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NATIONAL MARINE FISHERIES SERVICE
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March 6, 2012

MEMORANDUM FOR: F/PR - James H. Lecky
FROM: F/NWC3 - Douglas B. Dey *Douglas B. Dey*
SUBJECT: Estimation of Percentages for Listed Pacific
Salmon and Steelhead Smolts Arriving at
Various Locations in the Columbia River
Basin in 2011

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 2011. 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 2011 outmigration, and the percentage of the total collection they will comprise at each dam. We have developed estimates based on transportation with spill river 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 2011 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,



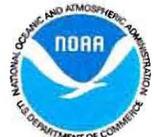
Study 1) that were subsequently captured and re-measured at one of the lower Snake River dams during slide-gate evaluations (1989-1994 and 1999-2004).

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. If you have any questions regarding this memorandum, please contact Randy Absolon at Randy.Absolon@noaa.gov or (509) 542-4050.

Attachments

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



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 2009. 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 1,523,316 wild/natural spring/summer Chinook salmon will reach Lower Granite Dam in 2011.

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 14,149,755 hatchery spring/summer Chinook salmon smolts will be released from Idaho (13,327,595) and Oregon (822,160). Of these 14,149,755 hatchery spring/summer Chinook salmon smolts, 5,283,331 will be listed (4,412,800 with AD-clips and 870,531 without AD-clips) and 8,866,424 will be unlisted (6,940,016 with AD-clips and 1,926,408 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 1996-2010 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 2011 projected release numbers for each hatchery. We estimate that 8,840,545 or 62.47843% of the 14,149,755 hatchery fish released will arrive at Lower Granite Dam. Of these 8,840,545 hatchery spring/summer Chinook salmon smolts, 2,756,088 will be listed (2,258,222 with AD-clips and 497,866 without AD-clips) and 6,084,457 will be unlisted (4,821,439 with AD-clips and 1,263,018 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 2011, 217,000 AD-clipped and 269,000 Non-AD-clipped yearling listed hatchery fall Chinook salmon will be released above Lower Granite Dam. Using an average survival rate of 0.877, we estimate that 426,222 (190,309 AD-clipped and 235,913 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:

$$\begin{aligned} \text{total yearling smolts} &= \text{total hatchery fish} + \text{wild fish} = \\ 10,790,083 &= (8,840,545 + 426,222) + 1,523,316 \end{aligned}$$

$$\begin{aligned} \% \text{ wild fish to dam} &= \text{wild fish} / \text{total smolts} = \\ 14.11774\% &= 1,523,316 / 10,790,083 \end{aligned}$$

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

AD-clip spring/summer	20.92868% = 2,258,222/10,790,083
Non-AD-clip spring/summer	4.61411% = 497,866/10,790,083
AD-clip yearling fall	1.76374% = 190,309/10,790,083
Non-AD-clip yearling fall	2.18639% = 235,913/10,790,083

We set fish guidance efficiencies (FGE) at Lower Granite and Little Goose Dams to 0.368 and 0.433, respectively. Using an FGE of 0.368, the total collection at Lower Granite Dam will be 3,970,751 (10,790,083 x 0.368), based on 10,790,083 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	560,580	14.1
AD-clip hatchery spring/summer	831,026	20.9
Non-AD-clip hatchery spring/summer	183,215	4.6
AD-clip hatchery yearling fall	70,034	1.8
Non-AD-clip hatchery yearling fall	86,816	2.2
<u>Unlisted groups</u>		
AD-clip hatchery spring/summer	1,774,292	44.7
Non-AD-clip hatchery spring/summer	464,788	11.7

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 2011, 27,286 wild and 229,000 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 2011 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 39,298 PIT-tagged spring/summer Chinook salmon from the Snake River (including 15,221 wild and 9,922 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 (0.371), we determined that 41,027 wild ($15,221/0.371$) and 26,744 listed hatchery ($9,922/0.371$) 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 2009 produced the smolts that will outmigrate in 2011. We obtained 2009 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 0.789 (Dworshak Hatchery's survival estimate to Lower Granite Dam) to the fish from Winthrop, Methow, Entiat, and Leavenworth Hatcheries, a survival estimate of 0.702 (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 2011, a total of 3,162,000 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 5,160,066 spring Chinook salmon will arrive at McNary Dam. The composition of fish arriving at McNary Dam will be as follows:

Listed wild spring	310,008
Listed AD-clip hatchery spring	328,757
Listed Non-AD-clip hatchery spring	607,099
Unlisted wild spring	715,706
Unlisted AD-clip hatchery spring	1,527,666
Unlisted Non-AD-clip hatchery spring	0
Unlisted AD-clip hatchery yearling summer	1,670,830

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 (5,160,066) and the Snake River (2,337,725).

We estimate that 7,497,791 (5,160,066 + 2,337,725) spring/summer Chinook salmon smolts will arrive at McNary Dam in 2011, and that 2,781,680 fish will be collected (FGE = 0.371). 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	116,228	115,013	231,241	8.3
AD-clip hatchery spring/summer	150,956	121,969	272,925	9.8
Non-AD-clip hatchery spring/summer	80,366	225,234	305,600	11.0
AD-clip hatchery yearling fall	110,861	0	110,861	4.0
Non-AD-clip hatchery yearling fall	14,734	0	14,734	0.5
<u>Unlisted groups</u>				
Wild spring (from Mid-Columbia)	0	265,527	265,527	9.6
AD-clip hatchery spring/summer	315,271	566,764	882,035	31.7
Non-AD-clip hatchery spring/summer	78,880	0	78,880	2.8
AD-clip hatchery yearling Col. R. summer	0	619,878	619,878	22.3
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 0.497:0.503 (310,008:313,284). 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	0.393 (406,889)	0.251 (216,621)
Snake R yearling falls	0.289 (298,818)	0.046 (39,713)
Upper Columbia R springs	<u>0.318</u> (328,757)	<u>0.703</u> (607,099)
	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 256,500 wild unlisted fish between arriving between McNary and John Day Dams. Hatchery releases between McNary and John Day Dams will total 886,000 (693,000 AD-clipped and 193,000 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 2009 redd count data for the Deschutes River from ODFW (Streamnet), which resulted in an estimated 51,656 wild unlisted fish being added between John Day and The Dalles Dams. Based on data from WDFW (Streamnet), we estimate that 36,338 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 1,225,780 (777,280 AD-clipped and 448,500 non-AD-clipped) unlisted spring Chinook salmon. Hatchery releases between The Dalles and Bonneville Dams will total 2,410,379 (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 37,590 wild spring Chinook salmon will be produced above Bonneville Dam. Also, 2,410,379 unlisted AD-clipped hatchery spring Chinook salmon will be released above Bonneville Dam. This ESU will introduce 2,548,565 wild, 2,940,400 listed hatchery (2,470,400 AD-clipped and 470,000 non-AD-clipped), and 1,150,000 (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 0.459:0.464:0.076 (225,995:228,384:37,590).

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 3,481,948. The composition of these fish will be as follows:

Snake River ESU (Total number = 3,481,948)	
Listed wild spring/summers	1,069,079
Listed AD-clip hatchery spring/summers	1,573,358
Listed Non-AD-clip hatchery spring/summers	411,912
Listed AD-clip hatchery yearling falls	263,233
Listed Non-AD-clip hatchery yearling falls	164,366

A total of 7,721,134 (3,481,948 listed + 4,239,186 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, 6,060,000 listed hatchery (all AD-clipped), and 0 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 0.037:0.212:0.423:0.328 (225,995:1,297,463:2,586,155:2,009,457). 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	0.022 (239,664)	0.264 (442,575)
Snake R spring/summer	0.168 (1,869,980)	0.340 (569,829)
Lower Columbia R spring	0.222 (2,470,400)	0.281 (470,000)
Upper Willamette R spring	0.545 (6,060,000)	0.000 (0)
Snake R yearling fall	<u>0.043</u> (481,071)	<u>0.115</u> (193,317)
	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 2011. 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 0.368. 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 1,012,720 hatchery coho salmon (60,000 AD-clipped and 952,720 non-AD-clipped) were released into the Snake River drainage. We estimate that 6,799,177 hatchery coho salmon (4,458,150 AD-clipped and 2,341,027 non-AD-clipped) were released into the Columbia River drainage above the Lower Columbia River ESU. From these releases, we estimate that 6,617,993 hatchery coho salmon (4,304,365 AD-clipped and 2,313,628 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 2011 from the various agencies involved in the lower Columbia River system. From the information provided, we estimate that 94,740 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 1,067,388, while listed hatchery releases in this area are 11,647,884 (11,184,000 AD-clipped and 463,884 non-AD-clipped) and 1,735,000 unlisted (all AD-clipped).

In addition, another 5,850 listed wild and 854,000 hatchery (29,000 listed AD-clipped and 825,000 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 2011. 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 2011 collection number at Lower Granite Dam, we used the 2010 collection number and the adult returns over the dam for 2009 and 2010. In 2010, a total of 1,430,000 unmarked hatchery subyearling fall Chinook salmon were released above Lower Granite Dam. Assuming a survival rate of 0.806 (the estimated survival rate of hatchery subyearling fall Chinook salmon released above Lower Granite Dam in 2010), a total of 1,152,103 (1,430,000 x 0.806) of these fish would have arrived at Lower Granite Dam. Assuming an FGE of 0.215 (derived from PIT-tagged hatchery subyearling fall Chinook salmon in 2010), a total of 247,702 (1,152,103 x 0.215) would have been collected at Lower Granite Dam. Through December 31, 2010 a total of 343,618 unclipped (and without a coded-wire tag) subyearling Chinook salmon had been collected at Lower Granite Dam. By removing the estimated 247,702 unmarked hatchery subyearling fall Chinook salmon, we estimate that 95,916 (343,618 - 247,702) wild subyearling fall Chinook salmon were collected at Lower Granite Dam in 2010. These wild subyearling fall Chinook salmon were from the 2009 adult return. The adult count over Lower Granite Dam in 2009 was 15,167. Of these, 1,716 were hatchery fish that were returned to Lyons Ferry Hatchery and 13,451 adults were passed above Lower Granite Dam. The 2011 outmigration will be the result of the 2010 adults that passed over Lower Granite Dam. Through December 31, 2010, a total of 42,077 adults had been counted in the adult ladder. Of these, 2,789 fish were returned to Lyons Ferry Hatchery, leaving 39,288 adults that were passed above Lower Granite Dam. The 2010 count of 39,288 adults represents only 292.1% of the 2009 count (13,451). We applied this decrease (292.1%) to the 2010 subyearling collection number to arrive at the estimated 2011 collection number.

$$\left(\begin{array}{l} \text{total wild fall} \\ \text{Chinook} \\ \text{collected at} \\ \text{Lower Granite Dam} \end{array} \right) = \left(\begin{array}{l} \text{wild fall} \\ \text{Chinook} \\ \text{collected in} \\ \text{2010} \end{array} \right) \times \left(\begin{array}{l} \% \text{ change between adult} \\ \text{counts for 2010 and 2011} \\ \text{outmigrations} \end{array} \right) =$$

$$280,171 = 95,916 \times 2.921$$

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 2006-2010 (after onset of court ordered spill) is 0.195. Therefore, the

total wild fall Chinook = total wild fall Chinook collected/FGE,
or 1,436,774 fish (280,171/0.195).

