
# Fisheries Management and Evaluation for 2021 Willamette River Spring Chinook

Oregon Department of Fish and Wildlife
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Columbia River Management

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# Contents

# Introduction

The population of Upper Willamette River wild spring Chinook salmon were listed as a threatened species under the federal Endangered Species Act (ESA) in May 1999. In response, the Oregon Department of Fish and Wildlife (ODFW) submitted a Fisheries Management and Evaluation Plan (FMEP) for the upper Willamette River spring Chinook salmon to the National Marine Fisheries Service (NMFS) in February 2001. The FMEP specifies the future management of recreational and commercial fisheries potentially affecting this listed stock in the Willamette Basin and lower Columbia River. The NMFS determined the FMEP adequately addressed all the criteria specified in the ESA listing and, as a result, take prohibitions do not apply to fishery harvest activities within the Willamette and lower Columbia Rivers, provided such fisheries are managed in accordance with the FMEP.

The objective of the FMEP is to harvest known, hatchery origin spring Chinook and other fish species in a manner that does not jeopardize the survival and recovery of listed spring Chinook in the Upper Willamette River (UWR) Evolutionary Significant Unit (ESU). All freshwater sport and commercial fisheries which affect or could potentially affect upper Willamette River spring Chinook salmon in the Willamette Basin and lower Columbia River are included in the FMEP. To accomplish this objective ODFW implemented permanent angling regulations in all streams within the Willamette River Basin and the lower Columbia River that requires the release of unmarked spring Chinook salmon. Only spring Chinook that are adipose fin-clipped will be allowed to be retained beginning in 2002. Hatchery spring Chinook released within the Willamette River basin have been mass-marked with an adipose fin-clip beginning with the 1997 brood so that hatchery fish are available for harvest.

The goal of Willamette Basin fishery management for spring chinook is to limit fishery impacts on wild fish to levels which ensure the survival and rebuilding of the population. Average impact rates equivalent to an annual average of 15% or less in combined freshwater fisheries in the Willamette Basin and lower Columbia River will achieve this goal even under the most pessimistic assumptions of wild stock productivity. A harvest rate-based strategy implicitly recognizes variable run sizes and reduces the number of fish harvested at low run sizes. This strategy is thus effective over a wide range of run size which might be expected in the foreseeable future.

Performance indicators are used to assess the status of the wild spring Chinook populations within the Willamette River Basin to determine trends in abundance, risk thresholds, and the impacts of management actions identified in the FMEP. Independent estimates or indices of numbers are available annually for each wild population. Primary fish population indicators for wild Willamette spring chinook are spawning escapement estimates from Leaburg Dam counts on the McKenzie River, North Fork Dam counts on the Clackamas River, and spawning area redd counts in the Santiam River and Middle Fork Willamette River. Secondary fish population indicators include escapement estimates of Willamette River spring Chinook to the mouth of the Columbia River, counts from Willamette Falls, and counts from the upper and lower Bennett Dams on the North Santiam River.

Fishery indicators are also included as a performance indicator used for monitoring fishery performance and regulating impacts within prescribed limits. The primary fishery indicators for

Willamette spring chinook sport fisheries are statistical catch and handle estimates in roving angler creel surveys conducted in the lower Columbia, lower Willamette, and lower Clackamas Rivers. Secondary fishery indicators include catch rate, fishing effort, and catch composition (size, age, mark rates, coded-wire tags (CWT), etc.) associated with statistical creel surveys and annual catch record card data from harvest tag returns by anglers. Fishery indicators for commercial fisheries include total landings and catch composition which is obtained by subsampling a portion of the catch at commercial fish buyer sites.

