn, it is very difficult to obtain redd count information. All of our steelhead estimates, not otherwise explained, are based on adult counts in the spawning areas. We assumed that 65% of the adults were females and that every female spawned successfully. To estimate the number of outmigrants, we used average fecundity estimates, and assigned an egg-to-smolt survival rate of 1%. This survival rate is conservative as all rates we calculated or found in the literature were from 0.5% to 0.75%.

### Snake River Steelhead ESU

Prior to the 2001 outmigration, nearly all hatchery steelhead were fin-clipped, allowing us to use the juvenile collection numbers at Lower Granite Dam without making any adjustments for unclipped hatchery fish. Because it was known that a large number of unclipped steelhead were to be released for the 2011 outmigration, WDFW not only recorded the number of unclipped steelhead collected but also the number of unclipped steelhead that had fin erosion, a strong indicator that a fish is of hatchery origin. Based on the information provided by WDFW (Fred Mensik, WDFW, Pers. commun., February 2012), we determined that 347,036 wild steelhead were collected at Lower Granite Dam in 2011 (0.420, or 251,220, of the 598,256 unclipped steelhead collected at Lower Granite Dam in 2011 had fin erosion). We applied the 2011 estimated FGE (0.392) to the collection number to determine that 885,296 (347,036/0.392) wild steelhead arrived at Lower Granite Dam in 2011.

To our knowledge, no research has been conducted on the age-class distribution of migrating juvenile steelhead in the Snake River; however, there has been research on the mid-Columbia River (Pevan et al. 1994<sup>1</sup>). Pevan's research showed that in the mid-Columbia River, migrating steelhead were 0.7% age-1, 43.2% age-2, 46.4% age-3, and 8.6% age-4 smolts. The age-class of the

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<sup>1</sup> Pevan, C. M., R. R. Whitney, and K. R. Williams. 1994. Age and length of steelhead smolts from the Mid-Columbia River Basin, Washington. N. Am. J. Fish. Manage. 14:77-86.

remainder of smolts (1.1%) was greater than age-4, up to age-7. Because of this age-class breakdown, we decided to base our estimates on age-classes 1 to 4. Because steelhead spawn in the spring, our annual counts were from July 1 to June 30, rather than by calendar year. Using the adult counts at Lower Granite Dam of the 4 years that comprised the 2011 wild smolt outmigration (2006-2010 brood years, July 1, 2005-June 30, 2010), and applying the smolt age-class percentages to the adult counts for each of these 4 years, we estimated that 154,459 of the adults passing Lower Granite Dam produced the 2011 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2007-2011 brood years) producing the 2012 wild outmigration. We calculated that the 2012 wild outmigration will be based on 237,301 adults, or 153.6% of the number of fish producing the 2011 outmigration. We applied the change in the number of adults to the number of wild steelhead that arrived at Lower Granite Dam in 2011 (885,296) to determine the estimated 2012 arrival number.

$$\left( \begin{array}{c} \text{total wild} \\ \text{steelhead} \\ \text{arriving at Lower} \\ \text{Granite} \end{array} \right) = \left( \begin{array}{c} \text{wild} \\ \text{steelhead} \\ \text{arriving in} \\ \text{2011} \end{array} \right) \times \left( \begin{array}{c} \% \text{ change between adult counts for} \\ \text{2011 and 2012 outmigrations} \end{array} \right) =$$

$$1,359,815 = 885,296 \times 1.536$$

For the steelhead hatchery release numbers, we used IDFG's, ODFW's, and WDFW's estimates of hatchery releases in Idaho, Oregon, and Washington. We estimate that 8,767,766 hatchery smolts (Table 4) will be released from Idaho (7,576,266), Oregon (1,015,000), and Washington (176,500 above Lower Granite Dam).

In order to estimate how many hatchery smolts will reach Lower Granite Dam, we attempted to use the survival estimates for the 2004-2011 outmigrations (from the NMFS survival study, Research Action #1212). Using the 2012 projected release number and survival estimate for each hatchery, we estimated how many total hatchery fish will arrive at Lower Granite Dam. We estimate that 7,148,988 or 81.5372% of the 8,767,766 hatchery fish released will arrive at the dam (Table 4).

Knowing the numbers of hatchery and wild fish arriving at Lower Granite Dam, we estimated the percentage composition of listed wild fish arriving at the dam as follows:

$$\begin{aligned} \text{total smolts} &= \text{total hatchery fish} + \text{wild fish} = \\ 8,508,803 &= 7,148,988 + 1,359,815 \end{aligned}$$

$$\begin{aligned} \% \text{ wild fish to Lower Granite Dam} &= \text{wild fish} / \text{total smolts} = \\ 15.98127\% &= 1,359,815 / 8,508,803 \end{aligned}$$

$$\% \text{ listed hatchery fish} = \text{listed hatchery fish} / \text{total smolts} =$$

AD-clip summer	31.19634% = 2,654,435/8,508,803
Non-AD-clip summer	8.31347% = 707,377/8,508,803

We set FGEs at Lower Granite and Little Goose Dams at 0.433 and 0.525, respectively. Using an FGE of 0.433, the total collection at Lower Granite Dam will be 3,684,312 (8,508,803 x 0.433), based on 8,508,803 smolts arriving at the dam. The collection at Lower Granite Dam will be comprised of the following:

	<u>Number</u>	<u>Percent</u>
Listed wild	588,800	16.0
Listed hatchery AD-clip	1,149,370	31.2
Listed hatchery Non-AD-clip	306,294	8.3
Unlisted hatchery AD-clip	1,559,976	42.3
Unlisted hatchery Non-AD-clip	79,872	2.2

Wild/natural Tucannon River drainage fish are listed within the Snake River ESU. In spring 2012, 21,143 wild fish are expected to outmigrate from the Tucannon River. In addition, 51,000 (all Non-AD-clipped) listed hatchery fish and 140,500 (all AD-clipped) unlisted hatchery fish will be released into the Tucannon River or released directly from Lyons Ferry Hatchery. The Tucannon River joins the Snake River between Little Goose and Lower Monumental Dams. Because of the short distance from the confluence to Lower Monumental Dam, we assumed no mortality of these fish prior to Lower Monumental Dam. The estimates shown in Table 5 and Tables 9-10 reflect the addition of these fish above Lower Monumental Dam.

Except when research studies require an alternate disposition, all PIT-tagged fish bypassed at the collection dams (Lower Granite, Little Goose, Lower Monumental, and McNary Dams) are returned to the river to continue migrating inriver. This return of fish to the river requires adjustment of our estimates of the number of listed fish that reach McNary Dam. We



estimated the number of fish that will be PIT tagged for 2012 and, as described in Appendix B, adjusted for fish diverted to transportation at each Snake River collector dam. A detailed description of how we estimated the impact of returning PIT-tagged fish to the river is presented in Appendix B. We estimated that 9,806 PIT-tagged steelhead from the Snake River (including 3,768 wild fish) will be collected at McNary Dam because they were returned to the river at an upstream dam(s). These numbers represent collected fish. Dividing the collected number by the FGE at McNary Dam (0.212), we determined that 17,774 wild Snake River steelhead ( $3,768/0.212$ ) will arrive at McNary Dam and must be added to the number of fish that were estimated to reach McNary Dam as a result of not having been collected at an upstream dam (column "Listed fish to McNary", Table 5).

### **Upper-Columbia River ESU Steelhead**

Very little is known regarding wild steelhead in the Columbia River above the confluence with the Yakima River. Also, little is known regarding dam passage of smolts at the dams above McNary Dam. Because of this lack of information, the estimates of wild steelhead from the listed Upper Columbia River ESU are based on what little information is available and on broad generalizations based on this information. No FGE's have been established for the dams in this reach, so the numbers presented in this section of the memorandum (and in Tables 9 and 10) are the number of fish arriving at the dam, not collection numbers (unless otherwise noted in the text).

As mentioned above, Pevan et al. (1994) showed that migrating steelhead were 0.7% age-1, 43.2% age-2, 46.4% age-3, and 8.6% age-4 smolts. The age-class of the remainder of smolts (1.1%) was greater than age-4, up to age-7. Because of this age-class breakdown, we decided to base our estimates on age-classes 1 to 4.

We based our estimates of wild fish on counts collected at Rock Island Dam by the Fish Passage Center. During the 2011 outmigration, 11,369 wild steelhead smolts were counted in the Smolt Monitoring Program's sample. It is estimated that the sample represents 3-5% of the fish passing the dam. Using a 4% sample rate, we estimated that 284,225 wild steelhead passed Rock Island Dam in 2011.

We then examined the adult counts at Rock Island Dam. Because steelhead spawn in the spring, our annual counts were from July 1 to June 30, rather than by calendar year. Using the adult counts of the 4 years that comprised the 2011 wild smolt outmigration (2006-2010 brood years, July 1, 2005-June 30, 2010), and applying the smolt age-class percentages to the adult counts for each of these 4 years, we estimated that 14,322 of the adults passing Rock Island Dam produced the 2011 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2007-2011 brood years) producing the 2012 wild outmigration. We calculated that the 2012 wild outmigration will be based on 25,067 adults, or 1.750 of the number of fish producing the 2011 outmigration. We applied the change in the number of adults to the 2011 Rock Island Dam collection to arrive at the estimated 2012 collection number.

$$\left( \begin{array}{c} \text{total wild} \\ \text{steelhead} \\ \text{collected at Rock} \end{array} \right) = \left( \begin{array}{c} \text{wild} \\ \text{steelhead} \\ \text{collected} \\ \text{2011} \end{array} \right) \times \left( \begin{array}{c} \% \text{ change between adult} \\ \text{counts} \\ \text{for 2011 and 2012} \end{array} \right) =$$

$$19,896 = 11,369 \times 1.750$$

Since this represents 4% of the fish passing the dam, we estimate that 497,400 wild steelhead smolts will pass the dam in 2012. Using the smolt age-class percentages, we estimate that 3,482 smolts will be age-1, 214,877 will be age-2, 230,794 will be age-3, and 42,776 will be age-4, and 5,471 will be age-5 and older.

To determine the number of wild smolts passing the two dams above Rock Island Dam (Rocky Reach and Wells Dams), we used the estimate of wild smolts passing Rock Island Dam (497,400) and the adult counts at all three dams.

By comparing the adult counts at each of the three dams for the 4 years that will produce the 2012 outmigration (2007-2011), we calculated the number of adults "lost" between each dam. We assigned this "loss" to adults migrating up rivers between the dams. The difference in adult counts between dams varied between years, so we applied the age-class percentages to each year's differences between dams to determine the number of wild smolts added from the rivers between the dams.

From Rock Island Dam to McNary Dam, the only adjustment made to the wild steelhead smolt count was for per-project survival.

To determine the number of hatchery smolts arriving at each dam in 2012, we used the outplanting data for the 3 years comprising the 2012 outmigration (2010-2012). Because hatchery fish are larger than equivalent age-class wild fish, we assigned age-2 status to hatchery fish released in 2012, age-3 to those released in 2011, and age-4 to those released in 2010. All of the hatchery outplants will be of listed hatchery stocks.

Because there are no survival data for the various hatcheries releasing fish in this section of the Columbia River, we assumed that all fish released survived to the first dam. We again applied the age-class percentages to the number of fish released each of the 3 years to determine the number of hatchery fish that would outmigrate in 2012. Beginning at Wells Dam and assuming 90% per-project survival, we determined both the number of listed hatchery and the total number of hatchery fish reaching each dam through McNary Dam (Tables 5 and 9).

#### **Mid-Columbia River ESU Steelhead**

The Mid-Columbia River wild summer-run and winter-run steelhead are listed protected species. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Only summer steelhead from the Yakima and Walla Walla Rivers enter the Columbia River above McNary Dam.

Based on our assumptions described in the steelhead introduction, 192,169 wild summer steelhead will enter above McNary Dam in 2012.

WDFW will release 53,000 (all Non-AD-clipped) listed (from Mid-Columbia River ESU stock) and 89,000 (all AD-clipped) unlisted hatchery steelhead (Lyons Ferry Hatchery stock) into the Touchet River, a tributary of the Walla Walla River, and 100,000 (all AD-clipped) non-listed hatchery steelhead (from Mid-Columbia River ESU stock) into the Walla Walla River. The Walla Walla River enters the Columbia River above McNary Dam. For these fish, survival to McNary Dam was set at 100%.

An additional 187,629 wild steelhead from this ESU will be added between McNary and John Day Dams. Hatchery summer steelhead

will be released between McNary and John Day Dams. Release numbers will be as follows:

Summer Steelhead

Listed hatchery AD-clip 150,000

Between John Day and The Dalles Dams, 140,201 wild and 805,500 listed hatchery (192,000 AD-clipped and 613,500 non-AD-clipped) summer steelhead will be added. Between The Dalles and Bonneville Dams, 60,353 wild winter, 90,000 (all AD-clipped) unlisted hatchery summer, and no unlisted hatchery winter steelhead will be added.

**Estimate of Fish Arriving at McNary Dam**

McNary Dam is the first dam on the Columbia River below the confluence of the Snake River. To obtain an estimate of the number of steelhead smolts arriving at McNary Dam, we added the estimated numbers from the Upper Columbia River (1,379,312), Mid-Columbia (192,169) and the Snake River (1,064,901) ESUs.