The Nez Perce Tribe along with WDFW will release 6,212,000 listed subyearling fall Chinook salmon in the Clearwater and Snake Rivers in 2011. Of these fish, 2,428,000 will be AD-clipped and 3,784,000 will be non-AD-clipped. Assuming a survival rate of 0.546 (the average estimated survival rate of PIT-tagged hatchery subyearling fall Chinook salmon released above Lower Granite Dam from 1995-2010 (excluding 2001)), 3,391,752 (6,212,000 x 0.546) of the 6,212,000 hatchery fish will arrive at Lower Granite Dam. Of these fish, 1,325,688 will be AD-clipped and 2,066,064 will be non-AD-clipped. In 2011, 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 (0.546), 178,176 (326,330 x 0.546) 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 2,244,240 (2,066,064 + 178,176). By adding the non-AD-clipped fish to the total number of wild fall Chinook salmon (1,436,774), we estimate that 3,681,014 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 39.0320% (1,436,774/3,681,014). We added the total AD-clipped hatchery fish (1,325,688), the total non-AD-clipped hatchery fish (2,244,240), and the total wild fish (1,436,774) to determine the total number of subyearling fall Chinook salmon arriving at Lower Granite Dam (5,006,702).

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	28.6970% = 1,436,774/5,006,702
AD-clip subyearling fall	26.4783% = 1,325,688/5,006,702
Non-AD-clip subyearling fall	44.8247% = 2,244,240/5,006,702

We set FGEs at Lower Granite and Little Goose Dams to 0.195 and 0.297, respectively. Using an FGE of 0.195, the total collection at Lower Granite Dam will be 976,307 (5,006,702 x 0.195), based on 5,006,702 smolts arriving at the dam. The

collection at Lower Granite Dam will be comprised of the following:

Listed wild subyearling fall	280,171
Listed AD-clip hatchery subyearling fall	258,509
Listed Non-AD-clip hatchery subyearling fall	437,627

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 2006-2010, 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 (1998-2010) and the number of juvenile subyearling fall Chinook salmon collected at McNary Dam (1998-2010). The 2010 count of 197,721 adults represents 170.6% of the average for 1998-2010 count (115,891). We applied this change (170.6%) to the average 1998-2010 subyearling collection number (4,984,408) to arrive at an estimated 2011 collection number of 8,503,400 (4,984,408 x 1.706).

Based on the NMFS subyearling fall Chinook salmon survival studies conducted from 2006-2010, per-project survival was set at 75%. We set the FGEs at Little Goose, Lower Monumental, and McNary Dams, based on 2006-2010 NMFS fall Chinook salmon survival study results (since court ordered spill was initiated), to 0.297, 0.136, and 0.187, 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 334,771 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 6,964,337 tule

fall Chinook salmon and 2,992,574 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 0.200:0.800 (83,740:334,771).

With the June 2005 change in ESA listing status, most hatchery fish released in this ESU are now listed. In 2011, hatchery releases above Bonneville Dam will total 12,558,841 listed tule (12,155,841 AD-clipped and 403,000 non-AD-clipped) and 10,952,045 unlisted (5,445,883 AD-clipped and 5,506,162 non-AD-clipped) subyearling fall Chinook salmon. Below Bonneville Dam releases totaled 18,900,000 listed tule (18,700,000 AD-clipped and 200,000 non-AD-clipped) and 9,291,500 unlisted (7,871,500 AD-clipped and 1,420,000 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 0.008:0.992 (103,682:12,155,841), while the ratio for hatchery non-AD-clipped fish at Bonneville Dam will be 0.228:0.772 (119,085:403,000).

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 651,781 wild, 637,344 AD-clipped, and 1,002,135 non-AD-clipped fish, all from the Snake River ESU. A total of 10,627,551 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 0.067:0.662:0.271 (735,521:7,299,108:2,992,574). The proportion for hatchery fish at Tongue Point will be as follows:

	Ad-clipped		Non-AD-clipped	
Snake R. subyearling fall	0.023	(741,026)	0.650	(1,121,220)
Lower Columbia R. subyearling fall				

- Tule	0.977	(30,855,841)	0.350	(603,000)
Lower Columbia R. subyearling fall				
- Late run	<u>0.000</u>		(0) <u>0.000</u>	(0)
	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 2011. 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 2011 and IDFG and NOAA Fisheries estimates of survival to Lower Granite Dam. IDFG estimates that 9,132 wild fish and 96,588 hatchery fish that have overwintered in the lakes will survive to Lower Granite Dam in spring 2011. All of these fish are listed as endangered.

$$\begin{aligned} \text{listed sockeye (wild and hatchery) to Lower Granite Dam} &= \\ \text{IDFG's estimated wild fish} + \text{estimated hatchery fish} &= \\ 105,720 &= 9,132 + 96,588 \end{aligned}$$

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 2010, WDFW staff at Lower Granite Dam estimated that 2,133 kokanee were collected. With an FGE of 0.197 (the 2010 estimate), 10,827 ($2,133/0.197$) kokanee reached Lower Granite Dam. Assuming the same amount of spill from Dworshak Dam in 2011 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 19,959 ($10,827 + 9,132$). We then estimated the percentage of wild *O. nerka* arriving at Lower Granite Dam that will be listed Snake River sockeye salmon.

$$\begin{aligned} \% \text{ listed wild sockeye} &= \\ \text{listed wild sockeye} / \text{total wild } O. \text{ nerka to Lower Granite Dam} &= \\ 45.8\% &= 9,132 / 19,959 \end{aligned}$$

A total of 116,547 ($105,720$ listed sockeye + $10,827$ kokanee) *O. nerka* will arrive at Lower Granite Dam.

$$\begin{aligned} \% \text{ total listed sockeye} &= \\ \text{total listed sockeye} / \text{total } O. \text{ nerka to Lower Granite Dam} &= \\ 90.7\% &= 105,720 / 116,547 \end{aligned}$$

An FGE of 0.272 (average for 1998-2010 (excluding 2001)) was used to estimate the number of *O. nerka* smolts reaching Lower Granite Dam that will be collected.

$$\begin{aligned} O. \text{ nerka salmon collected} &= \text{total } O. \text{ nerka salmon} \times \text{FGE} = \\ 31,701 &= 116,547 \times 0.272 \end{aligned}$$

Because of extreme year-to-year variability, the count used at McNary Dam for 2011 is based on the average of the counts at the

dam from 1989 to 2010 (426,726). 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 2011. 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 2010 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., April 2011), we determined that 218,398 wild steelhead were collected at Lower Granite Dam in 2010 (0.375, or 130,897, of the 349,295 unclipped steelhead collected at Lower Granite Dam in 2010 had fin erosion). We applied the 2010 estimated FGE (0.208) to the collection number to determine that 1,049,990 (218,398/0.208) wild steelhead arrived at Lower Granite Dam in 2010.

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. 1994¹). 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 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

¹ 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.

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 2010 wild smolt outmigration (2005-2009 brood years, July 1, 2004-June 30, 2009), and applying the smolt age-class percentages to the adult counts for each of these 4 years, we estimated that 88,882 of the adults passing Lower Granite Dam produced the 2010 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2006-2010 brood years) producing the 2011 wild outmigration. We calculated that the 2011 wild outmigration will be based on 154,459 adults, or 173.8% of the number of fish producing the 2010 outmigration. We applied the change in the number of adults to the number of wild steelhead that arrived at Lower Granite Dam in 2010 (1,049,990) to determine the estimated 2011 arrival number.

$$\left(\begin{array}{c} \text{total wild} \\ \text{steelhead} \\ \text{arriving at Lower} \\ \text{Granite} \end{array} \right) = \left(\begin{array}{c} \text{wild} \\ \text{steelhead} \\ \text{arriving in} \\ \text{2010} \end{array} \right) \times \left(\begin{array}{c} \% \text{ change between adult} \\ \text{counts for} \\ \text{2010 and 2011} \\ \text{outmigrations} \end{array} \right) =$$

$$1,824,883 = 1,049,990 \times 1.738$$

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 10,318,374 hatchery smolts (Table 4) will be released from Idaho (9,163,374), Oregon (958,000), and Washington (197,000 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 2003-2010 outmigrations (from the NMFS survival study, Research Action #1212). Using the 2011 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 8,234,231 or 79.8016% of the 10,318,374 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:

$$\begin{aligned} \text{total smolts} &= \text{total hatchery fish} + \text{wild fish} = \\ 10,059,114 &= 8,234,231 + 1,824,883 \end{aligned}$$

% wild fish to Lower Granite Dam = wild fish/total smolts =
 18.14159% = 1,824,883/10,059,114

% listed hatchery fish = listed hatchery fish/total smolts =

AD-clip summer 26.81975% = 2,697,829/10,059,114
 Non-AD-clip summer 15.56499% = 1,565,700/10,059,114

We set FGEs at Lower Granite and Little Goose Dams at 0.420 and 0.514, respectively. Using an FGE of 0.420, the total collection at Lower Granite Dam will be 4,224,828 (10,059,114 x 0.420), based on 10,059,114 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	766,451	18.1
Listed hatchery AD-clip	1,133,088	26.8
Listed hatchery Non-AD-clip	657,594	15.6
Unlisted hatchery AD-clip	1,554,633	36.8
Unlisted hatchery Non-AD-clip	113,062	2.7

Wild/natural Tucannon River drainage fish are listed within the Snake River ESU. In spring 2011, 21,857 wild fish are expected to outmigrate from the Tucannon River. In addition, 77,000 (all Non-AD-clipped) listed hatchery fish and 160,000 (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 2011 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 9,907 PIT-tagged steelhead from the Snake River (including 3,820 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 (0.217), we determined that 17,604 wild Snake River steelhead ($3,820/0.217$) 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 2010 outmigration, 8,585 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 214,625 wild steelhead passed Rock Island Dam in 2010.