## 2021 Willamette Spring Chinook Performance Indicators

### Columbia River Mouth

Willamette spring Chinook returns have been monitored since 1946 and have displayed a wide variation in total returns (Figure 1). From 1946 to 1970 the run size was estimated to the mouth of the Willamette River. Beginning in 1971 and continuing through present day the run size has been estimated to the mouth of the Columbia River. Estimates of escapement to the mouth of the Columbia River were made by reconstructing the run using sport and commercial harvest estimates in the lower Columbia River, sport harvest estimates in the lower Willamette River, counts from Willamette Falls, escapement estimates to the Clackamas River, and estimates of sea lion predation. The largest estimate of Willamette spring Chinook returning to the Columbia River occurred in 2004 with a return of 143,700 fish while the smallest occurred in 2008 with an estimated return of 26,614 (Figure 1).

Prior to the implementation of the Willamette FMEP only a portion of the hatchery origin spring Chinook salmon were externally marked before release prohibiting the ability to distinguish between hatchery and wild fish. Beginning with the 1997 brood year (1999 release year) all hatchery origin spring Chinook released in the Willamette were marked. The first year all returning hatchery origin jack and adults were marked was 2004, after which time estimates of returning wild and hatchery spring Chinook to the mouth of the Columbia River were possible (Figure 2, Appendix 1).

The estimated number of Willamette River spring Chinook returning to the Columbia River in 2021 was 41,308 adult fish (Table 1). This estimate is similar to the previous 5-year average of 41,821 and 78% of the previous 10-year average of 52,787. An estimate of 7,812 of the 2021 Willamette adult spring Chinook returning to the mouth of the Columbia River were unmarked (i.e., no adipose fin clip), which is 73% and 70% of the previous five- and ten-year averages of 10,700 and 11,156, respectively (Table 1). The estimated number of marked spring Chinook was 33,496 adults. This estimate is 108% of the 5-year average of 31,121 adults and 80% of the 10-year average of 41,631 adults. The estimated return to the Columbia River mouth includes fish destined for the Clackamas River.

The total return was made up of 1,840 Age-3, 29,245 Age-4, 12,063 Age-5, and 0 Age-6 fish based on scale analysis and CWT returns from marked fish recovered from the lower Willamette River sport fishery (Table 2).

The 2021 preseason forecast developed by ODFW was for a total return of 52,400 spring Chinook entering the Columbia River (Figure 3, Table 2). The unmarked/wild population pre-season estimate was for approximately 27% or 14,140 fish and the marked estimate was for approximately 73% or 38,260 returns. The actual total return estimate was 43,148 fish which is 82% of the forecast with the unmarked/wild population estimate of 8,119 adults or 57% of the forecast and a marked/hatchery estimate of 35,029 or 92% of the preseason forecast.

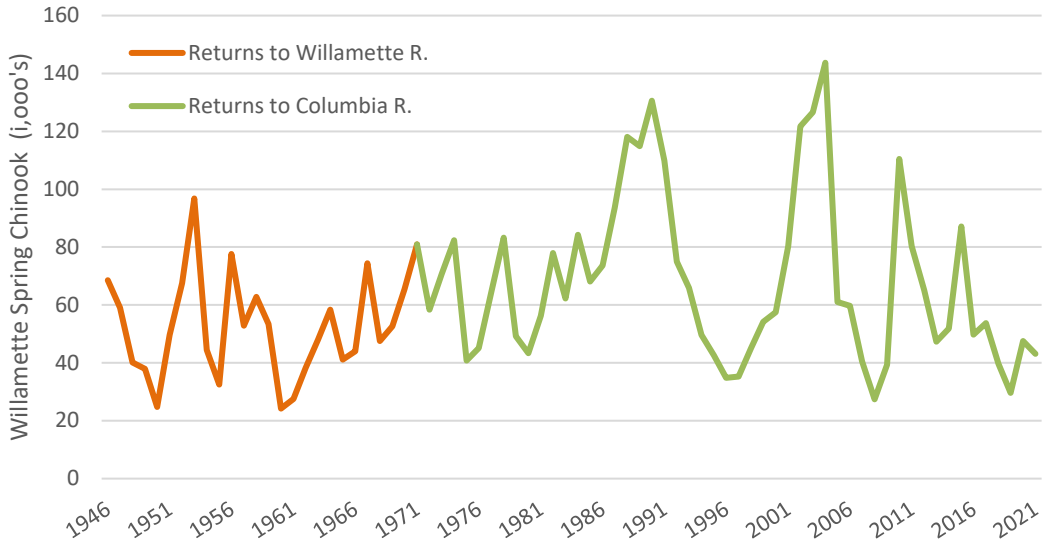


Figure 1. Historic Willamette spring Chinook return estimates, 1946-2021. From 1946 -1970 (red line) return numbers are to the mouth of the Willamette River and from 1971 – present (green line) returns are to the mouth of the Columbia River.