We estimate that 2,636,382 (1,379,312 + 192,169 + 1,064,901) steelhead smolts will arrive at McNary Dam in 2012, and that 558,913 fish will be collected. Of the 558,913 smolts collected at McNary Dam, 153,684 (0.275) will be wild (75,342 Upper Columbia River ESU, 37,602 Snake River ESU, and 40,740 Mid-Columbia River ESU), 162,223 (0.29) will be listed hatchery AD-clipped (97,368 Upper Columbia River ESU, 64,855 Snake River ESU, and 0 Mid-Columbia River ESU), 60,122 (0.108) will be listed hatchery Non-AD-clipped (27,027 Upper Columbia River ESU, 21,859 Snake River ESU, and 11,236 Mid-Columbia River ESU), and 234,186 (0.419) will be unlisted hatchery fish (213,417 AD-clipped and 20,769 Non-AD-clipped). The ratio of Upper Columbia River ESU wild fish, Snake River ESU wild fish and Mid-Columbia River ESU wild fish at McNary, John Day, and The Dalles Dams will be as follows:

	McNary Dam		John Day		The Dalles	
Upper Columbia	0.490	(355,389)	0.390	(319,850)	0.333	(287,865)
Snake River	0.245	(177,369)	0.194	(159,632)	0.166	(143,669)
Mid-Columbia						
Summer	0.265	(192,169)	0.416	(341,818)	0.501	(433,817)
Winter	—		—		—	
	<u>1.000</u>		<u>1.000</u>		<u>1.000</u>	

The proportion of Upper Columbia River ESU, Snake River ESU, and Mid-Columbia River ESU hatchery fish at McNary, John Day, and The Dalles Dams will be as follows:

	McNary Dam		John Day		The Dalles	
Upper Columbia						
AD-clipped	0.600	(459,285)	0.493	(413,357)	0.393	(372,021)
Non-AD-clipped	0.449	(127,486)	0.449	(114,737)	0.122	(103,263)
Snake River						
AD-clipped	0.400	(305,919)	0.328	(275,327)	0.262	(247,794)
Non-AD-clipped	0.364	(103,110)	0.364	(92,799)	0.099	(83,519)
Mid-Columbia						
Summer						
AD-clipped	0.000	(0)	0.179	(150,000)	0.345	(327,000)
Non-AD-clipped	0.187	(53,000)	0.187	(47,700)	0.779	(656,430)
Winter						
AD-clipped	0.000	(0)	0.000	(0)	0.000	(0)
Non-AD-clipped	0.000	(0)	0.000	(0)	0.000	(0)

#### Lower Columbia River ESU Steelhead

We estimate that 41,630 (26,675 summer and 14,955 winter) wild steelhead from this ESU will arrive at Bonneville Dam. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Because the hatchery steelhead are denoted as of summer or winter stock, we have decided to track each run individually. At Bonneville Dam, the proportion of wild fish in the various ESUs will be as follows:

Upper Columbia	0.294	(259,079)
Snake River	0.147	(129,302)
Mid-Columbia		
summer	0.443	(390,435)
winter	0.069	(60,353)
Lower Columbia		
summer	0.030	(26,675)
winter	<u>0.017</u>	(14,955)
	1.000	

Between The Dalles and Bonneville Dams, no listed and no unlisted hatchery summer steelhead will be added. There will be 50,000 AD-clipped winter steelhead released above Bonneville Dam from this ESU. At Bonneville Dam, the proportion of hatchery fish in the various ESUs will be as follows:

	Bonneville Dam	
Upper Columbia		
AD-clipped	0.371	(334,819)
Non-AD-clipped	0.122	(92,937)
Snake River		
AD-clipped	0.247	(223,015)
Non-AD-clipped	0.099	(75,167)
Mid-Columbia		
Summer		
AD-clipped	0.326	(294,300)
Non-AD-clipped	0.779	(590,787)
Winter		
AD-clipped	0.000	(0)
Non-AD-clipped	0.000	(0)
Lower Columbia		
Summer		
AD-clipped	0.000	(0)
Non-AD-clipped	0.000	(0)
Winter		
AD-clipped	0.056	(50,000)
Non-AD-clipped	0.000	(0)

Another 470,329 (37,864 summer and 432,465 winter) wild steelhead are expected to enter the Columbia River from Washington and Oregon downstream from Bonneville Dam.

Fish transported from Snake River dams are released below Bonneville Dam. The number of listed transport fish returned to the river will be 3,842,762 (1,107,700 wild, 2,142,213 AD-clipped hatchery, and 592,849 Non-AD-clipped hatchery), all from the Snake River ESU. A total of 6,750,053 transported steelhead will be released below Bonneville Dam.

#### Upper Willamette River ESU

The Upper Willamette River wild winter-run steelhead are listed protected species. With the January 2006 listings, some hatchery steelhead in this ESU are now listed. Because the

hatchery steelhead are denoted as of summer or winter stock, we have decided to track each run individually.

Based on our assumptions described in the steelhead introduction, 306,432 winter steelhead will enter the Columbia River in 2012, 239,830 of which will be from listed stocks.

At Tongue Point the proportions of wild fish from the various ESUs will be as follows:

	Tongue Point	
Upper Columbia	0.096	(259,079)
Snake River	0.458	(1,237,002)
Mid-Columbia		
summer	0.145	(390,435)
winter	0.022	(60,353)
Lower Columbia		
summer	0.024	(64,539)
winter	0.166	(447,420)
Upper Willamette		
summer	0	(0)
winter	<u>0.089</u>	(239,830)
	1.000	

Listed hatchery releases from this ESU will total 184,500 (all AD-clipped) summer and no winter steelhead. At Tongue Point the ratios of listed hatchery fish from the various ESUs will be as follows:

	Tongue Point	
Upper Columbia		
AD-clipped	0.078	(334,819)
Non-AD-clipped	0.069	(92,937)
Snake River		
AD-clipped	0.551	(2,365,228)
Non-AD-clipped	0.494	(668,016)
Mid-Columbia		
Summer		
AD-clipped	0.068	(294,300)
Non-AD-clipped	0.437	(590,787)
Winter		
AD-clipped	0.000	(0)
Non-AD-clipped	0.000	(0)
Lower Columbia		
Summer		
AD-clipped	0.000	(0)
Non-AD-clipped	0.000	(0)
Winter		
AD-clipped	0.260	(1,116,000)
Non-AD-clipped	0.000	(0)
Upper Willamette		
Summer		
AD-clipped	0.043	(184,500)
Non-AD-clipped	0.000	(0)
Winter		
AD-clipped	0.000	(0)
Non-AD-clipped	0.000	(0)

#### Summary

Tables 9 and 10 summarize the estimated number of steelhead that will be collected, or will be arriving (Columbia River dams above McNary Dam), at each of the collection dams during 2012. This information is derived from the data shown in Tables 4-5 and Appendix Table B1. Table 11 shows the estimated number of steelhead expected to outmigrate from each ESU.



## CHUM ESTIMATES

### Columbia River ESU

Wild and all hatchery chum salmon in the Columbia River are listed protected species.

To estimate wild chum salmon outmigration, we used a five year average of available adult data (Streamnet) for the Grays and lower Columbia river systems. We assumed 50% of the adults were females and that every female spawned successfully. To estimate the number of outmigrants, we used an average fecundity estimate of 3000, and assigned an egg-to-smolt rate of 0.15%. We estimate a total of 2,034,000 (1,333,800 Grays River and 435,150 Columbia River) wild chum salmon outmigrating in 2012.

We expect the hatchery (all non-AD-clipped) chum salmon outmigration to be 520,000 (170,000 from the Columbia River, 100,000 from Chinook River, and 250,000 from Grays River). This provides an overall estimate of 2,554,000 (2,034,000 + 520,000) listed chum salmon outmigrating in 2012.

## Full Transportation Scenario

The estimates shown in Table 3 were derived using the same methodology utilized under the Transportation with Spill Scenario, with one major difference. The number of fish removed at each dam under the Transportation with Spill Scenario was based on an FGE value that was adjusted for spill. For our estimates under the Full Transportation Scenario, we used the FGE values developed during developmental testing of the diversion screens installed in each of the turbine intakes. Using the results from these tests, the FGEs for spring/summer Chinook salmon and sockeye salmon were changed from the values in Table 2 to 60.0, 65.0, 50.0, and 80.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Subyearling fall Chinook salmon FGEs were changed from the values in Table 2 to 55.0, 60.0, 40.0, and 65.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Steelhead FGEs (in Table 6) were changed from the values in Table 5 to 80.0, 90.0, 65.0, and 90.0% at Lower Granite, Little Goose, Lower Monumental, and McNary Dams, respectively. Using the same formulas as under the Transportation with Spill Scenario, we derived the values found in Tables 3 and 6-10.

Because the adjusted FGE at Lower Granite Dam was changed from 38.0 to 60.0% for yearling spring/summer Chinook and sockeye salmon, the total number of fish collected at Lower Granite Dam will be 6,349,333 ( $10,582,222 \times 0.600$ ) spring/summer Chinook salmon and 164,650 ( $274,416 \times 0.600$ ) *O. nerka* salmon.

Because more PIT-tagged fish will be collected at the upstream dams, the number of PIT-tagged fish that are returned to the river and subsequently collected at McNary Dam will be different under this scenario. The effects of this are shown in Appendices A and B.

As under the Transportation with Spill Scenario, to estimate the number of spring/summer Chinook salmon smolts arriving at McNary Dam, we added the estimated numbers from the Columbia River above McNary (5,781,775) and the Snake River (909,907).

$$5,781,775 + 909,907 = 6,691,682$$

Tables 7-10 show the changes in percentages of listed fish at each dam.

Table 1. Estimated percentage composition of Snake River spring/summer Chinook salmon arriving at Lower Granite Dam from listed hatcheries compared with total hatchery releases projected for spring 2012.

Hatchery	2012 Total hatchery releases <sup>a</sup>		Survival to	Fish to Lower Granite Dam	
	AD-clipped	Non-AD-clipped	<u>Lower Granite Dam</u>	AD-clipped	Non-AD-clipped
			Mean <sup>b</sup>		
Dworshak <sup>c</sup>	1,045,000	0	0.800	836,000	0
Kooskia <sup>c</sup>	804,000	50,000	0.690	554,760	34,500
Lookingglass					
Imnaha <sup>d</sup>	253,000	0	0.654	165,462	0
Grande Ronde <sup>d</sup>	900,000	0	0.519	467,100	0
Clearwater <sup>c</sup>	1,839,654	406,346	0.659	1,212,332	267,782
Rapid River <sup>c</sup>	3,118,000	0	0.732	2,282,376	0
Sawtooth <sup>d</sup>	1,082,000	376,000	0.483	522,606	181,608
McCall <sup>d</sup>	787,088	334,446	0.535	421,092	178,929
Pahsimeroi <sup>d</sup>	853,000	180,000	0.494	421,382	88,920
Nez Perce <sup>c</sup>	368,500	1,166,558	0.659	242,842	768,762
Totals					
All stocks	11,050,242	2,825,350		7,125,952	1,726,109
Listed stocks	3,875,088	1,202,446		1,997,642	655,065
Percent of listed stocks	36.59328%			29.96711%	

- a Data from USFWS, NPT, IDFG and ODFW.
- b Mean survival estimate made from PIT-tag detections of marked hatchery fish releases as part of the NMFS survival studies (Research Action #1212) for 1993-2011 (excluding 2001).
- c Non-listed stocks in 2012.
- d Listed stocks in 2012.

Table 2. Estimate of listed threatened and endangered species arriving at various locations during outmigration year 2012 under past transportation and spill conditions.

**Yearling spring/summer Chinook salmon**

*Snake River ESU*

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE <sup>1</sup>			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low Mon**	McNary			Listed Fish	% Listed Fish
Wild	4,021,244	2,930,553	12.255	1,296,901	0.380	0.438	0.279	0.364	0.900	272,201	99,081	3.38
Listed Hatchery***												
AD-clipped	4,021,244	2,930,553	18.877	1,997,642	0.380	0.438	0.279	0.364	0.900	355,887	129,543	4.42
Non-AD-clipped	4,021,244	2,930,553	6.190	655,065	0.380	0.438	0.279	0.364	0.900	223,024	81,181	2.77

*Upper Columbia River ESU*

Rearing type	Number of listed fish passing dam			Of dam total, % listed fish			FGE McNary	Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild****	172,069	211,914	540,997	6.2	6.9	10.5	0.364	0.900	398,781	145,156	4.95
Listed Hatchery											
AD-clipped	0	0	298,000	0.0	0.0	5.8	0.364	0.900	219,662	79,957	2.73
Non-AD-clipped	1,174,000	1,081,254	1,024,891	42.3	35.3	19.9	0.364	0.900	755,470	274,991	9.38

**Fall Chinook salmon**

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE <sup>1</sup>			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low Mon	McNary			Listed Fish	% Listed Fish
Wild****	732,438	6,319,768	9.657	368,389	0.192	0.284	0.137	0.186	0.75	80,040	14,887	0.24
Listed Subyearling Hatchery												
AD-clipped	732,438	6,319,768	35.515	1,354,824	0.192	0.284	0.137	0.186	0.75	311,112	57,867	0.92
Non-AD-clipped	732,438	6,319,768	54.828	2,091,568	0.192	0.284	0.137	0.186	0.75	330,409	61,456	0.97
Listed Yearling Hatchery												
AD-clipped	4,021,244	2,930,553	1.91968	203,145	0.380	0.438	0.279	0.364	0.900	178,903	65,121	2.22
Non-AD-clipped	4,021,244	2,930,553	2.17454	230,115	0.380	0.438	0.279	0.364	0.900	178,676	65,038	2.22

**Sockeye salmon**

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE <sup>1</sup>			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low Mon	McNary			Listed Fish	% Listed Fish
Wild and listed hatchery*****	76,013	394,162	34.1	93,665	0.277	0.371	0.337	0.194	0.9	18,529	3,595	0.91

\*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

\*\*Note: Listed wild and hatchery spring Chinook salmon enter the Snake River above Lower Monumental Dam. WDFW predicts that 29,429 wild and 197,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2012 (Michael Gallinat, WDFW, Pers. commun., February 2012)

\*\*\*Note: Based on 2012 hatchery releases, it was estimated that 28.03334% and 37.95038% of the AD-clipped and non-AD-clipped, respectively, hatchery fish arriving at Lower Granite Dam are products of a listed hatchery (Table 1). Because Table 2 is based on the total collection at Lower Granite Dam, which includes both wild and hatchery (listed and unlisted) fish, these estimates of 28.03334% and 37.95038% of all hatchery fish were adjusted to % and % of the total collection at Lower Granite Dam.