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 2010 wild smolt outmigration (2005-2009 brood years, July 1, 2004-June 30, 2009), and applying the smolt age-class percentages to the adult

counts for each of these 4 years, we estimated that 11,473 of the adults passing Rock Island Dam produced the 2010 steelhead outmigration. We performed the same calculation to estimate the number of adults from the 4 years (2006-2010 brood years) producing the 2011 wild outmigration. We calculated that the 2011 wild outmigration will be based on 14,322 adults, or 1.248 of the number of fish producing the 2010 outmigration. We applied the change in the number of adults to the 2010 Rock Island Dam collection to arrive at the estimated 2011 collection number.

$$\left(\begin{array}{c} \text{total wild} \\ \text{steelhead} \\ \text{collected at Rock} \end{array} \right) = \left(\begin{array}{c} \text{wild} \\ \text{steelhead} \\ \text{collected} \\ \text{in 2010} \end{array} \right) \times \left(\begin{array}{c} \% \text{ change between adult} \\ \text{counts} \\ \text{for 2010 and 2011} \end{array} \right) =$$

$$10,714 = 8,585 \times 1.248$$

Since this represents 4% of the fish passing the dam, we estimate that 267,850 wild steelhead smolts will pass the dam in 2011. Using the smolt age-class percentages, we estimate that 1,875 smolts will be age-1, 115,711 will be age-2, 124,282 will be age-3, and 23,035 will be age-4, and 2,946 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 (267,850) 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 2011 outmigration (2006-2010), 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 2011, we used the outplanting data for the 3 years comprising the 2011 outmigration (2009-2011). Because hatchery fish are larger than equivalent age-class wild fish, we assigned age-2 status to hatchery fish released in 2011, age-3 to those released in 2010, and age-4 to those released in 2009. 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 2011. 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, 126,314 wild summer steelhead will enter above McNary Dam in 2011.

WDFW will release 68,400 (all Non-AD-clipped) listed (from Mid-Columbia River ESU stock) and 85,000 (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 186,668 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	92,000
-------------------------	--------

Between John Day and The Dalles Dams, 209,901 wild and 800,500 listed hatchery (187,000 AD-clipped and 613,500 non-AD-clipped) summer steelhead will be added. Between The Dalles and Bonneville Dams, 60,353 wild winter, 108,300 (all AD-clipped) unlisted hatchery summer, and 20,000 (all AD-clipped) 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 (1,252,577), Mid-Columbia (126,314) and the Snake River (1,298,936) ESUs.

We estimate that 2,677,827 (1,252,577 + 126,314 + 1,298,936) steelhead smolts will arrive at McNary Dam in 2011, and that 581,088 fish will be collected. Of the 581,088 smolts collected at McNary Dam, 120,548 (0.207) will be wild (41,529 Upper Columbia River ESU, 51,609 Snake River ESU, and 27,410 Mid-Columbia River ESU), 160,805 (0.277) will be listed hatchery AD-clipped (90,301 Upper Columbia River ESU, 70,504 Snake River ESU, and 0 Mid-Columbia River ESU), 119,887 (0.206) will be listed hatchery Non-AD-clipped (57,695 Upper Columbia River ESU, 47,349 Snake River ESU, and 14,843 Mid-Columbia River ESU), and 234,838 (0.404) will be unlisted hatchery fish (214,500 AD-clipped and 20,338 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	0.345	(191,377)	0.258	(172,239)	0.196	(155,015)
Snake River	0.428	(237,828)	0.320	(214,045)	0.244	(192,641)
Mid-Columbia						
Summer	0.227	(126,314)	0.422	(281,684)	0.560	(442,427)
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	0.562 (416,132)	0.494 (374,519)	0.387 (337,067)
Non-AD-clipped	0.481 (265,876)	0.481 (239,288)	0.203 (215,359)
Snake River			
AD-clipped	0.438 (324,901)	0.385 (292,411)	0.303 (263,170)
Non-AD-clipped	0.395 (218,198)	0.395 (196,378)	0.167 (176,740)
Mid-Columbia			
Summer			
AD-clipped	0.000 (0)	0.121 (92,000)	0.310 (269,800)
Non-AD-clipped	0.124 (68,400)	0.124 (61,560)	0.630 (668,904)
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 43,982 (29,027 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	0.171	(139,514)
Snake River	0.213	(173,377)
Mid-Columbia		
summer	0.488	(398,184)
winter	0.074	(60,353)
Lower Columbia		
summer	0.036	(29,027)
winter	<u>0.018</u>	(14,955)
	1.000	

Between The Dalles and Bonneville Dams, 0 listed and 0 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	0.364	(303,360)
Non-AD-clipped	0.203	(193,823)
Snake River		
AD-clipped	0.284	(236,853)
Non-AD-clipped	0.167	(159,066)
Mid-Columbia		
Summer		
AD-clipped	0.292	(242,820)
Non-AD-clipped	0.630	(602,014)
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	0.060	(50,000)
Non-AD-clipped	0.000	(0)

Another 473,590 (38,185 summer and 435,405 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 4,916,070 (1,470,508 wild, 2,158,136 AD-clipped hatchery, and 1,287,426 Non-AD-clipped hatchery), all from the Snake River ESU. A total of 7,894,890 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 2011, 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	0.047	(139,514)
Snake River	0.548	(1,643,885)
Mid-Columbia		
summer	0.133	(398,184)
winter	0.020	(60,353)
Lower Columbia		
summer	0.022	(67,212)
winter	0.150	(450,360)
Upper Willamette		
summer	0	(0)
winter	<u>0.080</u>	(239,830)
	1.000	

Listed hatchery releases from this ESU will total 184,500 (all AD-clipped) summer and 0 (all AD-clipped) 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	0.077	(303,360)
Non-AD-clipped	0.086	(193,823)
Snake River		
AD-clipped	0.605	(2,394,989)
Non-AD-clipped	0.645	(1,446,492)
Mid-Columbia		
Summer		
AD-clipped	0.061	(242,820)
Non-AD-clipped	0.269	(602,014)
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	0.211	(835,000)
Non-AD-clipped	0.000	(0)
Upper Willamette		
Summer		
AD-clipped	0.046	(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 2011. 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 1,449,900 (1,002,600 Grays River and 447,300 Columbia River) wild chum salmon outmigrating in 2011.

We expect the hatchery (all non-AD-clipped) chum salmon outmigration to be 307,000 (57,000 from the Columbia River, 0 from Chinook River, and 250,000 from Grays River) This provides an overall estimate of 1,756,900 (1,449,900 + 307,000) listed chum salmon outmigrating in 2011.

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 36.8 to 60.0% for yearling spring/summer Chinook and sockeye salmon, the total number of fish collected at Lower Granite Dam will be 6,474,050 (10,790,083 x 0.600) spring/summer Chinook salmon and 69,928 (116,547 x 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 (5,160,066) and the Snake River (919,188).

$$5,160,066 + 919,188 = 6,079,254$$

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 2011.

Hatchery	2011 Total hatchery releases ^a		Survival to <u>Lower Granite Dam</u>	Fish to Lower Granite Dam	
	AD-clipped	Non-AD-clipped	Mean ^b	AD-clipped	Non-AD-clipped
Dworshak ^c	1,070,019	8,231	0.789	844,245	6,494
Kooskia ^c	291,604	0	0.668	194,791	0
Lookingglass					
Imnaha ^d	253,000	0	0.658	166,474	0
Grande Ronde ^d	376,800	192,360	0.535	201,588	102,913
Clearwater ^c	1,684,974	257,813	0.651	1,096,918	167,836
Rapid River ^c	2,958,228	152,772	0.702	2,076,676	107,246
Sawtooth ^d	1,539,000	199,000	0.480	738,720	95,520
McCall ^d	1,070,000	106,000	0.533	570,310	56,498
Pahsimeroi ^d	1,174,000	0	0.495	581,130	0
Nez Perce ^c	935,191	1,507,592	0.651	608,809	981,442
Totals					
All stocks	11,352,816	2,796,939		7,079,661	1,760,884
Listed stocks	4,412,800	870,531		2,258,222	497,866
Percent of listed stocks	37.33867%			31.17554%	

- a Data from USEFWS, 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 1993-2010 (excluding 2001).
- c Non-listed stocks in 2011.
- d Listed stocks in 2011.

Table 2. Estimate of listed threatened and endangered species arriving at various locations during outmigration year 2011 under past transportation and spill conditions.

Yearling spring/summer Chinook salmon

Snake River ESU

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE ¹			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish
Wild	3,970,751	2,781,680	14.118	1,523,316	0.368	0.433	0.284	0.371	0.900	313,284	116,228	4.18
Listed Hatchery***												
AD-clipped	3,970,751	2,781,680	20.929	2,258,222	0.368	0.433	0.284	0.371	0.900	406,889	150,956	5.43
Non-AD-clipped	3,970,751	2,781,680	4.614	497,866	0.368	0.433	0.284	0.371	0.900	216,621	80,366	2.89

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 ^b	Of Fish Collected at McNary	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild****	134,306	176,421	420,565	5.6	6.8	8.6	0.371	0.900	310,008	115,013	4.13
Listed Hatchery											
AD-clipped	0	0	446,000	0.0	0.0	9.1	0.371	0.900	328,757	121,969	4.38
Non-AD-clipped	783,067	721,205	823,605	32.8	27.8	16.8	0.371	0.900	607,099	225,234	8.10

Fall Chinook salmon

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE ¹			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild****	976,307	8,503,400	28.697	1,436,772	0.195	0.297	0.136	0.187	0.75	244,149	45,656	0.54
Listed Subyearling Hatchery												
AD-clipped	976,307	8,503,400	26.478	1,325,688	0.195	0.297	0.136	0.187	0.75	302,293	56,529	0.66
Non-AD-clipped	976,307	8,503,400	44.825	2,244,240	0.195	0.297	0.136	0.187	0.75	347,200	64,926	0.76
Listed Yearling Hatchery												
AD-clipped	3,970,751	2,781,680	1.76374	190,309	0.368	0.433	0.284	0.371	0.900	298,818	110,861	3.99
Non-AD-clipped	3,970,751	2,781,680	2.18639	235,913	0.368	0.433	0.284	0.371	0.900	39,713	14,734	0.53

Sockeye salmon

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE ¹			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild and listed hatchery*****	31,701	426,726	90.7	105,720	0.272	0.389	0.333	0.220	0.9	20,579	4,527	1.06

*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 27,286 wild and 229,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2011 (Michael Gallinat, WDFW, Pers. commun., February 2011)

***Note: Based on 2011 hatchery releases, it was estimated that 31.89732% and 28.27364% 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 31.89732% and 28.27364% 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 1995-2010 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2010 (excluding 2001) and the 2010 adult returns (FPC Weekly Reports 1994-2010).