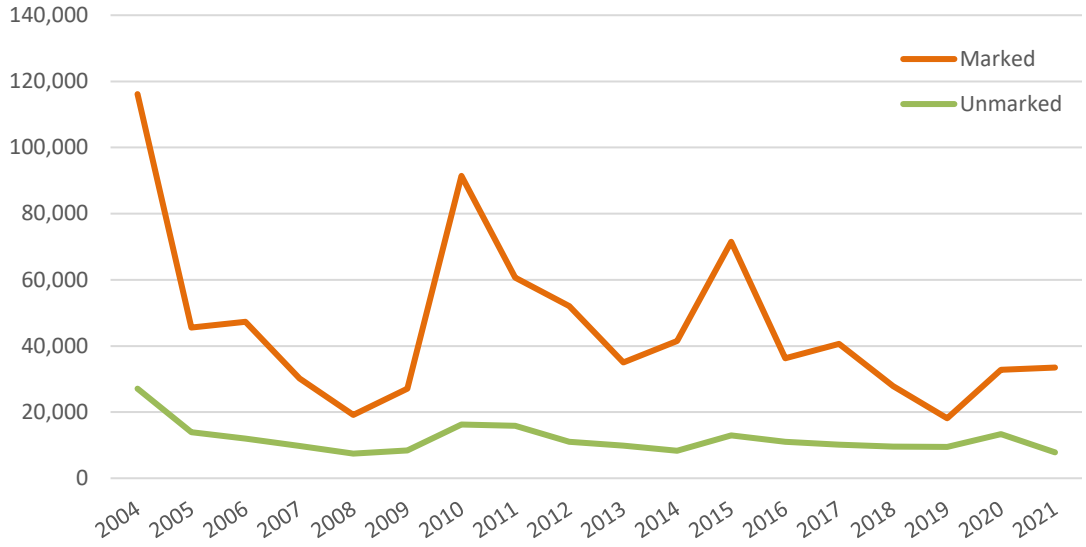


Figure 2. Estimates of adult Willamette River spring Chinook to the Columbia River, 2004 – 2021.

Table 1. Estimates of adult Willamette River spring Chinook to the Columbia River with previous five- and ten-year averages, 2011-2021.

| | HATCHERY/MARKED | | WILD/UNMARKED | | |
|---|---|---|---|---|---|
| **YEAR** | **Est. Number** | **Percent** | **Est. Number** | **Percent** | **Total** |
| **2011** | 60,662 | 79.2% | 15,887 | 20.8% | 76,549 |
| **2012** | 52,040 | 82.6% | 10,997 | 17.4% | 63,037 |
| **2013** | 34,988 | 78.0% | 9,892 | 22.0% | 44,880 |
| **2014** | 41,492 | 83.4% | 8,273 | 16.6% | 49,765 |
| **2015** | 71,525 | 84.6% | 13,007 | 15.4% | 84,532 |
| **2016** | 36,242 | 76.7% | 10,983 | 23.3% | 47,225 |
| **2017** | 40,586 | 79.9% | 10,188 | 20.1% | 50,774 |
| **2018** | 27,859 | 74.4% | 9,582 | 25.6% | 37,441 |
| **2019** | 18,131 | 65.8% | 9,437 | 34.2% | 27,568 |
| **2020** | 32,786 | 71.1% | 13,309 | 28.9% | 46,095 |
| **2021** | 33,496 | 81.1% | 7,812 | 18.9% | 41,308 |
| **5-YR. AVE.** | 31,121 | 73.6% | 10,700 | 26.4% | 41,821 |
| **10-YR. AVE** | 41,631 | 77.6% | 11,156 | 22.4% | 52,787 |