\*\*\*\*Note: Estimated values based on the average collection numbers from 1995-2011 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2011 (excluding 2001) and the 2011 adult returns (FPC Weekly Reports 1994-2011).

\*\*\*\*\*Note: The Lower Granite Dam estimate is based on IDFG's estimate of 13,466 wild sockeye salmon smolts and 80,199 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2012 (Mike Peterson, IDFG, Pers. commun., April 2012). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2011 (Annual Fish Passage Reports 1985-2011, and WDFW's 2011 fish counts).

1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2011 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2012).

Formulas:

a) Listed fish to Granite =  $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}})) \times (\text{Of Granite Total \% Listed Fish})$

b) Listed Fish to McNary =  $(\text{Listed Fish to Granite}) \times (1 - \text{FGE}_{\text{Granite}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Goose}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{listed Tucannon fish}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 29,429 wild and 197,000 hatchery (all non-AD-clipped)  
PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table A1.

Table 3. Estimate of listed threatened and endangered species arriving at various locations during outmigration year 2012 under full transportation conditions (no spill).

**Yearling spring/summer Chinook salmon**

*Snake River ESU*

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish
Wild	6,349,333	5,353,346	12.255	1,296,901	0.60	0.65	0.50	0.80	0.900	124,460	99,568	1.86
Listed Hatchery***												
AD-clipped	6,349,333	5,353,346	18.877	1,997,642	0.60	0.65	0.50	0.80	0.900	123,997	99,198	1.85
Non-AD-clipped	6,349,333	5,353,346	6.190	655,065	0.60	0.65	0.50	0.80	0.900	109,870	87,896	1.64

*Upper Columbia River ESU*

Rearing type	Number of listed fish passing dam			Of dam total, % listed fish			FGE McNary	Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild****	172,069	211,914	540,997	6.2	6.9	10.5	0.80	0.900	398,781	319,025	5.96
Listed Hatchery											
AD-clipped	0	0	298,000	0.0	0.0	5.8	0.80	0.900	219,662	175,730	3.28
Non-AD-clipped	1,174,000	1,081,254	1,024,891	42.3	35.3	19.9	0.80	0.900	755,470	604,376	11.29

**Subyearling fall Chinook salmon**

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild****	2,098,130	22,077,814	9.657	368,389	0.55	0.60	0.40	0.65	0.75	27,776	18,054	0.08
Listed Subyearling Hatchery												
AD-clipped	2,098,130	22,077,814	35.515	1,354,824	0.55	0.60	0.40	0.65	0.75	113,797	73,968	0.34
Non-AD-clipped	2,098,130	22,077,814	54.828	2,091,568	0.55	0.60	0.40	0.65	0.75	71,473	46,457	0.21
Listed Yearling Hatchery												
AD-clipped	6,349,333	5,353,346	1.91968	203,145	0.60	0.65	0.50	0.80	0.900	110,175	88,140	1.65
Non-AD-clipped	6,349,333	5,353,346	2.17454	230,115	0.60	0.65	0.50	0.80	0.900	108,173	86,538	1.62

**Sockeye salmon**

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	Granite	FGE			Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild and listed hatchery*****	164,649	394,162	34.1	93,665	0.60	0.65	0.50	0.80	0.900	4,302	3,441	0.87

\*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

\*\*Note: Listed wild and hatchery spring Chinook salmon enter the Snake River above Lower Monumental Dam. WDFW predicts that 29,429 wild and 197,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2012 (Michael Gallinat, WDFW, Pers. commun., February 2012)

\*\*\*Note: Based on 2012 hatchery releases, it was estimated that 28.03334% and 37.95038% of the AD-clipped and non-AD-clipped, respectively, hatchery fish arriving at Lower Granite Dam are products of a listed hatchery (Table 1). Because Table 2 is based on the total collection at Lower Granite Dam, which includes both wild and hatchery (listed and unlisted) fish, these estimates of 28.03334% and 37.95038% of all hatchery fish were adjusted to % and % of the total collection at Lower Granite Dam.

\*\*\*\*Note: Estimated values based on the average collection numbers from 1995-2011 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2011 (excluding 2001) and the 2011 adult returns (FPC Weekly Reports 1994-2011).

\*\*\*\*\*Note: The Lower Granite Dam estimate is based on IDFG's estimate of 13,466 wild sockeye salmon smolts and 80,199 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2012 (Mike Peterson, IDFG, Pers. commun., April 2012). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2011 (Annual Fish Passage Reports 1985-2011, and WDFW's 2011 fish counts).

- 1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2011 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2012).

Fórmulas:

a) Listed fish to Granite =  $((\text{Collection}_{\text{Granite}})/(\text{FGE}_{\text{Granite}})) \times (\text{Of Granite Total } \% \text{ Listed Fish})$

b) Listed Fish to McNary =  $(\text{Listed Fish to Granite}) \times (1 - \text{FGE}_{\text{Granite}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Goose}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{listed Tucannon fish}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 29,429 wild and 197,000 hatchery (all non-AD-clipped)

PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table A1.



Table 4. Estimated percentage composition of Snake River steelhead arriving at Lower Granite Dam from total hatchery releases projected for spring 2012.

Hatchery	2012 Total hatchery releases <sup>a</sup>		Survival to Lower Granite Dam	Fish to Lower Granite Dam	
	AD-clipped	Non-AD-clipped	Mean <sup>b</sup>	AD-clipped	Non-AD-clipped
Dworshak <sup>c</sup>	1,900,000	200,000	0.807	1,533,300	161,400
Clearwater <sup>c</sup>	422,000	305,300	0.805	339,710	245,767
Hagerman <sup>c,d</sup>	982,000	425,000	0.802	787,564	340,850
Magic Valley <sup>c,d</sup>	1,360,000	180,000	0.799	1,086,640	143,820
Niagara Springs <sup>d</sup>	1,801,966	0	0.880	1,585,730	0
Irrigon (released above Lower Granite Dam) <sup>c,d</sup>	1,015,000	0	0.773	784,595	0
Lyons Ferry (released into Grande Ronde) <sup>d</sup>	176,500	0	0.791	139,612	0
Totals					
All stocks	7,657,466	1,110,300		6,257,151	891,837
Listed stocks	3,307,000	880,300		2,654,435	707,377
Percent of listed stocks	47.75789%			47.02501%	

- a Data from USFWS, IDFG, ODFW, and WDFW.
- b Mean survival estimate made from PIT-tag detections of marked hatchery fish releases as part of the NMFS survival studies (Research Action #1212) for 1993-2011 (excluding 2001).
- c Listed stocks in 2012.
- d Un-listed stocks in 2012.

Table 5. Estimates of listed threatened and endangered steelhead arriving at various locations during outmigration year 2012 under past transportation and spill conditions.

*Snake River ESU*

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	FGE <sup>1</sup>			McNary	Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary			Goose	Low	Mon**				Listed Fish	% Listed Fish
Wild	3,684,312	551,516	15.9813	1,359,815	0.433	0.525	0.38	0.212	0.9	177,369	37,602	6.82
Listed Hatchery***												
AD-clipped	3,684,312	551,516	31.1963	2,654,435	0.433	0.525	0.38	0.212	0.9	305,919	64,855	11.76
Non-AD-clipped	3,684,312	551,516	8.3135	707,377	0.433	0.525	0.38	0.212	0.9	103,110	21,859	3.96

*Upper Columbia River ESU*

Rearing type	Number of listed fish passing dam			Of dam total, % listed fish			FGE <sup>1</sup> McNary	Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild***	349,233	427,890	497,400	42.5	48.6	43.6	0.212	0.9	355,389	75,342	13.66
Listed Hatchery***											
AD-clipped	472,930	453,066	642,813	51.4	46.5	51.6	0.212	0.9	459,285	97,368	17.65
Non-AD-clipped	97,856	93,746	105,586	10.6	9.6	8.5	0.212	0.9	127,486	27,027	4.90

*Mid-Columbia River ESU*

Rearing type	Total Collection*		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	FGE <sup>1</sup>			McNary	Project Survival	Listed fish to McNary <sup>b</sup>	Of Fish Collected at McNary	
	Granite	McNary			Goose	Low	Mon**				Listed Fish	% Listed Fish
Summer-run (First dam reached is McNary Dam)												
Wild								0.212	0.9	192,169	40,740	7.39
Listed Hatchery***												
AD-clipped								0.212	0.9	0	0	0.00
Non-AD-clipped								0.212	0.9	53,000	11,236	2.04
Winter-run (First dam reached is Bonneville Dam)												
Wild								0.212	0.9	0	0	0.00
Listed Hatchery***												
AD-clipped								0.212	0.9	0	0	0.00
Non-AD-clipped								0.212	0.9	0	0	0.00

\*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

\*\*Note: Hatchery steelhead and listed wild steelhead enter the Snake River above Lower Monumental Dam. WDFW predicts that 21,143 wild fish and 51,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2012. An additional 53,000 (0 AD-clipped and 53,000 Non-AD-clipped) listed Mid-Columbia hatchery summer steelhead will outmigrate from the Touchet and Walla Walla Rivers above McNary Dam Michael Gillanet, WDFW, Pers. commun., April 2012).

\*\*\*Note: Estimated values based on 2011 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2011 (FPC Weekly Reports 1995-2011).

- 1 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2011 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2012).

Formulas:

a) Listed fish to Granite =  $((\text{Collection}_{\text{Granite}}) / (\text{FGE}_{\text{Granite}})) \times (\text{Of Granite Total \% Listed Fish})$

b) Listed Fish to McNary =  $(\text{Listed Fish to Granite}) \times (1 - \text{FGE}_{\text{Granite}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Goose}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{listed Tucannon fish}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{Rock Island listed fish}) \times (\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 21,143 wild and 51,000 (all Non-AD-clipped) hatchery fish

PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table B1.

Table 6. Estimates of listed threatened and endangered steelhead arriving at various locations during outmigration year 2012 under full transportation conditions (no spill).

*Snake River ESU*

Rearing type	<u>Total Collection*</u>		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	<u>FGE</u>				Project Survival	Listed fish to McNary <sup>b</sup>	<u>Of Fish Collected at McNary</u>	
	Granite	McNary			Granite	Goose	Low	Mon**			McNary	Listed Fish
Wild	6,807,042	1,514,512	15.9813	1,359,815	0.80	0.90	0.65	0.90	0.90	35,948	32,353	2.14
Listed Hatchery***												
AD-clipped	6,807,042	1,514,512	31.1963	2,654,435	0.80	0.90	0.65	0.90	0.90	31,134	28,021	1.85
Non-AD-clipped	6,807,042	1,514,512	8.3135	707,377	0.80	0.90	0.65	0.90	0.90	17,707	15,936	1.05

*Upper Columbia River ESU*

Rearing type	<u>Number of listed fish passing dam</u>			<u>Of dam total, % listed fish</u>			<u>FGE<sup>1</sup></u> McNary	Project Survival	Listed fish to McNary <sup>b</sup>	<u>Of Fish Collected at McNary</u>	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild***	349,233	427,890	497,400	42.5	48.6	43.6	0.90	0.90	355,389	319,850	21.12
Listed Hatchery***											
AD-clipped	472,930	453,066	642,813	51.4	46.5	51.6	0.90	0.90	459,285	413,357	27.29
Non-AD-clipped	97,856	93,746	105,586	10.6	9.6	8.5	0.90	0.90	127,486	114,737	7.58

*Mid-Columbia River ESU*

Rearing type	<u>Total Collection*</u>		Of Granite Total % Listed Fish	Listed Fish to Granite <sup>a</sup>	<u>FGE<sup>1</sup></u>				Project Survival	Listed fish to McNary <sup>b</sup>	<u>Of Fish Collected at McNary</u>		
	Granite	McNary			Granite	Goose	Low	Mon**			McNary	Listed Fish	% Listed Fish
Summer-run(First dam reached is McNary Dam)													
Wild									0.90	0.90	192,169	172,952	11.42
Listed Hatchery***													
AD-clipped									0.90	0.90	0	0	0.00
Non-AD-clipped									0.90	0.90	53,000	47,700	3.15
Winter-run(First dam reached is Bonneville Dam)													
Wild									0.90	0.90	0	0	0.00
Listed Hatchery***													
AD-clipped									0.90	0.90	0	0	0.00
Non-AD-clipped									0.90	0.90	0	0	0.00

\*Note: Total Collection is the total number of fish collected of that species or run, regardless of rearing type.