*****Note: The Lower Granite Dam estimate is based on IDFG's estimate of 9,132 wild sockeye salmon smolts and 96,588 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2011 (Mike Peterson, IDFG, Pers. commun., April 2011). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2010 (Annual Fish Passage Reports 1985-2010, and WDFW's 2010 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 1995-2010 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2011).

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

where: listed Tucannon fish = 27,286 wild and 229,000 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 2011 under full transportation conditions (no spill).

Yearling spring/summer Chinook salmon

Snake River ESU

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish
Wild	6,474,050	4,863,403	14.118	1,523,316	0.60	0.65	0.50	0.80	0.900	133,990	107,192	2.20
Listed Hatchery***												
AD-clipped	6,474,050	4,863,403	20.929	2,258,222	0.60	0.65	0.50	0.80	0.900	136,238	108,990	2.24
Non-AD-clipped	6,474,050	4,863,403	4.614	497,866	0.60	0.65	0.50	0.80	0.900	115,610	92,488	1.90

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 ^b	Of Fish Collected at McNary	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild****	134,306	176,421	420,565	5.6	6.8	8.6	0.80	0.900	310,008	248,006	5.10
Listed Hatchery											
AD-clipped	0	0	446,000	0.0	0.0	9.1	0.80	0.900	328,757	263,006	5.41
Non-AD-clipped	783,067	721,205	823,605	32.8	27.8	16.8	0.80	0.900	607,099	485,679	9.99

Subyearling fall Chinook salmon

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild****	2,753,685	29,549,007	28.697	1,436,772	0.55	0.60	0.40	0.65	0.75	64,285	41,785	0.14
Listed Subyearling Hatchery												
AD-clipped	2,753,685	29,549,007	26.478	1,325,688	0.55	0.60	0.40	0.65	0.75	112,801	73,321	0.25
Non-AD-clipped	2,753,685	29,549,007	44.825	2,244,240	0.55	0.60	0.40	0.65	0.75	76,690	49,849	0.17
Listed Yearling Hatchery												
AD-clipped	6,474,050	4,863,403	1.76374	190,309	0.60	0.65	0.50	0.80	0.900	195,040	156,032	3.21
Non-AD-clipped	6,474,050	4,863,403	2.18639	235,913	0.60	0.65	0.50	0.80	0.900	10,835	8,668	0.18

Sockeye salmon

Rearing type	Total Collection*		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	FGE			Project Survival	Listed fish to McNary ^b	Of Fish Collected at McNary	
	Granite	McNary				Goose	Low	Mon			McNary	Listed Fish
Wild and listed hatchery*****	69,928	426,726	90.7	105,720	0.60	0.65	0.50	0.80	0.900	4,855	3,884	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 27,286 wild and 229,000 listed hatchery (all non-AD-clipped) fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2011 (Michael Gallinat, WDFW, Pers. commun., February 2011)

***Note: Based on 2011 hatchery releases, it was estimated that 31.89732% and 28.27364% 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 31.89732% and 28.27364% 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 1995-2010 (excluding 2001) (Fish Passage Center Weekly Reports), and on the average number of adult returns from 1994-2010 (excluding 2001) and the 2010 adult returns (FPC Weekly Reports 1994-2010).

*****Note: The Lower Granite Dam estimate is based on IDFG's estimate of 9,132 wild sockeye salmon smolts and 96,588 hatchery fish that overwintered in the lakes arriving at Lower Granite Dam in 2011 (Mike Peterson, IDFG, Pers. commun., April 2011). The McNary Dam estimate is the average collection count at McNary Dam from 1985-2010 (Annual Fish Passage Reports 1985-2010, and WDFW's 2010 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 1995-2010 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2011).

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

where: listed Tucannon fish = 27,286 wild and 229,000 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 2011.

Hatchery	2011 Total hatchery releases ^a		Survival to <u>Lower Granite Dam</u>	Fish to Lower Granite Dam	
	AD-clipped	Non-AD-clipped	Mean ^b	AD-clipped	Non-AD-clipped
Dworshak ^c	2,092,697	276,408	0.803	1,680,436	221,956
Clearwater ^c	534,193	1,560,076	0.78	416,671	1,216,859
Hagerman ^{c,d}	969,000	391,000	0.769	745,161	300,679
Magic Valley ^{c,d}	1,420,000	120,000	0.795	1,128,900	95,400
Niagara Springs ^d	1,800,000	0	0.850	1,530,000	0
Irrigon (released above Lower Granite Dam) ^{c,d}	958,000	0	0.779	746,282	0
Lyons Ferry (released into Grande Ronde) ^d	197,000	0	0.771	151,887	0
Totals					
All stocks	7,970,890	2,347,484		6,399,337	1,834,894
Listed stocks	3,384,890	2,001,484		2,697,829	1,565,700
Percent of listed stocks	52.20177%			51.77811%	

- a Data from USEWS, 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 1993-2010 (excluding 2001).
- c Listed stocks in 2011.
- d Un-listed stocks in 2011.

Table 5. Estimates of listed threatened and endangered steelhead arriving at various locations during outmigration year 2011 under past transportation and spill conditions.

Snake River ESU

Rearing type	<u>Total Collection*</u>		Of Granite Total % Listed Fish	Listed Fish to Granite ^a	Granite	<u>FGE¹</u>			Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>	
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish
Wild	4,224,828	545,335	18.1416	1,824,883	0.420	0.514	0.38	0.217	0.9	237,828	51,609	9.46
Listed Hatchery***												
AD-clipped	4,224,828	545,335	26.8197	2,697,829	0.420	0.514	0.38	0.217	0.9	324,901	70,504	12.93
Non-AD-clipped	4,224,828	545,335	15.5650	1,565,700	0.420	0.514	0.38	0.217	0.9	218,198	47,349	8.68

Upper Columbia River ESU

Rearing type	<u>Number of listed fish passing dam</u>			<u>Of dam total, % listed fish</u>			<u>FGE¹</u> McNary	Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild***	184,651	225,357	267,850	29.5	34.8	32.0	0.217	0.9	191,377	41,529	7.62
Listed Hatchery***											
AD-clipped	441,116	422,588	570,379	61.3	57.2	51.0	0.217	0.9	416,132	90,301	16.56
Non-AD-clipped	94,272	90,312	279,649	13.1	12.2	25.0	0.217	0.9	265,876	57,695	10.58

Mid-Columbia River ESU

Rearing type	<u>Total Collection*</u>		Of Granite Total % Listed Fish	Listed Fish to Granite ^a	Granite	<u>FGE¹</u>			Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>		
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish	% Listed Fish
Summer-run(First dam reached is McNary Dam)													
Wild									0.217	0.9	126,314	27,410	5.03
Listed Hatchery***													
AD-clipped									0.217	0.9	0	0	0.00
Non-AD-clipped									0.217	0.9	68,400	14,843	2.72
Winter-run(First dam reached is Bonneville Dam)													
Wild									0.217	0.9	0	0	0.00
Listed Hatchery***													
AD-clipped									0.217	0.9	0	0	0.00
Non-AD-clipped									0.217	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 21,857 wild fish and 77,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2011. An additional 68,400 (0 AD-clipped and 68,400 Non-AD-clipped) listed Mid-Columbia hatchery summer steelhead will outmigrate from the Touchet and Walla Walla Rivers above McNary Dam Michael Gillan, WDFW, Pers. commun., April 2011).

***Note: Estimated values based on 2010 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2010 (FPC Weekly Reports 1995-2010).

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 1995-2010 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2011).

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 = 21,857 wild and 77,000 (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 2011 under full transportation conditions (no spill).

Snake River ESU

Rearing type	<u>Total Collection*</u>		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	<u>FGE</u>			Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>	
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish
Wild	8,047,291	1,238,720	18.1416	1,824,883	0.80	0.90	0.65	0.90	0.90	38,287	34,458	2.78
Listed Hatchery***												
AD-clipped	8,047,291	1,238,720	26.8197	2,697,829	0.80	0.90	0.65	0.90	0.90	32,122	28,910	2.33
Non-AD-clipped	8,047,291	1,238,720	15.5650	1,565,700	0.80	0.90	0.65	0.90	0.90	29,020	26,118	2.11

Upper Columbia River ESU

Rearing type	<u>Number of listed fish passing dam</u>			<u>Of dam total, % listed fish</u>			FGE ¹ McNary	Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>	
	Wells	Rocky Reach	Rock Island	Wells	Rocky Reach	Rock Island				Listed Fish	% Listed Fish
Wild***	184,651	225,357	267,850	29.5	34.8	32.0	0.90	0.90	191,377	172,239	13.90
Listed Hatchery***											
AD-clipped	441,116	422,588	570,379	61.3	57.2	51.0	0.90	0.90	416,132	374,519	30.23
Non-AD-clipped	94,272	90,312	279,649	13.1	12.2	25.0	0.90	0.90	265,876	239,288	19.32

Mid-Columbia River ESU

Rearing type	<u>Total Collection*</u>		Of Granite % Listed Fish	Total Listed Fish to Granite ^a	Granite	<u>FGE¹</u>			Project Survival	Listed fish to McNary ^b	<u>Of Fish Collected at McNary</u>		
	Granite	McNary				Goose	Low	Mon**			McNary	Listed Fish	% Listed Fish
Summer-run (First dam reached is McNary Dam)													
Wild									0.90	0.90	126,314	113,683	9.18
Listed Hatchery***													
AD-clipped									0.90	0.90	0	0	0.00
Non-AD-clipped									0.90	0.90	68,400	61,560	4.97
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 21,857 wild fish and 77,000 (all Non-AD-clipped) listed hatchery fish will outmigrate from the Tucannon River and Lyons Ferry Fish Hatchery in 2011. An additional 68,400 (0 AD-clipped and 68,400 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 2011).

***Note: Estimated values based on 2010 collection numbers (Fish Passage Center Weekly Reports), and on the number of adult returns from 1995-2010 (FPC Weekly Reports 1995-2010).

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 1995-2010 (excluding 2001) (Steven G. Smith, NMFS, Pers. commun., November 2011).

Formulas:

a) Listed fish to Granite = ((Collection_{Granite})/(FGE_{Granite}))x(Of Granite Total % Listed Fish)

b) Listed Fish to McNary = (Listed Fish to Granite)x(1-FGE_{Granite})x(Project Survival)x(1-FGE_{Goose})x(Project Survival)x(1-FGE_{Low Mon})x(Project Survival)² + (listed Tucannon fish)x(1-FGE_{Low Mon})x(Project Survival)² + (Rock Island listed fish)x(Project Survival)² + (PIT-tagged fish)

where: listed Tucannon fish = 21,857 wild and 77,000 (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 2011 under a full transportation scenario.