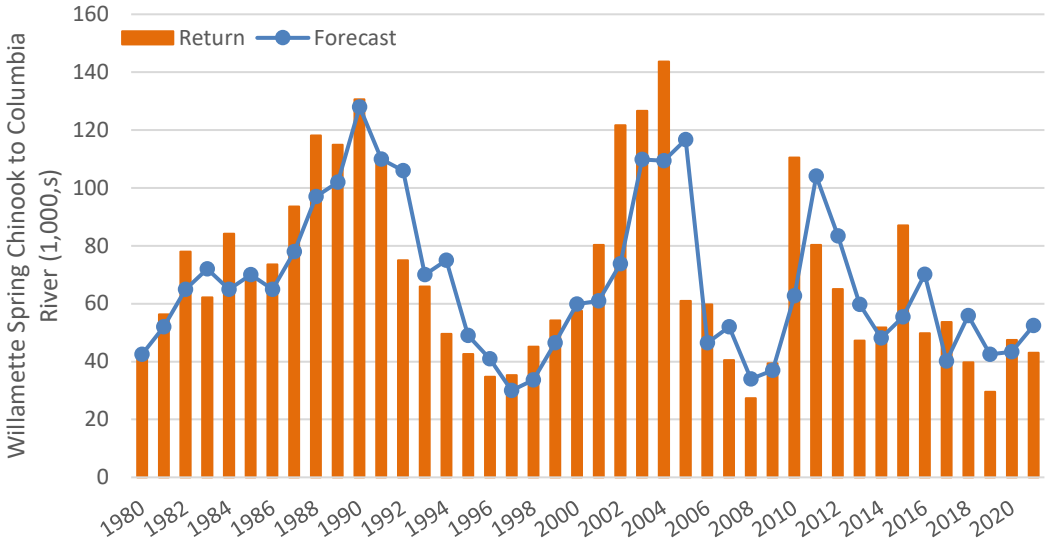


Figure 3. Predicted and observed Willamette River spring Chinook returns to the Columbia River mouth, 1980-2021.

Table 2. Forecast and reconstructed run estimates for Willamette River spring Chinook to the Columbia River mouth, 2021.

| | AGE 3 | AGE 4 | AGE 5 | AGE 6 | TOTAL |
|---|---|---|---|---|---|
| **2021 FORECAST** | 2,350 | 32,820 | 17,140 | 90 | 52,400 |
| **95% CI** | 1,030 – 3,720 | 8,190 - 69,830 | 4,310 – 32,480 | 0 - 235 | |
| **2021 RECONSTRUCTED RETURN** | 1,840 | 29,245 | 12,063 | 0 | 43,148 |

## Willamette Falls

Willamette Falls is a natural fall located at river kilometer 42 on the Willamette River and is the reference point used to demark the upper and lower Willamette River in NOAA Fisheries Evolutionary Significant Unit (ESU) designation. The falls act as a seasonal barrier to fish passage requiring most fish to use a fishway to pass above. Fish passing Willamette Falls through the fishway are counted at a viewing window which is monitored using a digital camera to record daily passage. The time-lapse recordings are reviewed to determine the species composition and daily numbers of fish passing. These counts are used to monitor trends in abundance of fish populations migrating into the upper Willamette River and to ensure that escapement goals outlined in the FMEP are achieved. The escapement goals are designed to provide for full mark-selective recreational fisheries in the Willamette River and its tributaries upstream of Willamette Falls and meet hatchery broodstock goals.