\*\*Note: Hatchery steelhead and listed wild steelhead enter the Snake River above Lower Monumental Dam. WDFW predicts that 21,143 wild fish and 51,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2012. An additional 53,000 (0 AD-clipped and 53,000 Non-AD-clipped) listed Mid-Columbia hatchery summer steelhead will outmigrate from the Touchet and Walla Walla Rivers above McNary Dam Michael Gillanet, WDFW, Pers. commun., April 2012).

\*\*\*Note: Estimated values based on 2011 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2011 (FPC Weekly Reports 1995-2011).

2 The FGE used in this table is adjusted for spill conditions, and PIT-tag detection efficiency at a dam. This estimate was obtained from the NMFS survival studies conducted in 1995-2011 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2012).

Formulas:

a) Listed fish to Granite =  $((\text{Collection}_{\text{Granite}}) / (\text{FGE}_{\text{Granite}})) \times (\text{Of Granite Total } \% \text{ Listed Fish})$

b) Listed Fish to McNary =  $(\text{Listed Fish to Granite}) \times (1 - \text{FGE}_{\text{Granite}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Goose}}) \times (\text{Project Survival}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{listed Tucannon fish}) \times (1 - \text{FGE}_{\text{Low Mon}}) \times (\text{Project Survival})^2 + (\text{Rock Island listed fish}) \times (\text{Project Survival})^2 + (\text{PIT-tagged fish})$

where: listed Tucannon fish = 21,143 wild and 51,000 (all Non-AD-clipped) hatchery fish

PIT-tagged fish = fish collected at Snake River dams, returned to the river, and subsequently arrived at McNary Dam; See Appendix Table B1.

Table 7a. Estimated juvenile Chinook salmon collection at each of eight mainstem collection facilities in 2012 under a full transportation scenario.

	Full Transportation Scenario							
	Chinook salmon							
	Yearlings			Subyearlings				
<b>Total fish collected at:</b>								
Lower Granite	6,349,333						2,098,130	
Little Goose	2,522,498						772,493	
Lower Monumental	1,031,080						252,499	
Ice Harbor**	606,602						127,828	
<u>Columbia River</u>								
Wells***	2,776,469						NA	
Rocky Reach***	3,066,566						NA	
Rock Island***	5,155,442						NA	
Wanapum***	4,665,675						NA	
Priest Rapids***	4,222,436						NA	
McNary****	5,353,346						22,077,814	
John Day** ****	4,435,146						3,330,614	
The Dalles** ****	2,979,248						1,784,258	
Bonneville (I & II combined)** *****	3,856,768						8,627,171	
---To the tailrace of Bonneville	9,641,920						28,757,237	
---To Tongue Point*****	34,628,524						93,346,220	
	Spring/Summer Chinook			Fall Chinook - Yearlings		Fall Chinook - Subyearlings		
	Hatchery			Hatchery		Hatchery		
<b>Total listed fish at:</b>	Wild	Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	Wild	Ad-clip	No Ad-clip
Lower Granite	778,141	1,198,585	393,039	121,887	138,069	202,615	745,153	1,150,363
Little Goose	324,516	481,463	153,285	47,536	53,847	74,599	274,352	423,543
Lower Monumental	117,026	131,040	135,642	136,018	133,548	32,920	134,870	84,709
Ice Harbor**	82,972	82,665	73,247	73,450	72,116	16,666	68,278	42,884
<u>Columbia River</u>								
Wells***	172,069	0	1,174,000	0	0	NA	NA	NA
Rocky Reach***	211,914	0	1,081,254	0	0	NA	NA	NA
Rock Island***	540,997	298,000	1,024,891	0	0	NA	NA	NA
Wanapum***	489,602	269,690	927,526	0	0	NA	NA	NA
Priest Rapids***	443,090	244,069	839,411	0	0	NA	NA	NA
McNary****	418,593	274,928	692,273	88,140	86,538	18,054	73,968	46,457
John Day** ****	282,550	185,576	467,284	59,495	58,413	2,552	10,455	6,567
The Dalles** ****	169,530	111,346	280,370	35,697	35,048	1,367	5,601	3,518
Bonneville (I & II combined)** *****	164,622	100,211	252,333	32,127	31,543	107,570	3,619,741	213,466
---To the tailrace of Bonneville	411,555	250,528	630,833	80,318	78,858	358,567	12,065,803	711,553
---To Tongue Point*****	5,952,322	11,111,729	1,562,799	385,759	404,322	10,755,031	33,072,417	2,616,625
<b>Percent listed fish at:</b>								
Lower Granite	12.26%	18.88%	6.19%	1.92%	2.17%	9.66%	35.52%	54.83%
Little Goose	12.86%	19.09%	6.08%	1.88%	2.13%	9.66%	35.52%	54.83%
Lower Monumental	11.35%	12.71%	13.16%	13.19%	12.95%	13.04%	53.41%	33.55%
Ice Harbor**	13.68%	13.63%	12.07%	12.11%	11.89%	13.04%	53.41%	33.55%
<u>Columbia River</u>								
Wells***	6.20%	0.00%	42.28%	0.00%	0.00%	NA	NA	NA
Rocky Reach***	6.91%	0.00%	35.26%	0.00%	0.00%	NA	NA	NA
Rock Island***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
Wanapum***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
Priest Rapids***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
McNary****	7.82%	5.14%	12.93%	1.65%	1.62%	0.08%	0.34%	0.21%
John Day** ****	6.37%	4.18%	10.54%	1.34%	1.32%	0.08%	0.31%	0.20%
The Dalles** ****	5.69%	3.74%	9.41%	1.20%	1.18%	0.08%	0.31%	0.20%
Bonneville (I & II combined)** *****	4.27%	2.60%	6.54%	0.83%	0.82%	1.25%	41.96%	2.47%
---To the tailrace of Bonneville	4.27%	2.60%	6.54%	0.83%	0.82%	1.25%	41.96%	2.47%
---To Tongue Point*****	17.19%	32.09%	4.51%	1.11%	1.17%	11.52%	35.43%	2.80%

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

\*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

\*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

\*\*\*\* Note: (See next page)

\*\*\*\*\* Note: (See next page)

\*\*\*\* Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are: For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Full Transportation scenario (above), 16.47% of them will be listed wild fish, or 165 fish. To these 165 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR,  $165 \times 0.2118 = 35$ ; UCR,  $165 \times 0.0488 = 8$ ; etc.).

Yearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	23.79	27.32	11.29
SR - Fall (Yrlg)	0.00	24.28	11.11
UCR	76.21	48.40	77.60
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Fall (Subyrlg)	100.00	100.00	100.00
LCR - Tule fall	0.00	0.00	0.00
LCR - Late run fall	0.00	0.00	0.00

\*\*\*\* Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.  
The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

Yearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	22.04	27.32	11.29
SR - Fall (Yrlg)	0.00	24.28	11.11
UCR	70.64	48.40	77.60
LCR - Spring	7.32	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Fall (Subyrlg)	1.14	0.14	1.48
LCR - Tule fall	98.86	99.86	98.52
LCR - Late run fall	0.00	0.00	0.00

Yearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	21.18	16.26	38.74
SR - Fall (Yrlg)	0.00	3.36	20.55
UCR	4.88	1.39	28.00
LCR - Spring	40.18	26.16	7.63
UWR	33.76	52.83	5.08

Subyearling Chinook salmon	Full Transportation		
	Wild	Ad-clip	No Ad-clip
SR - Fall (Subyrlg)	3.09	3.76	65.57
LCR - Tule fall	69.57	96.24	34.43
LCR - Late run fall	27.34	0.00	0.00

SR - Spr/Sum = Snake River ESU - Spring/Summer Chinook salmon  
 SR - Fall (Yrlg) = Snake River ESU - Yearling Fall Chinook salmon  
 SR - Fall (Subyrlg) = Snake River ESU - Subyearling Fall Chinook salmon  
 UCR = Upper Columbia River ESU  
 LCR - Spring = Lower Columbia River ESU - Spring Chinook salmon  
 UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon  
 LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon



Table 7b. Estimated juvenile Chinook salmon collection at each of eight mainstem collection facilities in 2012 under a transportation with spill scenario.

	Transportation with Spill Scenario							
	Chinook salmon						Subyearlings	
	Yearlings			Subyearlings				
<b>Total fish collected at:</b>								
Lower Granite	4,021,244						732,438	
Little Goose	2,606,078						656,539	
Lower Monumental	1,063,389						203,639	
Ice Harbor**	1,512,793						432,937	
<u>Columbia River</u>								
Wells***	2,776,469						NA	
Rocky Reach***	3,066,566						NA	
Rock Island***	5,155,442						NA	
Wanapum***	4,665,675						NA	
Priest Rapids***	4,222,436						NA	
McNary****	2,930,553						6,319,768	
John Day** *****	1,266,444						4,866,229	
The Dalles** *****	3,419,656						4,001,833	
Bonneville (I & II combined)** *****	1,871,380						5,630,184	
—To the tailrace of Bonneville	10,632,841						35,409,962	
—To Tongue Point*****	33,476,396						82,710,393	
	Spring/Summer Hatchery			Fall Chinook - Yearlings Hatchery		Fall Chinook - Subyearlings Hatchery		
	Wild	Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	Wild	Ad-clip	No Ad-clip
<b>Total listed fish at:</b>								
Lower Granite	492,822	759,104	248,925	77,195	87,444	70,731	260,126	401,581
Little Goose	325,947	494,213	160,101	49,649	56,241	63,402	233,170	359,967
Lower Monumental	122,130	164,931	106,546	85,467	85,359	22,589	87,802	93,248
Ice Harbor**	181,467	237,257	148,683	119,268	119,117	48,024	186,667	198,246
<u>Columbia River</u>								
Wells***	172,069	0	1,174,000	0	0	NA	NA	NA
Rocky Reach***	211,914	0	1,081,254	0	0	NA	NA	NA
Rock Island***	540,997	298,000	1,024,891	0	0	NA	NA	NA
Wanapum***	489,602	269,690	927,526	0	0	NA	NA	NA
Priest Rapids***	443,090	244,069	839,411	0	0	NA	NA	NA
McNary****	244,237	209,500	356,172	65,121	65,038	14,887	57,867	61,456
John Day** *****	88,771	76,145	129,455	23,670	23,639	11,141	43,305	45,991
The Dalles** *****	217,398	186,478	317,033	57,967	57,891	9,162	35,613	37,822
Bonneville (I & II combined)** *****	91,389	73,845	125,545	22,955	22,925	60,730	1,932,778	129,500
—To the tailrace of Bonneville	519,256	419,574	713,324	130,426	130,256	381,950	12,155,836	814,465
—To Tongue Point*****	5,810,282	10,906,114	1,478,896	342,737	359,300	10,621,835	32,573,072	1,930,717
<b>Percent listed fish at:</b>								
Lower Granite	12.26%	18.88%	6.19%	1.92%	2.17%	9.66%	35.52%	54.83%
Little Goose	12.51%	18.96%	6.14%	1.91%	2.16%	9.66%	35.52%	54.83%
Lower Monumental	11.48%	15.51%	10.02%	8.04%	8.03%	11.09%	43.12%	45.79%
Ice Harbor**	12.00%	15.68%	9.83%	7.88%	7.87%	11.09%	43.12%	45.79%
<u>Columbia River</u>								
Wells***	6.20%	0.00%	42.28%	0.00%	0.00%	NA	NA	NA
Rocky Reach***	6.91%	0.00%	35.26%	0.00%	0.00%	NA	NA	NA
Rock Island***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
Wanapum***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
Priest Rapids***	10.49%	5.78%	19.88%	0.00%	0.00%	NA	NA	NA
McNary****	8.33%	7.15%	12.15%	2.22%	2.22%	0.24%	0.92%	0.97%
John Day** *****	7.01%	6.01%	10.22%	1.87%	1.87%	0.23%	0.89%	0.95%
The Dalles** *****	6.36%	5.45%	9.27%	1.70%	1.69%	0.23%	0.89%	0.95%
Bonneville (I & II combined)** *****	4.88%	3.95%	6.71%	1.23%	1.23%	1.08%	34.33%	2.30%
—To the tailrace of Bonneville	4.88%	3.95%	6.71%	1.23%	1.23%	1.08%	34.33%	2.30%
—To Tongue Point*****	17.36%	32.58%	4.42%	1.02%	1.07%	12.84%	39.38%	2.33%

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.  
 \*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.  
 \*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.  
 \*\*\*\* Note: (See next page)  
 \*\*\*\*\* Note: (See next page)

\*\*\*\* Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:  
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Transportation with spill scenario (above),**  
 16.66% of them will be listed wild fish, or 167 fish. To these 167 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR,  $167 \times 0.1925 = 32$ ; UCR,  $167 \times 0.0500 = 8$ ; etc.).