	Full Transportation Scenario								
	Chinook salmon								
	Yearlings			Subyearlings					
Total fish collected at:*									
Lower Granite	6,474,050			2,753,685					
Little Goose	2,570,912			1,013,857					
Lower Monumental	1,042,637			300,771					
Ice Harbor**	612,792			152,265					
<u>Columbia River</u>									
Wells***	2,387,280			NA					
Rocky Reach***	2,594,625			NA					
Rock Island***	4,895,333			NA					
Wanapum***	4,430,276			NA					
Priest Rapids***	4,009,400			NA					
McNary****	4,863,403			29,549,007					
John Day** ****	4,256,297			4,386,638					
The Dalles** ****	3,064,753			2,349,985					
Bonneville (I & II combined)** *****	3,737,465			9,268,684					
---To the tailrace of Bonneville	9,343,663			30,895,613					
---To Tongue Point*****	34,020,956			102,661,344					
	Spring/Summer Chinook			Fall Chinook - Yearlings			Fall Chinook - Subyearlings		
	Hatchery			Hatchery			Hatchery		
	Wild	Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	Wild	Ad-clip	No Ad-clip	
Total listed fish at:									
Lower Granite	913,990	1,354,933	298,720	114,185	141,548	790,226	729,128	1,234,332	
Little Goose	377,497	542,475	116,501	44,532	55,204	290,947	268,452	454,459	
Lower Monumental	128,792	145,957	142,729	240,790	13,376	76,189	133,690	90,892	
Ice Harbor**	89,326	90,825	77,074	130,027	7,223	38,571	67,681	46,014	
<u>Columbia River</u>									
Wells***	134,306	0	783,067	0	0	NA	NA	NA	
Rocky Reach***	176,421	0	721,205	0	0	NA	NA	NA	
Rock Island***	420,565	446,000	823,605	0	0	NA	NA	NA	
Wanapum***	380,611	403,630	745,363	0	0	NA	NA	NA	
Priest Rapids***	344,453	365,285	674,554	0	0	NA	NA	NA	
McNary****	355,198	371,996	578,168	156,032	8,668	41,785	73,321	49,849	
John Day** ****	239,759	251,097	390,263	105,322	5,851	5,906	10,364	7,046	
The Dalles** ****	143,855	150,658	234,158	63,193	3,511	3,164	5,552	3,775	
Bonneville (I & II combined)** *****	144,505	135,592	210,742	56,874	3,160	103,279	3,651,749	124,298	
---To the tailrace of Bonneville	361,263	338,980	526,855	142,185	7,900	344,263	12,172,497	414,327	
---To Tongue Point*****	6,289,746	10,880,778	1,554,805	541,692	218,028	11,500,321	32,077,088	2,443,859	
Percent listed fish at:									
Lower Granite	14.12%	20.93%	4.61%	1.76%	2.19%	28.70%	26.48%	44.82%	
Little Goose	14.68%	21.10%	4.53%	1.73%	2.15%	28.70%	26.48%	44.82%	
Lower Monumental	12.35%	14.00%	13.69%	23.09%	1.28%	25.33%	44.45%	30.22%	
Ice Harbor**	14.58%	14.82%	12.58%	21.22%	1.18%	25.33%	44.45%	30.22%	
<u>Columbia River</u>									
Wells***	5.63%	0.00%	32.80%	0.00%	0.00%	NA	NA	NA	
Rocky Reach***	6.80%	0.00%	27.80%	0.00%	0.00%	NA	NA	NA	
Rock Island***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
Wanapum***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
Priest Rapids***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
McNary****	7.30%	7.65%	11.89%	3.21%	0.18%	0.14%	0.25%	0.17%	
John Day** ****	5.63%	5.90%	9.17%	2.47%	0.14%	0.13%	0.24%	0.16%	
The Dalles** ****	4.69%	4.92%	7.64%	2.06%	0.11%	0.13%	0.24%	0.16%	
Bonneville (I & II combined)** *****	3.87%	3.63%	5.64%	1.52%	0.08%	1.11%	39.40%	1.34%	
---To the tailrace of Bonneville	3.87%	3.63%	5.64%	1.52%	0.08%	1.11%	39.40%	1.34%	
---To Tongue Point*****	18.49%	31.98%	4.57%	1.59%	0.64%	11.20%	31.25%	2.38%	

* 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),
 18.49% of them will be listed wild fish, or 185 fish. To these 185 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 185 x 0.2334 = 43; UCR, 185 x 0.0359 = 7; etc).

Yearling Chinook salmon	Full Transportation		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	30.18	20.64	15.76
SR - Fall (Yrlg)	0.00	29.55	1.48
UCR	69.82	49.81	82.76
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon			
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	Full Transportation		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	27.04	20.64	15.76
SR - Fall (Yrlg)	0.00	29.55	1.48
UCR	62.56	49.81	82.76
LCR - Spring	10.40	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon			
SR - Fall (Subyrlg)	2.76	0.14	2.73
LCR - Tule fall	97.24	99.86	97.27
LCR - Late run fall	0.00	0.00	0.00

Tongue Point Yearling Chinook salmon	Full Transportation		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	23.34	18.48	36.23
SR - Fall (Yrlg)	0.00	4.74	12.30
UCR	3.59	2.10	24.96
LCR - Spring	41.12	21.63	26.51
UWR	31.95	53.05	0.00

Subyearling Chinook salmon			
SR - Fall (Subyrlg)	10.51	3.81	75.33
LCR - Tule fall	63.47	96.19	24.67
LCR - Late run fall	26.02	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 2011 under a transportation with spill scenario.

	Transportation with Spill Scenario								
	Chinook salmon								
	Yearlings			Subyearlings					
Total fish collected at:*									
Lower Granite	3,970,751			976,307					
Little Goose	2,676,302			897,771					
Lower Monumental	1,123,184			250,073					
Ice Harbor**	1,558,484			536,186					
<u>Columbia River</u>									
Wells***	2,387,280			NA					
Rocky Reach***	2,594,625			NA					
Rock Island***	4,895,333			NA					
Wanapum***	4,430,276			NA					
Priest Rapids***	4,009,400			NA					
McNary****	2,781,680			8,503,400					
John Day** ****	1,230,465			6,458,555					
The Dalles** ****	3,524,358			5,311,312					
Bonneville (I & II combined)** *****	1,826,488			6,324,955					
---To the tailrace of Bonneville	10,377,773			39,779,591					
---To Tongue Point*****	32,807,329			88,555,553					
	Spring/Summer			Fall Chinook - Yearlings			Fall Chinook - Subyearlings		
	Hatchery			Hatchery			Hatchery		
Total listed fish at:	Wild	Ad-clip	No Ad-clip	Ad-clip	No Ad-clip	Wild	Ad-clip	No Ad-clip	
Lower Granite	560,580	831,026	183,215	70,034	86,816	280,171	258,509	437,627	
Little Goose	383,775	561,920	122,620	46,871	58,103	257,633	237,714	402,423	
Lower Monumental	145,158	193,881	106,077	146,328	19,447	68,321	84,592	97,159	
Ice Harbor**	208,854	271,260	144,414	199,212	26,475	146,488	181,375	208,320	
<u>Columbia River</u>									
Wells***	134,306	0	783,067	0	0	NA	NA	NA	
Rocky Reach***	176,421	0	721,205	0	0	NA	NA	NA	
Rock Island***	420,565	446,000	823,605	0	0	NA	NA	NA	
Wanapum***	380,611	403,630	745,363	0	0	NA	NA	NA	
Priest Rapids***	344,453	365,285	674,554	0	0	NA	NA	NA	
McNary****	231,241	272,925	305,600	110,861	14,734	45,656	56,529	64,926	
John Day** ****	82,461	97,326	108,978	39,533	5,254	33,942	42,026	48,268	
The Dalles** ****	201,945	238,349	266,885	96,816	12,867	27,913	34,561	39,694	
Bonneville (I & II combined)** *****	86,586	94,386	105,686	38,339	5,095	66,543	1,949,264	83,011	
---To the tailrace of Bonneville	491,966	536,284	600,489	217,835	28,949	418,509	12,259,522	522,082	
---To Tongue Point*****	6,119,067	10,640,042	1,482,401	481,068	193,315	11,027,201	31,596,866	1,724,217	
Percent listed fish at:									
Lower Granite	14.12%	20.93%	4.61%	1.76%	2.19%	28.70%	26.48%	44.82%	
Little Goose	14.34%	21.00%	4.58%	1.75%	2.17%	28.70%	26.48%	44.82%	
Lower Monumental	12.92%	17.26%	9.44%	13.03%	1.73%	27.32%	33.83%	38.85%	
Ice Harbor**	13.40%	17.41%	9.27%	12.78%	1.70%	27.32%	33.83%	38.85%	
<u>Columbia River</u>									
Wells***	5.63%	0.00%	32.80%	0.00%	0.00%	NA	NA	NA	
Rocky Reach***	6.80%	0.00%	27.80%	0.00%	0.00%	NA	NA	NA	
Rock Island***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
Wanapum***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
Priest Rapids***	8.59%	9.11%	16.82%	0.00%	0.00%	NA	NA	NA	
McNary****	8.31%	9.81%	10.99%	3.99%	0.53%	0.54%	0.66%	0.76%	
John Day** ****	6.70%	7.91%	8.86%	3.21%	0.43%	0.53%	0.65%	0.75%	
The Dalles** ****	5.73%	6.76%	7.57%	2.75%	0.37%	0.53%	0.65%	0.75%	
Bonneville (I & II combined)** *****	4.74%	5.17%	5.79%	2.10%	0.28%	1.05%	30.82%	1.31%	
---To the tailrace of Bonneville	4.74%	5.17%	5.79%	2.10%	0.28%	1.05%	30.82%	1.31%	
---To Tongue Point*****	18.65%	32.43%	4.52%	1.47%	0.59%	12.45%	35.68%	1.95%	

* 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),
 18.65% of them will be listed wild fish, or 187 fish. To these 187 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 187 x 0.2120 = 40; UCR, 187 x 0.0369 = 7; etc).

Yearling Chinook salmon	Transportation with spill		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	50.26	39.33	25.09
SR - Fall (Yrlg)	0.00	28.89	4.60
UCR	49.74	31.78	70.31
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon			
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		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	46.42	39.33	25.09
SR - Fall (Yrlg)	0.00	28.89	4.60
UCR	45.94	31.78	70.31
LCR - Spring	7.64	0.00	0.00
UWR	0.00	0.00	0.00

Subyearling Chinook salmon			
SR - Fall (Subyrlg)	20.01	0.85	22.81
LCR - Tule fall	79.99	99.15	77.19
LCR - Late run fall	0.00	0.00	0.00

Tongue Point Yearling Chinook salmon	Transportation with spill		
	Wild	Hatchery	
		Ad-clip	No Ad-clip
SR - Spr/Sum	21.20	16.81	34.00
SR - Fall (Yrlg)	0.00	4.33	11.54
UCR	3.69	2.16	26.41
LCR - Spring	42.27	22.21	28.05
UWR	32.84	54.49	0.00

Subyearling Chinook salmon			
SR - Fall (Subyrlg)	6.67	2.35	65.03
LCR - Tule fall	66.19	97.65	34.97
LCR - Late run fall	27.14	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 2011.