The count of spring Chinook escaping to Willamette Falls has been recorded since 1946 and has shown a wide fluctuation in recorded totals (Figure 4). The largest estimate of Willamette spring Chinook returning to the Willamette Falls occurred in 2004 with a return of 95,967 fish while the smallest occurred in 2008 with an estimated return of 14,151. The first year all returning hatchery origin jack and adults were marked was 2004, after which time estimates of returning wild and hatchery spring Chinook to the mouth of the Willamette Falls was possible (Figure 5, Appendix 2). Estimates for marked adults escaping to Willamette Falls has ranged from 8,845 to 75,876 with an average return of 27,785 ± 6,968. Estimates for unmarked adults have ranged from 4,511 to 20,091 with an average return of 8,629 ± 1,726.

In 2021 the adult escapement to Willamette Falls was 28,646 spring Chinook (Table 3). This is equivalent to the previous five-year average of 28,363 and 87% of the previous ten-year average of 33,048 (Table 3). A total of 4,511 of the 2021 adult spring Chinook at Willamette Falls were unmarked (i.e., no adipose fin clip), which is 69% and 59% of the previous five- and ten-year averages of 6,492 and 7,632, respectively. The 2021 return of marked (i.e., adipose fin clip) spring Chinook to Willamette Falls was 24,135 which is 110% of the 5-year average of 21,871 adults and 95% of the 10-year average of 25,416 adults.

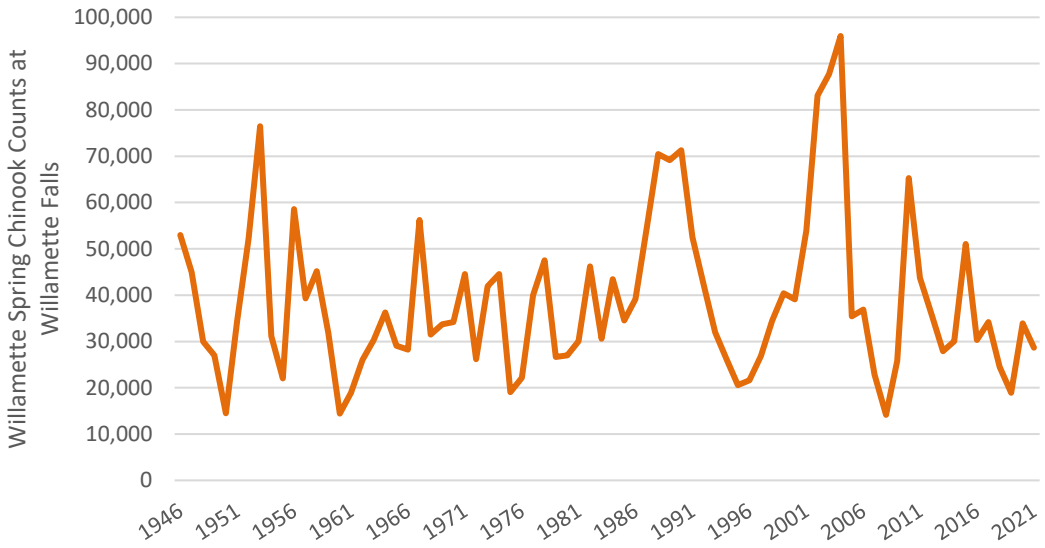


Figure 4. Historic Willamette spring Chinook escapement to Willamette Falls, 1946-2021.