Yearling Chinook salmon	Transportation with spill Hatchery		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	40.57	47.17	19.27
SR - Fall (Yrlg)	0.00	23.71	15.44
UCR	59.43	29.12	65.29
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00
<b>Subyearling Chinook salmon</b>			
SR - Fall (Subyrlg)	100.00	100.00	100.00
LCR - Tule fall	0.00	0.00	0.00
LCR - Late run fall	0.00	0.00	0.00

\*\*\*\*\* Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.  
 The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

Bonneville Dam Yearling Chinook salmon	Transportation with spill Hatchery		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	38.21	47.17	19.27
SR - Fall (Yrlg)	0.00	23.71	15.44
UCR	55.99	29.12	65.29
LCR - Spring	5.80	0.00	0.00
UWR	0.00	0.00	0.00
<b>Subyearling Chinook salmon</b>			
SR - Fall (Subyrlg)	7.20	0.88	13.93
LCR - Tule fall	92.80	99.12	86.07
LCR - Late run fall	0.00	0.00	0.00

Tongue Point Yearling Chinook salmon	Transportation with spill Hatchery		
	Wild	Ad-clip	No Ad-clip
SR - Spr/Sum	19.25	14.79	36.89
SR - Fall (Yrlg)	0.00	3.05	19.55
UCR	5.00	1.42	29.96
LCR - Spring	41.16	26.74	8.16
UWR	34.59	54.00	5.44
<b>Subyearling Chinook salmon</b>			
SR - Fall (Subyrlg)	1.87	2.29	53.33
LCR - Tule fall	70.44	97.71	46.67
LCR - Late run fall	27.69	0.00	0.00

SR - Spr/Sum = Snake River ESU - Spring/Summer Chinook salmon  
 SR - Fall (Yrlg) = Snake River ESU - Yearling Fall Chinook salmon  
 SR - Fall (Subyrlg) = Snake River ESU - Subyearling Fall Chinook salmon  
 UCR = Upper Columbia River ESU  
 LCR - Spring = Lower Columbia River ESU - Spring Chinook  
 UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon  
 LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 7c. Estimated juvenile sockeye, coho, and chum salmon collection at each of eight mainstem collection facilities in 2012.

	Full Transportation Scenario				Transportation with Spill Scenario					
	Sockeye salmon	Coho salmon			Chum salmon	Sockeye salmon	Coho salmon			Chum salmon
<b>Total fish collected at:</b>										
Lower Granite	164,649	336,090			0	76,013	212,857			0
Little Goose	64,213	131,075			0	66,246	136,903			0
Lower Monumental	15,559	31,760			0	34,065	44,108			0
Ice Harbor**	8,402	17,150			0	36,190	61,552			0
<u>Columbia River</u>										
Wells***	NA	533,238			0	NA	533,238			0
Rocky Reach***	NA	479,914			0	NA	479,914			0
Rock Island***	NA	1,184,946			0	NA	1,184,946			0
Wanapum***	NA	1,066,451			0	NA	1,066,451			0
Priest Rapids***	NA	959,806			0	NA	959,806			0
McNary****	394,162	1,160,116			0	394,162	552,096			0
John Day** ****	1,097,152	1,383,078			0	223,088	347,666			0
The Dalles** ****	658,291	829,847			0	658,292	851,427			0
Bonneville (I & II combined)** *****	592,462	2,463,061			12,000	263,646	1,092,292			12,000
—To the tailrace of Bonneville	1,481,155	6,157,653			30,000	1,481,157	6,206,205			30,000
—To Tongue Point*****	1,725,576	16,402,023			1,612,982	1,657,481	15,154,676			1,612,982
<b>Total listed fish at:</b>										
	Sockeye salmon	Coho salmon			Chum salmon	Sockeye salmon	Coho salmon			Chum salmon
		Wild	Hatchery				Wild	Hatchery		
			Ad-clip	No Ad-clip				Ad-clip	No Ad-clip	
Lower Granite	56,199	0	0	0	0	25,945	0	0	0	0
Little Goose	21,918	0	0	0	0	22,611	0	0	0	0
Lower Monumental	5,311	0	0	0	0	11,627	0	0	0	0
Ice Harbor**	2,868	0	0	0	0	12,352	0	0	0	0
<u>Columbia River</u>										
Wells***	NA	0	0	0	0	NA	0	0	0	0
Rocky Reach***	NA	0	0	0	0	NA	0	0	0	0
Rock Island***	NA	0	0	0	0	NA	0	0	0	0
Wanapum***	NA	0	0	0	0	NA	0	0	0	0
Priest Rapids***	NA	0	0	0	0	NA	0	0	0	0
McNary****	3,441	0	0	0	0	3,595	0	0	0	0
John Day** ****	2,323	0	0	0	0	2,035	0	0	0	0
The Dalles** ****	1,394	0	0	0	0	6,005	0	0	0	0
Bonneville (I & II combined)** *****	1,255	38,198	0	0	12,000	2,405	16,807	0	0	12,000
—To the tailrace of Bonneville	3,138	95,495	0	0	30,000	13,511	95,494	0	0	30,000
—To Tongue Point*****	90,007	1,162,883	7,487,215	275,000	1,612,982	73,694	1,162,882	7,487,215	275,000	1,612,982
<b>Percent listed fish at:</b>										
Lower Granite	34.13%	0.00%	0.00%	0.00%	—	34.13%	0.00%	0.00%	0.00%	—
Little Goose	34.13%	0.00%	0.00%	0.00%	—	34.13%	0.00%	0.00%	0.00%	—
Lower Monumental	34.13%	0.00%	0.00%	0.00%	—	34.13%	0.00%	0.00%	0.00%	—
Ice Harbor**	34.13%	0.00%	0.00%	0.00%	—	34.13%	0.00%	0.00%	0.00%	—
<u>Columbia River</u>										
Wells***	NA	0.00%	0.00%	0.00%	—	NA	0.00%	0.00%	0.00%	—
Rocky Reach***	NA	0.00%	0.00%	0.00%	—	NA	0.00%	0.00%	0.00%	—
Rock Island***	NA	0.00%	0.00%	0.00%	—	NA	0.00%	0.00%	0.00%	—
Wanapum***	NA	0.00%	0.00%	0.00%	—	NA	0.00%	0.00%	0.00%	—
Priest Rapids***	NA	0.00%	0.00%	0.00%	—	NA	0.00%	0.00%	0.00%	—
McNary****	0.87%	0.00%	0.00%	0.00%	—	0.91%	0.00%	0.00%	0.00%	—
John Day** ****	0.21%	0.00%	0.00%	0.00%	—	0.91%	0.00%	0.00%	0.00%	—
The Dalles** ****	0.21%	0.00%	0.00%	0.00%	—	0.91%	0.00%	0.00%	0.00%	—
Bonneville (I & II combined)** *****	0.21%	1.55%	0.00%	0.00%	—	0.91%	1.54%	0.00%	0.00%	—
—To the tailrace of Bonneville	0.21%	1.55%	0.00%	0.00%	100.00%	0.91%	1.54%	0.00%	0.00%	100.00%
—To Tongue Point*****	5.22%	7.09%	45.65%	1.68%	100.00%	4.45%	7.67%	49.41%	1.81%	100.00%

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.  
 \*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.  
 \*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

Table 8a. Estimated juvenile salmon collection at each of the mainstem collection facilities in 2012 under a full transportation scenario. Percentage of listed fish at each facility.

**\*\*Use this table only if the reartype and/or clip/no-clip status of all handled fish is known\*\***

	Full Transportation Scenario															
	Yearling Chinook salmon					Coho salmon			Subyearling Chinook salmon							
	Unclipped		Clipped			Unclipped		Clipped	Unclipped	Clipped						
<b>Total fish collected at:*</b>																
Lower Granite	1,951,875			4,397,458		336,090	0		1,352,976	745,153						
Little Goose	782,272			1,740,226		109,229	0		498,141	274,352						
Lower Monumental	446,944			584,136		22,056	0		117,628	134,870						
Ice Harbor**	261,128			345,473		9,925	0		59,549	68,278						
<i>Columbia River</i>																
Wells***	1,346,069			1,430,400		533,238	0		NA	NA						
Rocky Reach***	1,293,168			1,773,398		479,914	0		NA	NA						
Rock Island***	1,565,888			3,589,554		1,184,946	0		NA	NA						
Wanapum***	1,409,299			3,230,599		1,066,451	0		NA	NA						
Priest Rapids***	1,268,369			2,907,539		959,806	0		NA	NA						
McNary****	2,145,135			3,174,707		1,003,906	142,776		14,428,626	7,649,188						
John Day** *****	1,729,603			2,682,927		737,637	636,374		2,039,431	1,291,183						
The Dalles** *****	1,067,222			1,898,457		442,582	381,824		1,092,552	691,705						
Bonneville (I & II combined)** *****	972,545			2,872,011		652,522	1,805,642		2,049,936	6,577,235						
---To the tailrace of Bonneville	2,431,363			7,180,028		1,631,305	4,514,105		6,833,120	21,924,117						
---To Tongue Point*****	10,276,834			27,524,555		3,895,816	13,884,096		34,893,767	58,452,451						
	Spring/Summer Chinook		Fall Chinook		Spring/Summer Chinook		Fall Chinook		Coho salmon		Coho salmon		Fall Chinook		Fall Chinook	
	Wild	Hatchery	Hatchery	Hatchery	Hatchery	Wild	Hatchery	Hatchery	Wild	Hatchery	Hatchery	Wild	Hatchery	Hatchery		
	No Ad-clip	No Ad-clip	No Ad-clip	Ad-clip	Ad-clip	No Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	No Ad-clip	Ad-clip		
<b>Total listed fish at:</b>																
Lower Granite	778,141	393,039	138,069	1,198,585	121,887	0	0	0	202,615	1,150,363	745,153					
Little Goose	324,516	153,285	53,847	481,463	47,536	0	0	0	74,599	423,543	274,352					
Lower Monumental	117,026	135,642	133,548	131,040	136,018	0	0	0	32,920	84,709	134,870					
Ice Harbor**	82,972	73,247	72,116	82,665	73,450	0	0	0	16,666	42,884	68,278					
<i>Columbia River</i>																
Wells***	172,069	1,174,000	0	0	0	0	0	0	NA	NA	NA					
Rocky Reach***	211,914	1,081,254	0	0	0	0	0	0	NA	NA	NA					
Rock Island***	540,997	1,024,891	0	298,000	0	0	0	0	NA	NA	NA					
Wanapum***	489,602	927,526	0	269,690	0	0	0	0	NA	NA	NA					
Priest Rapids***	443,090	839,411	0	244,069	0	0	0	0	NA	NA	NA					
McNary****	418,593	692,273	86,538	274,928	88,140	0	0	0	18,054	46,457	73,968					
John Day** *****	282,550	467,284	58,413	185,576	59,495	0	0	0	2,552	6,567	10,455					
The Dalles** *****	169,530	280,370	35,048	111,346	35,697	0	0	0	1,367	3,518	5,601					
Bonneville (I & II combined)** *****	164,622	252,333	31,543	100,211	32,127	38,198	0	0	107,570	213,466	3,619,741					
---To the tailrace of Bonneville	411,555	630,833	78,858	250,528	80,318	95,495	0	0	358,567	711,553	12,065,803					
---To Tongue Point*****	5,952,322	1,562,798	404,322	11,111,729	385,759	1,162,883	275,000	7,487,215	10,755,031	2,616,625	33,072,417					
<b>Percent listed fish at:</b>																
Lower Granite	39.87%	20.14%	7.07%	27.256%	2.772%	0.00%	0.00%	0.00%	14.98%	85.02%	100.00%					
Little Goose	41.48%	19.59%	6.88%	27.667%	2.732%	0.00%	0.00%	0.00%	14.98%	85.02%	100.00%					
Lower Monumental	26.18%	30.35%	29.88%	22.433%	23.285%	0.00%	0.00%	0.00%	27.99%	72.01%	100.00%					
Ice Harbor**	31.77%	28.05%	27.62%	23.928%	21.261%	0.00%	0.00%	0.00%	27.99%	72.01%	100.00%					
<i>Columbia River</i>																
Wells***	12.78%	87.22%	0.00%	0.00%	0.00%	NA	NA	NA	NA	NA	NA					
Rocky Reach***	16.39%	83.61%	0.00%	0.00%	0.00%	NA	NA	NA	NA	NA	NA					
Rock Island***	34.55%	65.45%	0.00%	8.30%	0.00%	NA	NA	NA	NA	NA	NA					
Wanapum***	34.74%	65.81%	0.00%	8.35%	0.00%	NA	NA	NA	NA	NA	NA					
Priest Rapids***	34.93%	66.18%	0.00%	8.39%	0.00%	NA	NA	NA	NA	NA	NA					
McNary****	19.51%	32.27%	4.03%	8.66%	2.78%	0.00%	0.00%	0.00%	0.13%	0.32%	0.97%					
John Day** *****	16.34%	27.02%	3.38%	6.92%	2.22%	0.00%	0.00%	0.00%	0.13%	0.32%	0.81%					
The Dalles** *****	15.89%	26.27%	3.28%	5.87%	1.88%	0.00%	0.00%	0.00%	0.13%	0.32%	0.81%					
Bonneville (I & II combined)** *****	16.93%	25.95%	3.24%	3.49%	1.12%	5.85%	0.00%	0.00%	5.25%	10.41%	55.03%					
---To the tailrace of Bonneville	16.93%	25.95%	3.24%	3.49%	1.12%	5.85%	0.00%	0.00%	5.25%	10.41%	55.03%					
---To Tongue Point*****	57.92%	15.21%	3.93%	40.37%	1.40%	29.85%	7.06%	53.93%	30.82%	7.50%	56.58%					

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

\*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

\*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

\*\*\*\* Note: (See next page)

\*\*\*\*\* Note: (See next page)

\*\*\*\* Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:  
**For example, If you handle 1,000 yearling Chinook salmon at Tongue Point, under the Full Transportation scenario (above),**  
 51.39% of them will be listed wild fish, or 514 fish. To these 514 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU  
 (SR, 514 x 0.2118 = 109; UCR, 514 x 0.0488 = 25; etc.).