	Full Transportation Scenario				Transportation with Spill Scenario					
	Sockeye salmon	Coho salmon			Chum salmon	Sockeye salmon	Coho salmon			Chum salmon
Total fish collected at:*										
Lower Granite	69,928	395,569			0	31,701	242,615			0
Little Goose	27,272	154,272			0	29,705	162,374			0
Lower Monumental	6,608	37,381			0	13,983	54,347			0
Ice Harbor**	3,568	20,186			0	15,124	73,988			0
<u>Columbia River</u>										
Wells***	NA	377,117			0	NA	377,117			0
Rocky Reach***	NA	339,405			0	NA	339,405			0
Rock Island***	NA	993,478			0	NA	993,478			0
Wanapum***	NA	894,130			0	NA	894,130			0
Priest Rapids***	NA	804,717			0	NA	804,717			0
McNary****	426,726	1,154,017			0	426,726	565,116			0
John Day** *****	1,047,418	1,378,961			0	212,975	348,522			0
The Dalles** *****	628,451	827,377			0	628,451	853,523			0
Bonneville (I & II combined)** *****	565,606	2,406,995			12,000	251,695	1,069,432			12,000
---To the tailrace of Bonneville	1,414,015	6,017,488			30,000	1,414,017	6,076,318			30,000
---To Tongue Point*****	1,517,823	20,591,098			1,499,982	1,489,406	18,787,042			1,499,982
		Coho salmon					Coho salmon			
	Sockeye salmon	Wild	Hatchery Ad-clip	No Ad-clip	Chum salmon	Sockeye salmon	Wild	Hatchery Ad-clip	No Ad-clip	Chum salmon
Total listed fish at:										
Lower Granite	63,432	0	0	0	0	28,756	0	0	0	0
Little Goose	24,738	0	0	0	0	26,945	0	0	0	0
Lower Monumental	5,994	0	0	0	0	12,684	0	0	0	0
Ice Harbor**	3,237	0	0	0	0	13,719	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****	3,884	0	0	0	0	4,527	0	0	0	0
John Day** *****	2,622	0	0	0	0	2,259	0	0	0	0
The Dalles** *****	1,573	0	0	0	0	6,666	0	0	0	0
Bonneville (I & II combined)** *****	1,416	37,896	0	0	12,000	2,670	16,674	0	0	12,000
---To the tailrace of Bonneville	3,540	94,740	0	0	30,000	15,000	94,739	0	0	30,000
---To Tongue Point*****	101,588	1,162,128	11,184,000	463,884	1,499,982	83,385	1,162,127	11,184,000	463,884	1,499,982
Percent listed fish at:										
Lower Granite	90.71%	0.00%	0.00%	0.00%	---	90.71%	0.00%	0.00%	0.00%	---
Little Goose	90.71%	0.00%	0.00%	0.00%	---	90.71%	0.00%	0.00%	0.00%	---
Lower Monumental	90.71%	0.00%	0.00%	0.00%	---	90.71%	0.00%	0.00%	0.00%	---
Ice Harbor**	90.72%	0.00%	0.00%	0.00%	---	90.71%	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****	0.91%	0.00%	0.00%	0.00%	---	1.06%	0.00%	0.00%	0.00%	---
John Day** *****	0.25%	0.00%	0.00%	0.00%	---	1.06%	0.00%	0.00%	0.00%	---
The Dalles** *****	0.25%	0.00%	0.00%	0.00%	---	1.06%	0.00%	0.00%	0.00%	---
Bonneville (I & II combined)** *****	0.25%	1.57%	0.00%	0.00%	---	1.06%	1.56%	0.00%	0.00%	---
---To the tailrace of Bonneville	0.25%	1.57%	0.00%	0.00%	100.00%	1.06%	1.56%	0.00%	0.00%	100.00%
---To Tongue Point*****	6.69%	5.64%	54.31%	2.25%	100.00%	5.60%	6.19%	59.53%	2.47%	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 2011 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		
Total fish collected at:*												
Lower Granite	2,112,068		4,361,982		372,133		23,436		2,024,557		729,128	
Little Goose	844,748		1,726,164		120,943		7,617		745,405		268,452	
Lower Monumental	356,511		686,126		24,421		1,538		167,081		133,690	
Ice Harbor**	212,294		400,498		10,989		692		84,585		67,681	
<u>Columbia River</u>												
Wells***	917,373		1,469,907		377,117		0		NA		NA	
Rocky Reach***	897,626		1,696,999		339,405		0		NA		NA	
Rock Island***	1,244,170		3,651,163		993,478		0		NA		NA	
Wanapum***	1,119,753		3,286,047		894,130		0		NA		NA	
Priest Rapids***	1,007,778		2,957,442		804,717		0		NA		NA	
McNary****	1,552,918		3,278,675		1,116,927		21,277		19,311,312		10,237,695	
John Day** ****	1,461,920		2,772,906		813,926		554,362		2,729,580		1,657,059	
The Dalles** ****	1,077,214		1,974,656		488,356		332,617		1,462,275		887,710	
Bonneville (I & II combined)** *****	984,528		2,741,342		693,416		1,707,815		3,189,227		6,079,456	
---To the tailrace of Bonneville	2,461,320		6,853,355		1,733,540		4,269,538		10,630,757		20,264,853	
---To Tongue Point*****	10,253,930		26,453,345		4,899,236		17,242,406		44,456,023		58,205,318	
	Spring/Summer Chinook	Fall Chinook	Spring/Summer Chinook	Fall Chinook	Coho salmon	Coho salmon	Fall Chinook	Fall Chinook				
	Hatchery	Hatchery	Hatchery	Hatchery	Hatchery	Hatchery	Hatchery	Hatchery				
	Wild	No Ad-clip	No Ad-clip	Ad-clip	Ad-clip	Wild	No Ad-clip	Ad-clip	Wild	No Ad-clip	Ad-clip	
Total listed fish at:												
Lower Granite	913,990	298,720	141,548	1,354,933	114,185	0	0	0	790,226	1,234,332	729,128	
Little Goose	377,497	116,501	55,204	542,475	44,532	0	0	0	290,947	454,459	268,452	
Lower Monumental	128,792	142,729	13,376	145,957	240,790	0	0	0	76,189	90,892	133,690	
Ice Harbor**	89,326	77,074	7,223	90,825	130,027	0	0	0	38,571	46,014	67,681	
<u>Columbia River</u>												
Wells***	134,306	783,067	0	0	0	0	0	0	NA	NA	NA	
Rocky Reach***	176,421	721,205	0	0	0	0	0	0	NA	NA	NA	
Rock Island***	420,565	823,605	0	446,000	0	0	0	0	NA	NA	NA	
Wanapum***	380,611	745,363	0	403,630	0	0	0	0	NA	NA	NA	
Priest Rapids***	344,453	674,554	0	365,285	0	0	0	0	NA	NA	NA	
McNary****	355,198	578,168	8,668	371,996	156,032	0	0	0	41,785	49,849	73,321	
John Day** ****	239,759	390,263	5,851	251,097	105,322	0	0	0	5,906	7,046	10,364	
The Dalles** ****	143,855	234,158	3,511	150,658	63,193	0	0	0	3,164	3,775	5,552	
Bonneville (I & II combined)** *****	144,505	210,742	3,160	135,592	56,874	37,896	0	0	103,279	124,298	3,651,749	
---To the tailrace of Bonneville	361,263	526,855	7,900	338,980	142,185	94,740	0	0	344,263	414,327	12,172,497	
---To Tongue Point*****	6,289,746	1,554,805	218,028	10,880,778	541,692	1,162,128	463,884	11,184,000	11,500,321	2,443,859	32,077,088	
Percent listed fish at:												
Lower Granite	43.27%	14.14%	6.70%	31.062%	2.618%	0.00%	0.00%	0.00%	39.03%	60.97%	100.00%	
Little Goose	44.69%	13.79%	6.53%	31.427%	2.580%	0.00%	0.00%	0.00%	39.03%	60.97%	100.00%	
Lower Monumental	36.13%	40.03%	3.75%	21.273%	35.094%	0.00%	0.00%	0.00%	45.60%	54.40%	100.00%	
Ice Harbor**	42.08%	36.31%	3.40%	22.678%	32.466%	0.00%	0.00%	0.00%	45.60%	54.40%	100.00%	
<u>Columbia River</u>												
Wells***	14.64%	85.36%	0.00%	0.00%	0.00%	NA	NA	NA	NA	NA	NA	
Rocky Reach***	19.65%	80.35%	0.00%	0.00%	0.00%	NA	NA	NA	NA	NA	NA	
Rock Island***	33.80%	66.20%	0.00%	12.22%	0.00%	NA	NA	NA	NA	NA	NA	
Wanapum***	33.99%	66.56%	0.00%	12.28%	0.00%	NA	NA	NA	NA	NA	NA	
Priest Rapids***	34.18%	66.93%	0.00%	12.35%	0.00%	NA	NA	NA	NA	NA	NA	
McNary****	22.87%	37.23%	0.56%	11.35%	4.76%	0.00%	0.00%	0.00%	0.22%	0.26%	0.72%	
John Day** ****	16.40%	26.70%	0.40%	9.06%	3.80%	0.00%	0.00%	0.00%	0.22%	0.26%	0.63%	
The Dalles** ****	13.35%	21.74%	0.33%	7.63%	3.20%	0.00%	0.00%	0.00%	0.22%	0.26%	0.63%	
Bonneville (I & II combined)** *****	14.68%	21.41%	0.32%	4.95%	2.07%	5.47%	0.00%	0.00%	3.24%	3.90%	60.07%	
---To the tailrace of Bonneville	14.68%	21.41%	0.32%	4.95%	2.07%	5.47%	0.00%	0.00%	3.24%	3.90%	60.07%	
---To Tongue Point*****	61.34%	15.16%	2.13%	41.13%	2.05%	23.72%	9.47%	64.86%	25.87%	5.50%	55.11%	

* 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),
 61.34% of them will be listed wild fish, or 613 fish. To these 613 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 613 x 0.2334 = 143; UCR, 613 x 0.0373 = 23; etc).