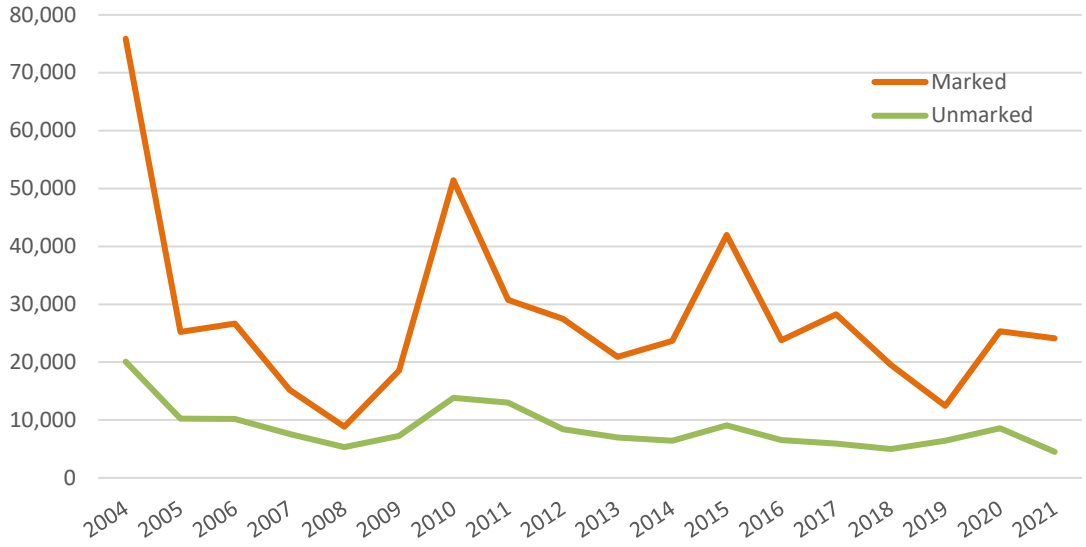


Figure 5. Estimates of adult spring Chinook to Willamette Falls, by origin, Willamette River, Oregon, 2004 – 2021.

Table 3. Estimates of adult spring Chinook to Willamette Falls with previous five- and ten-year averages, Willamette River, Oregon, 2011-2021.

| | MARKED/HATCHERY | | UNMARKED/WILD | | |
|---|---|---|---|---|---|
| **YEAR** | **Count** | **Percent** | **Count** | **Percent** | **Total** |
| **2011** | 30,737 | 70.3% | 13,011 | 29.7% | 43,748 |
| **2012** | 27,499 | 76.6% | 8,400 | 23.4% | 35,899 |
| **2013** | 20,923 | 75.0% | 6,974 | 25.0% | 27,897 |
| **2014** | 23,666 | 78.7% | 6,405 | 21.3% | 30,071 |
| **2015** | 41,979 | 82.2% | 9,065 | 17.8% | 51,044 |
| **2016** | 23,769 | 78.4% | 6,548 | 21.6% | 30,317 |
| **2017** | 28,272 | 82.7% | 5,914 | 17.3% | 34,186 |
| **2018** | 19,536 | 79.6% | 5,007 | 20.4% | 24,543 |
| **2019** | 12,455 | 66.0% | 6,428 | 34.0% | 18,883 |
| **2020** | 25,323 | 74.7% | 8,564 | 25.3% | 33,887 |
| **2021** | 24,135 | 84.3% | 4,511 | 15.7% | 28,646 |
| **5-YR. AVE.** | 21,871 | 76.3% | 6,492 | 23.7% | 28,363 |
| **10-YR. AVE** | 25,416 | 76.4% | 7,632 | 23.6% | 33,048 |

## Clackamas River

The Clackamas River is a major tributary of the Willamette River with its confluence at river kilometer 40, approximately two kilometers below Willamette Falls. While the Clackamas River is below the Willamette Falls the population of spring Chinook are defined by the National Marine Fisheries Service as part of the Upper Willamette River (UWR) Evolutionary Significant Unit (ESU). The Clackamas River is considered one of the major basins within the UWR ESU that historically produced spring Chinook. Today, the Clackamas River continues to support natural production and has a wild population that in most years exceeds critical and interim viability thresholds for abundance (ODFW 2001). The majority of the Clackamas River basin remains accessible to natural production, although a three-dam hydroelectric complex (river miles 23–31) has impacted migration and rearing conditions in the mainstem Clackamas River. Counts are available at the North Fork Dam, the uppermost of these dams, where hatchery fish are removed from the upstream population allowing only wild, unclipped fish to spawn naturally above the dam complex.

Beginning in 1999, all hatchery fish released in the Clackamas River were marked with an adipose fin clip. The first year all returning hatchery origin jack and adults were marked was 2004, after which time estimates of returning wild and hatchery spring Chinook to the Clackamas River was possible (Figure 6, Appendix 3). Both the marked and unmarked population have displayed wide variation in adult returns during this period, with the marked population decidedly so. The marked population has ranged from 192 to 21,220 and averaged 5,151 ± 2,294. The unmarked population has ranged from 617 to 5,596 with an average of 2,311 ± 588.