Spring/Summer Chinook salmon	Full Transportation Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	23.79	27.32	11.29
SR - Fall (Yrlg)	0.00	24.28	11.11
UCR	76.21	48.40	77.60
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Fall Chinook salmon			
SR	100.00	100.00	100.00
LCR - Tule fall	0.00	0.00	0.00
LCR - Late run fall	0.00	0.00	0.00

\*\*\*\*\* Note:  
 Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.  
 The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

Bonneville Dam Spring/Summer Chinook salmon	Full Transportation Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	22.04	27.32	11.29
SR - Fall (Yrlg)	0.00	24.28	11.11
UCR	70.64	48.40	77.60
LCR - Spring	7.32	0.00	0.00
UWR	0.00	0.00	0.00

Fall Chinook salmon			
SR	1.14	0.14	1.48
LCR - Tule fall	98.86	99.86	98.52
LCR - Late run fall	0.00	0.00	0.00

Tongue Point Spring/Summer Chinook salmon	Full Transportation Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	21.18	16.26	38.74
SR - Fall (Yrlg)	0.00	3.36	20.55
UCR	4.88	1.39	28.00
LCR - Spring	40.18	26.16	7.63
UWR	33.76	52.83	5.08

Fall Chinook salmon			
SR	3.09	3.76	65.57
LCR - Tule fall	69.57	96.24	34.43
LCR - Late run fall	27.34	0.00	0.00

SR = Snake River ESU  
 UCR = Upper Columbia River ESU  
 LCR - Spring = Lower Columbia River ESU - Spring Chinook  
 UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon  
 LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 8b. Estimated juvenile salmon collection at each of the mainstem collection facilities in 2012 under a transportation with spill scenario. Percentage of listed fish at each facility.

**\*\*Use this table only if the reartype and/or clip/no-clip status of all handled fish is known\*\***

	Transportation with Spill Scenario											
	Yearling Chinook salmon						Coho salmon			Subyearling Chinook salmon		
	Unclipped		Clipped				Unclipped		Clipped	Unclipped		Clipped
<b>Total fish collected at:</b>												
Lower Granite	1,236,188				2,785,057			212,857	0		472,312	260,126
Little Goose	804,056				1,802,023			114,086	0		423,369	233,170
Lower Monumental	398,373				665,016			30,631	0		115,837	87,802
Ice Harbor**	566,960				945,833			35,621	0		246,270	186,667
<i>Columbia River</i>												
Wells***	1,346,069				1,430,400			533,238	0		NA	NA
Rocky Reach***	1,293,168				1,773,398			479,914	0		NA	NA
Rock Island***	1,565,888				3,589,554			1,184,946	0		NA	NA
Wanapum***	1,409,299				3,230,599			1,066,451	0		NA	NA
Priest Rapids***	1,268,369				2,907,539			959,806	0		NA	NA
McNary****	1,143,021				1,772,289			465,195	64,963		4,130,190	2,189,578
John Day** *****	484,445				776,459			183,780	155,912		3,090,848	1,775,381
The Dalles** *****	1,215,856				2,190,233			450,073	381,825		2,541,816	1,460,017
Bonneville (I & II combined)** *****	486,779				1,379,228			290,076	794,483		1,777,765	3,852,419
---To the tailrace of Bonneville	2,765,790				7,836,523			1,648,159	4,514,108		11,180,912	24,229,050
---To Tongue Point*****	8,923,084				25,389,861			3,264,158	13,806,286		27,985,896	54,724,497
<b>Total listed fish at:</b>												
	Spring/Summer Chinook	Fall Chinook	Spring/Summer Chinook	Fall Chinook	Spring/Summer Chinook	Fall Chinook	Coho salmon	Coho salmon	Coho salmon	Fall Chinook	Fall Chinook	Fall Chinook
	Wild	Hatchery	Hatchery	Hatchery	Hatchery	Hatchery	Wild	Hatchery	Hatchery	Wild	Hatchery	Hatchery
	No Ad-clip	No Ad-clip	No Ad-clip	Ad-clip	Ad-clip	Ad-clip	No Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	No Ad-clip	Ad-clip
Lower Granite	492,822	248,925	87,444		759,104	77,195	0	0	0	70,731	401,581	260,126
Little Goose	325,947	160,101	56,241		494,213	49,649	0	0	0	63,402	359,967	233,170
Lower Monumental	122,130	106,546	85,359		164,931	85,467	0	0	0	22,589	93,248	87,802
Ice Harbor**	181,467	148,683	119,117		237,257	119,268	0	0	0	48,024	198,246	186,667
<i>Columbia River</i>												
Wells***	172,069	1,174,000	0		0	0	0	0	0	NA	NA	NA
Rocky Reach***	211,914	1,081,254	0		0	0	0	0	0	NA	NA	NA
Rock Island***	540,997	1,024,891	0		298,000	0	0	0	0	NA	NA	NA
Wanapum***	489,602	927,526	0		269,690	0	0	0	0	NA	NA	NA
Priest Rapids***	443,090	839,411	0		244,069	0	0	0	0	NA	NA	NA
McNary****	244,237	356,172	65,038		209,500	65,121	0	0	0	14,887	61,456	57,867
John Day** *****	88,771	129,455	23,639		76,145	23,670	0	0	0	11,141	45,991	43,305
The Dalles** *****	217,398	317,033	57,891		186,478	57,967	0	0	0	9,162	37,822	35,613
Bonneville (I & II combined)** *****	91,389	125,545	22,925		73,845	22,955	16,807	0	0	60,730	129,500	1,932,778
---To the tailrace of Bonneville	519,256	713,324	130,256		419,574	130,426	95,494	0	0	381,950	814,465	12,155,836
---To Tongue Point*****	5,810,282	1,478,896	359,300		10,906,114	342,737	1,162,882	275,000	7,487,215	10,621,835	1,930,717	32,573,072
<b>Percent listed fish at:</b>												
Lower Granite	39.87%	20.14%	7.07%		27.26%	2.77%	0.00%	0.00%	0.00%	14.98%	85.02%	100.00%
Little Goose	40.54%	19.91%	6.99%		27.43%	2.76%	0.00%	0.00%	0.00%	14.98%	85.02%	100.00%
Lower Monumental	30.66%	26.75%	21.43%		24.80%	12.85%	0.00%	0.00%	0.00%	19.50%	80.50%	100.00%
Ice Harbor**	32.01%	26.22%	21.01%		25.08%	12.61%	0.00%	0.00%	0.00%	19.50%	80.50%	100.00%
<i>Columbia River</i>												
Wells***	12.78%	87.22%	0.00%		0.00%	0.00%	NA	NA	NA	NA	NA	NA
Rocky Reach***	16.39%	83.61%	0.00%		0.00%	0.00%	NA	NA	NA	NA	NA	NA
Rock Island***	34.55%	65.45%	0.00%		8.30%	0.00%	NA	NA	NA	NA	NA	NA
Wanapum***	34.74%	65.81%	0.00%		8.35%	0.00%	NA	NA	NA	NA	NA	NA
Priest Rapids***	34.93%	66.18%	0.00%		8.39%	0.00%	NA	NA	NA	NA	NA	NA
McNary****	21.37%	31.16%	5.69%		11.82%	3.67%	0.00%	0.00%	0.00%	0.36%	1.49%	2.64%
John Day** *****	18.32%	26.72%	4.88%		9.81%	3.05%	0.00%	0.00%	0.00%	0.36%	1.49%	2.44%
The Dalles** *****	17.88%	26.07%	4.76%		8.51%	2.65%	0.00%	0.00%	0.00%	0.36%	1.49%	2.44%
Bonneville (I & II combined)** *****	18.77%	25.79%	4.71%		5.35%	1.66%	5.79%	0.00%	0.00%	3.42%	7.28%	50.17%
---To the tailrace of Bonneville	18.77%	25.79%	4.71%		5.35%	1.66%	5.79%	0.00%	0.00%	3.42%	7.28%	50.17%
---To Tongue Point*****	65.12%	16.57%	4.03%		42.95%	1.35%	35.63%	8.42%	54.23%	37.95%	6.90%	59.52%

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

\*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

\*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established. Also, there is no transportation from these dams.

\*\*\*\* Note: (See next page)

\*\*\*\*\* Note: (See next page)

\*\*\*\* Note: The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at McNary, John Day, and The Dalles Dams are:  
 For example, if you handle 1,000 yearling Chinook salmon at Tongue Point, under the Transportation with spill scenario (above), 57.22% of them will be listed wild fish, or 572 fish. To these 572 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR,  $572 \times 0.1925 = 110$ ; UCR,  $572 \times 0.0500 = 29$ ; etc.).

Spring/Summer Chinook salmon	Transportation with spill		
	Wild	Ad-clip	No Ad-clip
SR	40.57	47.17	19.27
SR - Fall (Yrlg)	0.00	23.71	15.44
UCR	59.43	29.12	65.29
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Fall			
Chinook salmon			
SR	100.00	100.00	100.00
LCR - Tule fall	0.00	0.00	0.00
LCR - Late run fall	0.00	0.00	0.00

\*\*\*\*\* Note: Because the Columbia River is a free flowing river below Bonneville Dam and there are no survival estimates available, survival was set at 100% to Tongue Point.  
 The percentage of listed wild and hatchery spring/summer and fall Chinook salmon at and downstream of Bonneville Dam are:

Bonneville Dam Spring/Summer Chinook salmon	Transportation with spill		
	Wild	Ad-clip	No Ad-clip
SR	38.21	47.17	19.27
SR - Fall (Yrlg)	0.00	23.71	15.44
UCR	55.99	29.12	65.29
LCR - Spring	5.80	0.00	0.00
UWR	0.00	0.00	0.00

Fall			
Chinook salmon			
SR	7.20	0.88	13.93
LCR - Tule fall	92.80	99.12	86.07
LCR - Late run fall	0.00	0.00	0.00

Tongue Point Spring/Summer Chinook salmon	Transportation with spill		
	Wild	Ad-clip	No Ad-clip
SR	19.25	14.79	36.89
SR - Fall (Yrlg)	0.00	3.05	19.55
UCR	5.00	1.42	29.96
LCR - Spring	41.16	26.74	8.16
UWR	34.59	54.00	5.44

Fall			
Chinook salmon			
SR	1.87	2.29	53.33
LCR - Tule fall	70.44	97.71	46.67
LCR - Late run fall	27.69	0.00	0.00

SR = Snake River ESU  
 UCR = Upper Columbia River ESU  
 LCR - Spring = Lower Columbia River ESU - Spring Chinook  
 UWR = Upper Willamette River ESU

LCR - Tule fall = Lower Columbia River ESU - Tule fall Chinook salmon  
 LCR - Late run fall = Lower Columbia River ESU - Late-run bright fall Chinook salmon

Table 9. Estimated juvenile steelhead trout collection at each of the mainstem collection facilities in 2012 under full transportation and transportation with spill scenarios.

	Full Transportation Scenario			Transportation with Spill Scenario		
	Steelhead trout			Steelhead trout		
<b>Total fish collected at:</b>						
<i>Snake River</i>						
Lower Granite	6,807,042			3,684,312		
Little Goose	1,407,209			2,288,046		
Lower Monumental	274,825			803,563		
Ice Harbor**	134,371			904,368		
<i>Columbia River</i>						
Wells***	920,019			920,019		
Rocky Reach***	974,702			974,702		
Rock Island***	1,245,799			1,245,799		
Wanapum***	1,121,219			1,121,219		
Priest Rapids***	1,009,097			1,009,097		
McNary****	1,777,883			614,529		
John Day** ****	1,480,858			568,670		
The Dalles** ****	1,424,831			1,798,765		
Bonneville (I & II combined)** *****	1,543,673			595,039		
—To the tailrace of Bonneville	2,806,678			3,479,760		
—To Tongue Point****	15,272,508			14,282,359		
<b>Total listed fish at:</b>						
<i>Snake River</i>						
	Steelhead trout			Steelhead trout		
	Wild	Hatchery		Wild	Hatchery	
		Ad-clip	No Ad-clip		Ad-clip	No Ad-clip
Lower Granite	1,087,852	2,123,548	565,902	588,800	1,149,370	306,294
Little Goose	224,718	442,386	114,595	365,704	715,048	189,511
Lower Monumental	45,803	42,256	40,599	127,146	225,860	78,020
Ice Harbor**	29,957	25,945	14,756	147,809	254,932	85,925
<i>Columbia River</i>						
Wells***	349,233	472,930	97,856	349,233	472,930	97,856
Rocky Reach***	427,890	453,066	93,746	427,890	453,066	93,746
Rock Island***	497,400	642,813	105,586	497,400	642,813	105,586
Wanapum***	443,183	572,746	94,077	443,183	572,746	94,077
Priest Rapids***	394,876	510,317	83,823	394,876	510,317	83,823
McNary****	525,155	441,378	178,373	153,684	162,223	60,122
John Day** ****	498,949	413,965	124,861	162,132	161,866	49,260
The Dalles** ****	390,853	362,120	387,018	448,128	473,408	421,805
Bonneville (I & II combined)** *****	443,035	358,499	383,148	155,373	145,715	129,770
—To the tailrace of Bonneville	805,518	651,816	696,633	908,614	852,135	758,889
—To Tongue Point****	2,612,051	4,483,833	1,417,729	2,452,809	4,183,196	1,332,714
<b>Percent listed fish at:</b>						
<i>Snake River</i>						
Lower Granite	15.98%	31.20%	8.31%	15.98%	31.20%	8.31%
Little Goose	15.97%	31.44%	8.14%	15.98%	31.25%	8.28%
Lower Monumental	16.67%	15.38%	14.77%	15.82%	28.11%	9.71%
Ice Harbor**	22.29%	19.31%	10.98%	16.34%	28.19%	9.50%
<i>Columbia River</i>						
Wells***	37.96%	51.40%	10.64%	37.96%	51.40%	10.64%
Rocky Reach***	43.90%	46.48%	9.62%	43.90%	46.48%	9.62%
Rock Island***	39.93%	51.60%	8.48%	39.93%	51.60%	8.48%
Wanapum***	39.53%	51.08%	8.39%	39.53%	51.08%	8.39%
Priest Rapids***	39.13%	50.57%	8.31%	39.13%	50.57%	8.31%
McNary****	29.54%	24.83%	10.03%	25.01%	25.40%	9.78%
John Day** ****	33.69%	27.95%	8.43%	28.51%	28.46%	8.66%
The Dalles** ****	27.43%	25.42%	27.16%	24.91%	26.32%	23.44%
Bonneville (I & II combined)** *****	28.70%	23.22%	24.82%	26.11%	24.49%	21.81%
—To the tailrace of Bonneville	28.70%	23.22%	24.82%	26.11%	24.49%	21.81%
—To Tongue Point****	17.10%	29.36%	9.28%	17.17%	29.29%	9.33%

\* Note: "Total fish collected at:" is the total number of fish collected of that species or run, regardless of rearing type.