Spring/Summer Chinook salmon	Full Transportation		
	Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	30.18	20.64	15.76
SR - Fall (Yrlg)	0.00	29.55	1.48
UCR	69.82	49.81	82.76
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	27.04	20.64	15.76
SR - Fall (Yrlg)	0.00	29.55	1.48
UCR	62.56	49.81	82.76
LCR - Spring	10.41	0.00	0.00
UWR	0.00	0.00	0.00

Fall			
Chinook salmon			
SR	2.76	0.14	2.73
LCR - Tule fall	97.24	99.86	97.27
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	23.34	18.48	36.23
SR - Fall (Yrlg)	0.00	4.74	12.30
UCR	3.59	2.10	24.96
LCR - Spring	41.12	21.63	26.51
UWR	31.95	53.05	0.00

Fall			
Chinook salmon			
SR	10.51	3.81	75.33
LCR - Tule fall	63.47	96.19	24.67
LCR - Late run fall	26.02	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

**** 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),
 66.36% of them will be listed wild fish, or 664 fish. To these 664 fish, apply the percentages
 listed below under the Tongue Point section to determine how many are from each ESU
 (SR, 664 x 0.2120 = 141; UCR, 664 x 0.0369 = 25; etc).

Spring/Summer Chinook salmon	Transportation with spill		
	Wild	Ad-clip	No Ad-clip
SR	50.26	39.33	25.09
SR - Fall (Yrlg)	0.00	28.89	4.60
UCR	49.74	31.78	70.31
LCR - Spring	0.00	0.00	0.00
UWR	0.00	0.00	0.00

Fall Chinook salmon	Hatchery		
	Wild	Ad-clip	No Ad-clip
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	46.42	39.33	25.09
SR - Fall (Yrlg)	0.00	28.89	4.60
UCR	45.94	31.78	70.31
LCR - Spring	7.64	0.00	0.00
UWR	0.00	0.00	0.00

Fall Chinook salmon	Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	20.01	0.85	22.81
LCR - Tule fall	79.99	99.15	77.19
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	21.20	16.81	34.00
SR - Fall (Yrlg)	0.00	4.33	11.54
UCR	3.69	2.16	26.41
LCR - Spring	42.27	22.21	28.05
UWR	32.84	54.49	0.00

Fall Chinook salmon	Hatchery		
	Wild	Ad-clip	No Ad-clip
SR	6.67	2.35	65.03
LCR - Tule fall	66.19	97.65	34.97
LCR - Late run fall	27.14	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 2011 under full transportation and transportation with spill scenarios.

	Full Transportation Scenario			Transportation with Spill Scenario		
	Steelhead trout			Steelhead trout		
Total fish collected at:						
<u>Snake River</u>						
Lower Granite	8,047,291			4,224,828		
Little Goose	1,660,414			2,706,930		
Lower Monumental	322,495			988,121		
Ice Harbor**	152,578			1,107,562		
<u>Columbia River</u>						
Wells***	720,039			720,039		
Rocky Reach***	738,257			738,257		
Rock Island***	1,117,878			1,117,878		
Wanapum***	1,006,090			1,006,090		
Priest Rapids***	905,481			905,481		
McNary****	1,634,475			642,615		
John Day** ****	1,339,200			568,171		
The Dalles** ****	1,366,115			1,829,952		
Bonneville (I & II combined)** *****	1,507,903			611,590		
---To the tailrace of Bonneville	2,741,642			3,576,550		
---To Tongue Point****	16,928,230			15,706,982		
Total listed fish at:						
<u>Snake River</u>						
	Steelhead trout			Steelhead trout		
	Wild	Hatchery		Wild	Hatchery	
		Ad-clip	No Ad-clip		Ad-clip	No Ad-clip
Lower Granite	1,459,906	2,158,263	1,252,560	766,451	1,133,088	657,594
Little Goose	300,059	449,603	253,643	490,959	727,613	420,090
Lower Monumental	51,164	43,312	66,537	172,894	239,992	165,104
Ice Harbor**	31,906	26,769	24,184	198,192	270,753	181,832
<u>Columbia River</u>						
Wells***	184,651	441,116	94,272	184,651	441,116	94,272
Rocky Reach***	225,357	422,588	90,312	225,357	422,588	90,312
Rock Island***	267,850	570,379	279,649	267,850	570,379	279,649
Wanapum***	238,654	508,208	249,167	238,654	508,208	249,167
Priest Rapids***	212,641	452,813	222,008	212,641	452,813	222,008
McNary****	320,380	403,429	326,966	120,548	160,805	119,887
John Day** ****	354,934	346,800	228,876	132,521	146,474	95,965
The Dalles** ****	333,122	316,443	453,885	413,937	435,020	530,503
Bonneville (I & II combined)** *****	387,175	313,279	449,346	145,251	133,899	163,289
---To the tailrace of Bonneville	703,955	569,598	816,993	849,421	783,035	954,906
---To Tongue Point****	2,966,505	4,162,817	2,389,733	2,745,730	3,843,543	2,197,694
Percent listed fish at:						
<u>Snake River</u>						
Lower Granite	18.14%	26.82%	15.57%	18.14%	26.82%	15.57%
Little Goose	18.07%	27.08%	15.28%	18.14%	26.88%	15.52%
Lower Monumental	15.87%	13.43%	20.63%	17.50%	24.29%	16.71%
Ice Harbor**	20.91%	17.54%	15.85%	17.89%	24.45%	16.42%
<u>Columbia River</u>						
Wells***	25.65%	61.26%	13.09%	25.65%	61.26%	13.09%
Rocky Reach***	30.53%	57.24%	12.23%	30.53%	57.24%	12.23%
Rock Island***	23.96%	51.02%	25.02%	23.96%	51.02%	25.02%
Wanapum***	23.72%	50.51%	24.77%	23.72%	50.51%	24.77%
Priest Rapids***	23.48%	50.01%	24.52%	23.48%	50.01%	24.52%
McNary****	19.60%	24.68%	20.00%	18.76%	25.02%	18.66%
John Day** ****	26.50%	25.90%	17.09%	23.32%	25.78%	16.89%
The Dalles** ****	24.39%	23.16%	33.23%	22.62%	23.77%	28.99%
Bonneville (I & II combined)** *****	25.68%	20.78%	29.80%	23.75%	21.89%	26.70%
---To the tailrace of Bonneville	25.68%	20.78%	29.80%	23.75%	21.89%	26.70%
---To Tongue Point****	17.52%	24.59%	14.12%	17.48%	24.47%	13.99%

* 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), 17.52% of them will be listed wild fish, or 175 fish. To these 175 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, $175 \times 0.5745 = 101$; UCR, $175 \times 0.0438 = 8$; etc).

	Full Transportation			Transportation with spill		
	Wild	AD-clipped	No AD-clip	Wild	AD-clipped	No AD-clip
McNary Dam						
SR	10.76	7.17	7.99	42.81	43.84	39.50
UCR	53.76	92.83	73.18	34.45	56.16	48.12
MCR - Summer	35.48	0.00	18.83	22.74	0.00	12.38
MCR - Winter	---	---	---	---	---	---
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
John Day Dam						
SR	7.05	5.84	7.99	32.04	38.53	39.50
UCR	35.27	75.59	73.18	25.79	49.35	48.12
MCR - Summer	57.68	18.57	18.83	42.17	12.12	12.38
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
The Dalles Dam						
SR	4.93	4.11	2.59	24.38	30.25	16.66
UCR	24.67	53.26	23.72	19.62	38.74	20.30
MCR - Summer	70.40	42.63	73.69	56.00	31.01	63.04
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
Bonneville Dam						
SR	4.17	3.78	2.59	21.26	28.43	16.66
UCR	20.82	48.96	23.72	17.11	36.42	20.30
MCR - Summer	59.44	39.19	73.69	48.83	29.15	63.04
MCR - Winter	9.01	0.00	0.00	7.40	0.00	0.00
LCR - Summer	4.33	0.00	0.00	3.56	0.00	0.00
LCR - Winter	2.23	8.07	0.00	1.84	6.00	0.00
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
Tongue Point						
SR	57.45	60.46	67.06	54.81	60.47	64.51
UCR	4.38	6.85	8.02	4.65	7.66	8.64
MCR - Summer	12.50	5.49	24.92	13.28	6.13	26.85
MCR - Winter	1.89	0.00	0.00	2.01	0.00	0.00
LCR - Summer	2.11	4.17	0.00	2.24	0.00	0.00
LCR - Winter	14.14	18.86	0.00	15.01	21.08	0.00
UWR - Summer	---	4.17	0.00	---	4.66	0.00
UWR - Winter	7.53	0.00	0.00	8.00	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 2011 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	
Total fish collected at:*						
<i>Snake River</i>						
Lower Granite	2,927,822	5,119,470		1,537,106	2,687,722	
Little Goose	597,312	1,049,248		983,275	1,720,758	
Lower Monumental	120,536	186,289		361,355	621,945	
Ice Harbor**	57,120	78,736		405,747	691,404	
<i>Columbia River</i>						
Wells***	278,923	441,116		278,923	441,116	
Rocky Reach***	315,669	422,588		315,669	422,588	
Rock Island***	547,499	570,379		547,499	570,379	
Wanapum***	492,749	513,341		492,749	513,341	
Priest Rapids***	443,474	462,007		443,474	462,007	
McNary****	705,029	910,756		260,772	379,132	
John Day** ****	624,188	701,929		244,765	321,236	
The Dalles** ****	812,964	544,740		982,396	842,496	
Bonneville (I & II combined)** *****	862,219	637,358		320,223	289,810	
---To the tailrace of Bonneville	1,567,671	1,158,833		1,872,649	1,694,795	
---To Tongue Point*****	6,027,694	11,125,231		5,583,322	10,354,385	
Total listed fish at:						
<i>Snake River</i>						
	Wild	Hatchery No Ad-clip	Hatchery Ad-clip	Wild	Hatchery No Ad-clip	Hatchery Ad-clip
Lower Granite	1,459,906	1,252,560	2,158,263	766,451	657,594	1,133,088
Little Goose	300,059	253,643	449,603	490,959	420,090	727,613
Lower Monumental	51,164	66,537	43,312	172,894	165,104	239,992
Ice Harbor**	31,906	24,184	26,769	198,192	181,832	270,753
<i>Columbia River</i>						
Wells***	184,651	94,272	441,116	184,651	94,272	441,116
Rocky Reach***	225,357	90,312	422,588	225,357	90,312	422,588
Rock Island***	267,850	279,649	570,379	267,850	279,649	570,379
Wanapum***	238,654	249,167	508,208	238,654	249,167	508,208
Priest Rapids***	212,641	222,008	452,813	212,641	222,008	452,813
McNary****	320,380	326,966	403,429	120,548	119,887	160,805
John Day** ****	354,934	228,876	346,800	132,521	95,965	146,474
The Dalles** ****	333,122	453,885	316,443	413,937	530,503	435,020
Bonneville (I & II combined)** *****	387,175	449,346	313,279	145,251	163,289	133,899
---To the tailrace of Bonneville	703,955	816,993	569,598	849,421	954,906	783,035
---To Tongue Point*****	2,966,505	2,389,733	4,162,817	2,745,730	2,197,694	3,843,543
Percent listed fish at:						
<i>Snake River</i>						
Lower Granite	49.86%	42.78%	42.16%	49.86%	42.78%	42.16%
Little Goose	50.23%	42.46%	42.85%	49.93%	42.72%	42.28%
Lower Monumental	42.45%	55.20%	23.25%	47.85%	45.69%	38.59%
Ice Harbor**	55.86%	42.34%	34.00%	48.85%	44.81%	39.16%
<i>Columbia River</i>						
Wells***	66.20%	33.80%	100.00%	66.20%	33.80%	100.00%
Rocky Reach***	71.39%	28.61%	100.00%	71.39%	28.61%	100.00%
Rock Island***	48.92%	51.08%	100.00%	48.92%	51.08%	100.00%
Wanapum***	48.43%	50.57%	99.00%	48.43%	50.57%	99.00%
Priest Rapids***	47.95%	50.06%	98.01%	47.95%	50.06%	98.01%
McNary****	45.44%	46.38%	44.30%	46.23%	45.97%	42.41%
John Day** ****	56.86%	36.67%	49.41%	54.14%	39.21%	45.60%
The Dalles** ****	40.98%	55.83%	58.09%	42.14%	54.00%	51.64%
Bonneville (I & II combined)** *****	44.90%	52.12%	49.15%	45.36%	50.99%	46.20%
---To the tailrace of Bonneville	44.90%	52.12%	49.15%	45.36%	50.99%	46.20%
---To Tongue Point*****	49.21%	39.65%	37.42%	49.18%	39.36%	37.12%

* 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), 49.21% of them will be listed wild fish, or 492 fish. To these 492 fish, apply the percentages listed below under the Tongue Point section to determine how many are from each ESU (SR, 492 x 0.5745 = 283; UCR, 492 x 0.0438 = 22; etc).

McNary Dam	Full Transportation			Transportation with spill		
	Wild	AD-clipped	No AD-clip	Wild	AD-clipped	No AD-clip
SR	10.76	7.17	7.99	42.81	43.84	39.50
UCR	53.76	92.83	73.18	34.45	56.16	48.12
MCR - Summer	35.48	0.00	18.83	22.74	0.00	12.38
MCR - Winter	---	---	---	---	---	---
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
John Day Dam						
SR	7.05	5.84	7.99	32.04	38.53	39.50
UCR	35.27	75.59	73.18	25.79	49.35	48.12
MCR - Summer	57.68	18.57	18.83	42.17	12.12	12.38
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
The Dalles Dam						
SR	4.93	4.11	2.59	24.38	30.25	16.66
UCR	24.67	53.26	23.72	19.62	38.74	20.30
MCR - Summer	70.40	42.63	73.69	56.00	31.01	63.04
MCR - Winter	---	0.00	0.00	---	0.00	0.00
LCR - Summer	---	---	---	---	---	---
LCR - Winter	---	---	---	---	---	---
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
Bonneville Dam						
SR	4.17	3.78	2.59	21.26	28.43	16.66
UCR	20.82	48.96	23.72	17.11	36.42	20.30
MCR - Summer	59.44	39.19	73.69	48.83	29.15	63.04
MCR - Winter	9.01	0.00	0.00	7.40	0.00	0.00
LCR - Summer	4.33	0.00	0.00	3.56	0.00	0.00
LCR - Winter	2.23	8.07	0.00	1.84	6.00	0.00
UWR - Summer	---	---	---	---	---	---
UWR - Winter	---	---	---	---	---	---
Tongue Point						
SR	57.45	60.46	67.06	54.81	60.47	64.51
UCR	4.38	6.85	8.02	4.65	7.66	8.64
MCR - Summer	12.50	5.49	24.92	13.28	6.13	26.85
MCR - Winter	1.89	0.00	0.00	2.01	0.00	0.00
LCR - Summer	2.11	4.17	0.00	2.24	0.00	0.00
LCR - Winter	14.14	18.86	0.00	15.01	21.08	0.00
UWR - Summer	---	4.17	0.00	---	4.66	0.00
UWR - Winter	7.53	0.00	0.00	8.00	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, 2011.

ESU	Run	Number of listed fish		
		Wild	AD-clipped	Hatchery ^e Non-AD-clipped
<u>Snake River</u>				
Chinook	Spring/summer	1,523,316	4,412,800	1,099,531
	Fall			
	- subyearlings	1,436,772	2,628,000	4,110,330
	- yearlings		677,000	269,000
Steelhead	Summer	1,846,740	3,384,890	2,078,484
Sockeye		9,132	96,588	0
<u>Upper Columbia</u>				
Chinook	Spring	442,819	446,000	1,142,480
Steelhead	Summer	284,332	624,141	298,000
<u>Mid-Columbia</u>				
Steelhead	Summer	522,883	279,000	681,900
	Winter	60,353	0	0
<u>Lower Columbia</u>				
Chinook	Spring	2,586,155	2,470,400	470,000
	Fall (tule)	7,299,108	30,855,841	603,000
	Fall (late run)	2,992,574	0	0
Steelhead	Summer	67,212	0	0
	Winter	450,360	835,000	0
Coho		1,167,978	11,213,000	463,884
<u>Upper Willamette</u>				
Chinook	Spring	1,334,785	6,060,000	0
Steelhead	Summer		184,500	0
	Winter	239,830	0	0
<u>Columbia River</u>				
Chum		6,030,000	0	307,000

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 2011. 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 (147,033). The CSS requires that 70% of the fish collected at each of the Snake River collector dams be transported.

Another 27,092 hatchery spring/summer Chinook salmon (PIT tagged at hatcheries (not part of the CSS) and traps) will arrive at Lower Granite Dam. Of the 174,125 (147,033 + 27,092) hatchery fish reaching Lower Granite Dam, 85,552 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 2011 outmigration year began in July 2010 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 x) will arrive at Lower Granite Dam.

National Marine Fisheries Service will be PIT-tagging fish at Lower Granite Dam during the 2011 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 63.2% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 36.8%), 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 2011 will be

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	26,455	30,144	48,264	104,863
Lower Monumental	8,968	11,225	16,154	36,347
McNary	6,794	10,965	19,410	37,169

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 2011 will be

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	31,577	33,640	60,431	125,648
Lower Monumental	7,851	10,151	14,643	32,645
McNary	5,088	11,883	24,953	41,924

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 2011 will be

Transportation with Spill Scenario

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	35,052	35,885	52,734	123,671
Lower Monumental	20,805	18,953	26,884	66,642
McNary	22,015	20,887	33,565	76,467

Full Transportation Scenario

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Little Goose	52,618	47,691	71,371	171,680
Lower Monumental	36,628	28,067	40,646	105,341
McNary	47,470	37,903	63,380	148,753

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, 2011.

Transportation with Spill Scenario

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	8,597	5,741	4,470	18,808
Lower Monumental	11,837	7,728	10,730	30,295
McNary	15,221	9,922	14,155	39,298
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.371):				
McNary	41,027	26,744	38,154	105,925

Full Transportation Scenario (No Spill)

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	21,041	14,051	10,940	46,032
Lower Monumental	28,777	17,916	26,003	72,696
McNary	42,382	26,020	38,427	106,829
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.800):				
McNary	52,978	32,525	48,034	133,537

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 2011. 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 21,551 (12,629 of which will be listed) will arrive at Lower Granite Dam. Another 12,735 (6,746 of which will be listed) hatchery steelhead (PIT tagged at traps) will arrive at Lower Granite Dam, bringing the total to 34,286 hatchery fish (which includes 19,375 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 2011 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, 10,356 will be listed hatchery fish, and 9,644 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 58.0% of the PIT-tagged fish arriving at Lower Granite Dam will not be collected (FGE = 42.0%), 3,965 ($6,836 \times 0.580$) wild, 11,237 ($19,375 \times 0.580$) listed hatchery, and 8,649 ($14,912 \times 0.580$) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 10,356 listed hatchery, and 9,644 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 33,965 ($3,965 + 30,000$) wild, 21,593 ($11,237 + 10,356$) listed hatchery, and 18,293 ($8,649 + 9,644$) 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 2011 will be

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	15,712	9,989	8,462	34,163
Lower Monumental	5,271	3,629	2,736	11,636
McNary	1,512	1,193	785	3,490

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, 3,875 (19,375 x 0.20) listed hatchery, and 2,982 (14,912 x 0.20) unlisted hatchery fish will reach the Lower Granite Dam tailrace. In addition, 30,000 wild, 10,356 listed hatchery, and 9,644 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, 14,231 (3,875 + 10,356) listed hatchery, and 12,626 (2,982 + 9,644) 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 2011 will be

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	25,408	11,527	10,227	47,162
Lower Monumental	1,977	1,432	665	4,074
McNary	777	1,192	261	2,230

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, 29,731 (19,375 + 10,356) listed hatchery, and 24,556 (14,912 + 9,644) 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 2011 will be

Transportation with Spill Scenario

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	17,040	13,753	11,359	42,152
Lower Monumental	11,528	9,550	7,558	28,636
McNary	5,332	4,569	3,496	13,397

Full Transportation Scenario

Dam	Wild	Listed hatchery	Un-listed hatchery	Total
Little Goose	29,836	24,082	19,890	73,808
Lower Monumental	19,718	16,336	12,929	48,983
McNary	22,115	18,951	14,500	55,566

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, 2011.

Transportation with Spill Scenario

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	1,328	3,764	2,897	7,989
Lower Monumental	6,257	5,921	4,822	17,000
McNary	3,820	3,376	2,711	9,907
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.217):				
McNary	17,604	15,558	12,493	45,655

Full Transportation Scenario (No Spill)

Dam	Wild	Listed hatchery	Unlisted hatchery	Total
Number of unaccounted for PIT-tagged fish collected:				
Little Goose	4,428	12,555	13,855	30,838
Lower Monumental	17,741	14,904	15,671	48,316
McNary	21,338	17,759	18,690	57,787
Number of unaccounted for PIT-tagged fish that arrived at McNary Dam (FGE = 0.90):				
McNary	23,709	19,732	20,767	64,208