\*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

\*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGE's at these dams are not currently established at this time. Also, there is no transportation from these dams.

\*\*\*\* Note: (See next page)



\*\*\*\* Note: The percentage of listed wild and hatchery fish from each ESU at each Columbia River dam from McNary Dam to Bonneville Dam and at Tongue Point.  
**For example** , If you handle 1,000 steelhead at Tongue Point, under the Full Transportation with spill scenario (above), 17.10% of them will be listed wild fish, or 171 fish. To these 171 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR,  $171 \times 0.4844 = 83$ ; UCR,  $171 \times 0.0914 = 16$ , etc.).

	Full Transportation			Transportation with spill		
	Wild	Hatchery		Wild	Hatchery	
		AD-clipped	No AD-clip		AD-clipped	No AD-clip
<b>McNary Dam</b>						
SR	6.16	6.35	8.94	24.47	39.98	36.36
UCR	60.91	93.65	64.32	49.02	60.02	44.95
MCR - Summer	32.93	0.00	26.74	26.51	0.00	18.69
MCR - Winter	---	---	---	---	---	---
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>John Day Dam</b>						
SR	4.66	4.74	8.94	19.44	32.83	36.36
UCR	46.09	69.90	64.32	38.94	49.29	44.95
MCR - Summer	49.25	25.36	26.74	41.62	17.89	18.69
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>The Dalles Dam</b>						
SR	3.88	3.48	1.85	16.60	26.17	9.90
UCR	38.34	51.37	13.34	33.27	39.29	12.25
MCR - Summer	57.78	45.15	84.81	50.13	34.54	77.85
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>Bonneville Dam</b>						
SR	3.37	3.23	1.85	14.68	24.72	9.90
UCR	33.31	47.71	13.34	29.41	37.12	12.25
MCR - Summer	50.21	41.93	84.81	44.33	32.62	77.85
MCR - Winter	7.76	0.00	0.00	6.85	0.00	0.00
LCR - Summer	3.43	0.00	0.00	3.03	0.00	0.00
LCR - Winter	1.92	7.13	0.00	1.70	5.54	0.00
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>Tongue Point</b>						
SR	48.44	55.46	52.31	45.84	55.07	49.42
UCR	9.14	7.05	6.48	9.60	7.80	6.87
MCR - Summer	13.77	6.20	41.21	14.47	6.85	43.71
MCR - Winter	2.13	0.00	0.00	2.24	0.00	0.00
LCR - Summer	2.28	3.89	0.00	2.39	0.00	0.00
LCR - Winter	15.78	23.51	0.00	16.58	25.98	0.00
UWR - Summer	---	3.89	0.00	---	4.30	0.00
UWR - Winter	8.46	0.00	0.00	8.89	0.00	0.00

SR = Snake River ESU  
 UCR = Upper Columbia River ESU  
 MCR - Summer = Mid Columbia River ESU summer steelhead  
 MCR - Winter = Mid Columbia River ESU winter steelhead  
 LCR - Summer = Lower Columbia River ESU summer steelhead  
 LCR - Winter = Lower Columbia River ESU winter steelhead  
 UWR - Summer = Upper Willamette River ESU summer steelhead  
 UWR - Winter = Upper Willamette River ESU winter steelhead

Table 10. Estimated juvenile steelhead trout collection at each of the mainstem collection facilities in 2012 under full transportation and transportation with spill scenarios. Percentage of listed fish by rearing type (wild or hatchery) at each facility.

**\*\*Use this table only if the reartype and/or clip/no-clip status of all handled fish is known\*\***

	Full Transportation Scenario Steelhead trout			Transportation with Spill Scenario Steelhead trout		
	Unclipped	Clipped		Unclipped	Clipped	
<b>Total fish collected at:</b>						
<i>Snake River</i>						
Lower Granite	1,801,322	5,005,721		974,965	2,709,346	
Little Goose	369,196	1,026,027		604,633	1,680,242	
Lower Monumental	88,344	171,518		220,457	577,909	
Ice Harbor**	45,419	72,927		250,574	642,649	
<i>Columbia River</i>						
Wells***	447,089	472,930		447,089	472,930	
Rocky Reach***	521,636	453,066		521,636	453,066	
Rock Island***	602,986	642,813		602,986	642,813	
Wanapum***	542,687	578,532		542,687	578,532	
Priest Rapids***	488,418	520,679		488,418	520,679	
McNary****	774,275	985,671		234,576	377,118	
John Day** ****	673,333	794,970		228,410	337,938	
The Dalles** ****	809,707	607,052		909,413	883,938	
Bonneville (I & II combined)** *****	857,701	677,981		297,356	296,016	
—To the tailrace of Bonneville	1,559,456	1,232,693		1,738,924	1,731,088	
—To Tongue Point*****	4,572,910	10,924,901		4,307,956	10,204,483	
<b>Total listed fish at:</b>						
<i>Snake River</i>						
Lower Granite	1,087,852	565,902	2,123,548	588,800	306,294	1,149,370
Little Goose	224,718	114,595	442,386	365,704	189,511	715,048
Lower Monumental	45,803	40,599	42,256	127,146	78,020	225,860
Ice Harbor**	29,957	14,756	25,945	147,809	85,925	254,932
<i>Columbia River</i>						
Wells***	349,233	97,856	472,930	349,233	97,856	472,930
Rocky Reach***	427,890	93,746	453,066	427,890	93,746	453,066
Rock Island***	497,400	105,586	642,813	497,400	105,586	642,813
Wanapum***	443,183	94,077	572,746	443,183	94,077	572,746
Priest Rapids***	394,876	83,823	510,317	394,876	83,823	510,317
McNary****	525,155	178,373	441,378	153,684	60,122	162,223
John Day** ****	498,949	124,861	413,965	162,132	49,260	161,866
The Dalles** ****	390,853	387,018	362,120	448,128	421,605	473,408
Bonneville (I & II combined)** *****	443,035	383,148	358,499	155,373	129,770	145,715
—To the tailrace of Bonneville	805,518	696,633	651,816	908,614	758,889	852,135
—To Tongue Point*****	2,612,051	1,417,729	4,483,833	2,452,809	1,332,714	4,183,196
<b>Percent listed fish at:</b>						
<i>Snake River</i>						
Lower Granite	60.39%	31.42%	42.42%	60.39%	31.42%	42.42%
Little Goose	60.87%	31.04%	43.12%	60.48%	31.34%	42.56%
Lower Monumental	51.85%	45.96%	24.64%	57.67%	35.39%	39.08%
Ice Harbor**	65.96%	32.49%	35.58%	58.99%	34.29%	39.67%
<i>Columbia River</i>						
Wells***	78.11%	21.89%	100.00%	78.11%	21.89%	100.00%
Rocky Reach***	82.03%	17.97%	100.00%	82.03%	17.97%	100.00%
Rock Island***	82.49%	17.51%	100.00%	82.49%	17.51%	100.00%
Wanapum***	81.66%	17.34%	99.00%	81.66%	17.34%	99.00%
Priest Rapids***	80.85%	17.16%	98.01%	80.85%	17.16%	98.01%
McNary****	67.83%	23.04%	44.78%	65.52%	25.63%	43.02%
John Day** ****	74.10%	18.54%	52.07%	70.98%	21.57%	47.90%
The Dalles** ****	48.27%	47.80%	59.65%	49.28%	46.36%	53.56%
Bonneville (I & II combined)** *****	51.65%	44.67%	52.88%	52.25%	43.64%	49.23%
—To the tailrace of Bonneville	51.65%	44.67%	52.88%	52.25%	43.64%	49.23%
—To Tongue Point*****	57.12%	31.00%	41.04%	56.94%	30.94%	40.99%

\* Note: "Total fish collected at:" is the total number of fish collected of that species, run and rearing type.

\*\* Note: These dams have no transportation facilities, therefore, no fish are removed from the river at these dams.

\*\*\* Note: The numbers shown for these dams represent the number of fish arriving at the dam, not the number collected; FGEs at these dams are not currently established. Also, there is no transportation from these dams.

\*\*\*\* Note: (See next page)

\*\*\*\* Note: The percentage of listed wild and hatchery fish from each ESU at each Columbia River dam from McNary Dam to Bonneville Dam and at Tongue Point.

For example , If you handle 1,000 steelhead at Tongue Point, under the Full Transportation with spill scenario (above), 57.12% of them will be listed wild fish, or 571 fish. To these 571 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 571 x 0.4844 = 277; UCR, 571 x 0.0914 = 52; etc.).

	Full Transportation			Transportation with spill		
	Wild	AD-clipped	No AD-clip	Wild	AD-clipped	No AD-clip
<b>McNary Dam</b>						
SR	6.16	6.35	8.94	24.47	39.98	36.36
UCR	60.91	93.65	64.32	49.02	60.02	44.95
MCR - Summer	32.93	0.00	26.74	26.51	0.00	18.69
MCR - Winter	---	---	---	---	---	---
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>John Day Dam</b>						
SR	4.66	4.74	8.94	19.44	32.83	36.36
UCR	46.09	69.90	64.32	38.94	49.29	44.95
MCR - Summer	49.25	25.36	26.74	41.62	17.89	18.69
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>The Dalles Dam</b>						
SR	3.88	3.48	1.85	16.60	26.17	9.90
UCR	38.34	51.37	13.34	33.27	39.29	12.25
MCR - Summer	57.78	45.15	84.81	50.13	34.54	77.85
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>Bonneville Dam</b>						
SR	3.37	3.23	1.85	14.68	24.72	9.90
UCR	33.31	47.71	13.34	29.41	37.12	12.25
MCR - Summer	50.21	41.93	84.81	44.33	32.62	77.85
MCR - Winter	7.76	0.00	0.00	6.85	0.00	0.00
LCR - Summer	3.43	0.00	0.00	3.03	0.00	0.00
LCR - Winter	1.92	7.13	0.00	1.70	5.54	0.00
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
<b>Tongue Point</b>						
SR	48.44	55.46	52.31	45.84	55.07	49.42
UCR	9.14	7.05	6.48	9.60	7.80	6.87
MCR - Summer	13.77	6.20	41.21	14.47	6.85	43.71
MCR - Winter	2.13	0.00	0.00	2.24	0.00	0.00
LCR - Summer	2.28	3.89	0.00	2.39	0.00	0.00
LCR - Winter	15.78	23.51	0.00	16.58	25.98	0.00
UWR - Summer	---	3.89	0.00	---	4.30	0.00
UWR - Winter	8.46	0.00	0.00	8.89	0.00	0.00

SR = Snake River ESU  
 UCR = Upper Columbia River ESU  
 MCR - Summer = Mid Columbia River ESU summer steelhead  
 MCR - Winter = Mid Columbia River ESU winter steelhead  
 LCR - Summer = Lower Columbia River ESU summer steelhead  
 LCR - Winter = Lower Columbia River ESU winter steelhead  
 UWR - Summer = Upper Willamette River ESU summer steelhead  
 UWR - Winter = Upper Willamette River ESU winter steelhead

Table 11. Estimated number of listed fish outmigrating from each ESU, 2012.

ESU	Run	Number of listed fish		
		Wild	Hatchery <sup>a</sup> AD-clipped	Non-AD- clipped
<u>Snake River</u>				
Chinook	Spring/summer	1,296,901	3,875,088	1,399,446
	Fall			
	- subyearlings	368,389	2,628,000	3,748,330
	- yearlings		482,500	505,500
Steelhead	Summer	1,380,958	3,307,000	931,300
Sockeye		13,466	80,199	0
<u>Upper Columbia</u>				
Chinook	Spring	568,576	298,000	1,482,500
Steelhead	Summer	528,642	708,000	100,000
<u>Mid-Columbia</u>				
Steelhead	Summer	519,999	342,000	666,500
	Winter	60,353	0	0
<u>Lower Columbia</u>				
Chinook	Spring	2,391,557	3,007,882	150,000
	Fall (tule)	7,481,775	31,827,271	901,000
	Fall (late run)	2,940,965	0	0
Steelhead	Summer	64,539	0	0
	Winter	447,420	1,116,000	0
Coho		619,576	7,515,215	275,000
<u>Upper Willamette</u>				
Chinook	Spring	1,334,785	6,074,020	100,000
Steelhead	Summer		184,500	0
	Winter	239,830	0	0
<u>Columbia River</u>				
Chum		2,034,000	0	520,000

a Listed hatchery numbers are release numbers

Appendix A.

Determination of the effects of returning all PIT-tagged spring/summer Chinook salmon to the river at each collection dam on the number of fish that arrive at each subsequent dam

We surveyed researchers regarding the number of outmigrating PIT-tagged spring/summer Chinook salmon in the Snake River we could expect in 2012. We found that 227,000 hatchery fish will be PIT tagged and released above Lower Granite Dam as part of the Comparative Survival Study (CSS). We applied the hatchery survival estimates found in Table 1 to the fish released from hatcheries to determine the number of CSS hatchery fish that will arrive at Lower Granite Dam (149,018). The CSS requires that 70% of the fish collected at each of the Snake River collector dams be transported.

Another 27,136 hatchery spring/summer Chinook salmon (PIT tagged at hatcheries (not part of the CSS) and traps) will arrive at Lower Granite Dam. Of the 176,154 (149,018 + 27,136) hatchery fish reaching Lower Granite Dam, 85,256 will be listed hatchery fish. It is unknown whether the PIT-tagged hatchery fish will be ad-clipped or not, so, because ad-clipped hatchery fish constitute the vast majority of hatchery fish, all PIT-tagged fish are assumed to be ad-clipped for the following calculations.

Because tagging for the 2012 outmigration year began in July 2011 and continues throughout the outmigration year, we cannot accurately estimate survival from tagging of natural and migrating fish to the head of the Lower Granite Reservoir. We assumed that all of these fish would survive to the head of the reservoir, realizing that this is an overestimation. We chose the head of the reservoir because that is where the last of the tagging occurs, and because we have survival estimates from the head of the reservoir to the tailrace of Lower Granite Dam. It is expected that 66,606 wild spring/summer Chinook salmon will be PIT tagged above Lower Granite Dam. Using 90% survival from tagging location through the Lower Granite Dam pool, 59,945 ( $66,606 \times 0.090$ ) will arrive at Lower Granite Dam.

National Marine Fisheries Service will be PIT-tagging fish at Lower Granite Dam during the 2012 outmigration. As part of this marking, 30,000 PIT-tagged wild and 91,154 PIT-tagged hatchery spring/summer Chinook salmon will be released into the Lower Granite Dam tailrace. As these fish move downstream, all of those collected at Little Goose and Lower Monumental Dams will be diverted back to the river. Another 28,846 PIT-tagged hatchery spring/summer Chinook salmon will be released below Ice Harbor Dam.

Approximately 4,400 fish (400 wild and 4,000 hatchery) will be released in the Tucannon River. These fish are assumed to arrive at Lower Monumental Dam with no mortality.

We performed two calculations to determine the expected number of PIT-tagged fish collected at each collector dam. The first calculation made use of the same formulas used under the "Transportation with Spill" and "Full Transportation" scenarios which assume that every fish collected is transported (except the CSS fish). This calculation provided the number of fish collected at each dam if no PIT-tagged fish were returned to the river. In other words, this calculation is based solely on the number of fish that are not collected and transported at upstream dam(s).

In the second calculation we assumed that the only fish transported at each Snake River collector dam are the CSS fish. This calculation provided the number of fish collected at each dam if the remaining PIT-tagged fish were returned to the river. This calculation includes both the fish that were returned to the river at upstream dam(s) and the fish that were not collected at upstream dam(s). Because the number derived from the second calculation includes the number from the first calculation, the difference between the numbers from these two calculations is the number of PIT-tagged fish that were collected at each dam that were not accounted for because they were returned to the river at each dam (the number for each dam was added to the appropriate "... fish collected ..." columns in Tables 7-8). This difference in the number of fish collected was then expanded to the number of fish that arrived at the dam by dividing by the FGE of that dam, and was added to the number of fish that arrived at McNary Dam because they had not been collected and transported at upstream dams under both the "Transportation with Spill" and "Full Transportation" scenarios (column "Listed fish to McNary" in Tables 2 and 3, respectively).

#### **Calculation 1 (Transportation)**

**Transportation with Spill Scenario**--The numbers presented below assume that 62.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 38.0%), and that 30% of the CSS fish are returned to the river. In addition, 30,000 wild and 91,154 hatchery fish will be released into the tailrace



of Lower Granite Dam from marking at the dam, and 28,846 will be released into the tailrace of Ice Harbor Dam.

Using the FGEs in Table 2, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	26,477	29,844	49,141	105,462
Lower Monumental	8,642	10,731	15,833	35,206
McNary	6,585	10,545	19,145	36,275

**Full Transportation Scenario**--The numbers presented below assume that 40.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 60.0%), and that 30% of the CSS fish are returned to the river. In addition, 30,000 wild and 91,154 hatchery fish will be released into the tailrace of Lower Granite Dam from marking at the dam, and 28,846 will be released into the tailrace of Ice Harbor Dam.

Using the FGEs in Table 3, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	31,577	33,317	61,228	126,122
Lower Monumental	7,851	10,073	14,836	32,760
McNary	5,088	11,733	25,176	41,997

**Calculation 2 (Only CSS fish transported)**

This calculation assumes that all collected PIT-tagged fish (except the CSS fish) are returned to the river at each Snake River collector dam.

For the PIT-tagged fish returned to the river at each collection dam, the only loss of fish as they migrate downstream is the mortality through each reservoir and dam. Based on the NMFS survival studies, survival through each reservoir and dam was

estimated to be 90%. The estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

**Transportation with Spill Scenario**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	35,456	35,825	53,922	125,203
Lower Monumental	20,438	18,360	26,627	65,425
McNary	21,599	20,234	33,220	75,053

**Full Transportation Scenario**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	52,618	47,332	72,430	172,380
Lower Monumental	36,628	27,847	41,138	105,613
McNary	47,470	37,534	63,984	148,988

Subtracting collection numbers estimated by Calculation 1 from Calculation 2 provides the number of unaccounted for PIT-tagged fish that were collected at each dam (Appendix Table A1).

Appendix Table A1. Estimates of the number of unaccounted for PIT-tagged spring/summer Chinook salmon that will be collected at each of the collection dams, and estimates of how many of these fish will arrive at McNary Dam, 2012.

**Transportation with Spill Scenario**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	8,979	5,981	4,781	19,741
Lower Monumental	11,796	7,629	10,794	30,219
McNary	15,014	9,689	14,075	38,778
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.364):				
McNary	41,247	26,618	38,668	106,533

**Full Transportation Scenario (No Spill)**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	21,041	14,015	11,202	46,258
Lower Monumental	28,777	17,774	26,302	72,853
McNary	42,382	25,801	38,808	106,991
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.800):				
McNary	52,978	32,251	48,510	133,739



Appendix B.

Determination of the effects of returning all PIT-tagged steelhead to the river at each collection dam on the number of fish that arrive at each subsequent dam

We surveyed researchers regarding the number of outmigrating PIT-tagged steelhead in the Snake River we could expect in 2012. We found that 27,400 (16,100 of which will be listed) hatchery fish will be PIT tagged prior to release above Lower Granite Dam. Based on the survival rates of the various hatcheries releasing fish, we estimate that 21,850 (12,932 of which will be listed) will arrive at Lower Granite Dam. Another 12,735 (6,156 of which will be listed) hatchery steelhead (PIT tagged at traps) will arrive at Lower Granite Dam, bringing the total to 34,585 hatchery fish (which includes 19,088 listed fish) arriving at Lower Granite Dam. In addition, 6,836 wild steelhead PIT tagged at traps will arrive at Lower Granite Dam.

National Marine Fisheries Service will be PIT-tagging steelhead at Lower Granite Dam during the 2012 outmigration. As part of this marking, 50,000 PIT-tagged fish will be released into the Lower Granite Dam tailrace. Of these, approximately 30,000 will be wild fish, 9,405 will be listed hatchery fish, and 10,595 will be unlisted hatchery fish. All of the fish collected at Little Goose and Lower Monumental Dams will be diverted back to the river. WDFW plans to release 1,550 PIT-tagged fish into the Tucannon River. Of these, 500 will be wild and 1,050 will be listed hatchery fish.

We performed two calculations to determine the expected number of PIT-tagged fish collected at each collector dam. The first calculation made use of the same formulas used under the "Transportation with Spill" and "Full Transportation" scenarios which assume that every fish collected is transported. This calculation provided the number of fish collected at each dam if no PIT-tagged fish were returned to the river. In other words, this calculation is based solely on the number of fish that are not collected and transported at upstream dam(s).

In the second calculation we assumed that no fish are transported. This calculation provided the number of fish collected at each dam if all PIT-tagged fish were returned to the river. This calculation includes both the fish that were returned to the river at upstream dam(s) and the fish that were not collected at upstream dam(s). Because the number derived from the second calculation includes the number from the first calculation, the difference between the numbers from these two calculations is the number of PIT-tagged fish that were collected at each dam that were not accounted for because they were returned to the river at each dam (the number for each dam

was added to the appropriate "... fish collected ..." columns in Tables 9-10). This difference in the number of fish collected was then expanded to the number of fish that arrived at the dam by dividing by the FGE of that dam, and was added to the number of fish that arrived at McNary Dam because they had not been collected and transported at upstream dams under both the "Transportation with Spill" and "Full Transportation" scenarios (column "Listed fish to McNary" in Tables 5 and 6, respectively).

### Calculation 1 (Transportation)

**Transportation with Spill Scenario**--Assuming that 56.7% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 43.3%), 3,876 (6,836 x 0.567) wild, 10,823 (19,088 x 0.567) listed hatchery, and 8,787 (15,497 x 0.567) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 9,405 listed hatchery, and 10,595 unlisted hatchery fish will be released into the tailrace from marking at the dam. Therefore, the total numbers of PIT-tagged fish in the Lower Granite Dam tailrace will be 33,876 (3,876 + 30,000) wild, 20,228 (10,823 + 9,405) listed hatchery, and 19,382 (8,787 + 10,595) unlisted hatchery fish.

Using the FGEs in Table 5, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	16,006	9,558	9,158	34,722
Lower Monumental	5,143	3,357	2,834	11,334
McNary	1,441	1,089	794	3,324



**Full Transportation Scenario**--Assuming that 20.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 80.0%), 1,367 (6,836 x 0.20) wild, 3,818 (19,088 x 0.20) listed hatchery, and 3,099 (15,497 x 0.20) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 9,405 listed hatchery, and 10,595 unlisted hatchery fish will be released into the tailrace from marking at the dam. Therefore, the total numbers of PIT-tagged fish in the Lower Granite Dam tailrace will be 31,367 (1,367 + 30,000) wild, 13,223 (3,818 + 9,405) listed hatchery, and 13,694 (3,099 + 10,595) unlisted hatchery fish.

Using the FGEs in Table 6, the estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	25,408	10,711	11,092	47,211
Lower Monumental	1,977	1,379	721	4,077
McNary	777	1,171	283	2,231

#### **Calculation 2 (No Transportation)**

Assuming that 100% of the collected PIT-tagged fish are returned to the river at Lower Granite Dam, 36,836 (6,836 + 30,000) wild, 28,493 (19,088 + 9,405) listed hatchery, and 26,092 (15,497 + 10,595) unlisted hatchery fish will reach the tailrace.

Because 100% of the PIT-tagged fish were assumed to be returned to the river at each collection dam, the only loss of fish as they migrate downstream is the mortality through each reservoir and dam. Based on the NMFS survival studies, survival through each reservoir and dam was estimated to be 90%. The estimated number of PIT-tagged fish collected at each dam below Lower Granite Dam in 2012 will be

### Transportation with Spill Scenario

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	17,405	13,463	12,328	43,196
Lower Monumental	11,528	9,169	8,031	28,728
McNary	5,209	4,292	3,629	13,130

### Full Transportation Scenario

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	29,836	23,079	21,135	74,050
Lower Monumental	19,718	15,684	13,738	49,140
McNary	22,115	18,220	15,407	55,742

Subtracting collection numbers estimated by Calculation 1 from Calculation 2 provides the number of unaccounted for PIT-tagged fish that were collected at each dam (Appendix Table B1).

Appendix Table B1. Estimates of the number of unaccounted for PIT-tagged steelhead that will be collected at each of the collection dams, and estimates of how many of these fish will arrive at McNary Dam, 2012.

**Transportation with Spill Scenario**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	1,399	3,905	3,170	8,474
Lower Monumental	6,385	5,812	5,197	17,394
McNary	3,768	3,203	2,835	9,806
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.212):				
McNary	17,774	15,108	13,373	46,255

**Full Transportation Scenario (No Spill)**

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	4,428	12,368	11,987	28,783
Lower Monumental	17,741	14,305	14,963	47,009
McNary	21,338	17,049	17,937	56,324
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.90):				
McNary	23,709	18,943	19,930	62,582