The estimated return to the Clackamas River in 2021 was 3,382 adult spring Chinook (Table 4). This estimate is 85% of the previous five-year average of 3,961 fish and 66% of the previous ten-year average of 5,125 adults. An estimated 2,858 adult spring Chinook escaped to the Clackamas River in 2021 were unmarked (i.e., no adipose fin clip), which is 90% of the previous five-year average of 3,164, but 116% of the 10-year average of 2,457. The estimate for marked adults was 524 returns which is 66% of the 5-year average of 798 and 20% of the 10-year average of 2,668 adults.

Age distribution was estimated for returning marked spring Chinook collected at Clackamas Hatchery, Eagle Creek, and the sport fishery using CWT recoveries and scale analysis. The age distribution was estimated as 9.4% Age-3, 53.3% Age-4, 37.3% Age-5, and 0.0% Age-6 fish (Table 5).

Counts have been conducted at the North Fork Dam on the Clackamas River since 1980 (Figure 7). During that time there has been a wide fluctuation in recorded totals ranging from 857 in 1999 to 10,207 in 2003. In 2021, a total of 3,022 adult spring Chinook were counted at the North Fork Dam (Table 6, Figure 7). These counts are approximately 88% of the previous five- and ten-year average of 3,414 and 3,450, respectively. A total of 2,857 unmarked spring Chinook were counted at the North Fork Dam which is 91% of the five-year average of 3,150 and 117% of the ten-year average of 2,436. Marked fish were either transferred to Clackamas Hatchery and used for broodstock or released in the lower river to allow for additional sport harvest opportunities. Only unmarked fish were released above the dam to spawn naturally.

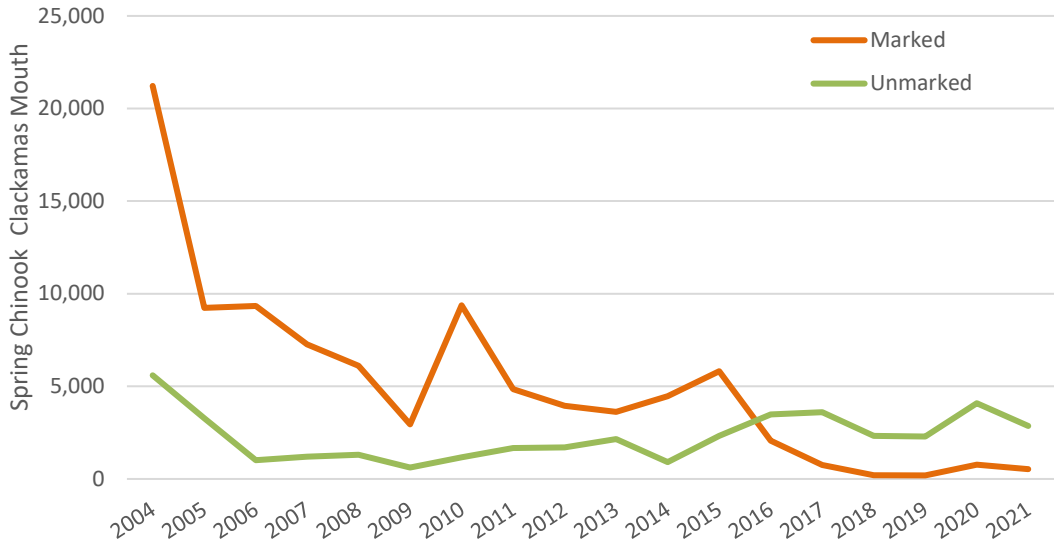


Figure 6. Estimates of adult spring Chinook returns to the Clackamas River, by origin, Clackamas River, Oregon, 2004-2021.

Table 4. Run reconstruction for adult spring Chinook, by origin, with previous five- and ten-year averages, Clackamas River, Oregon, 2011 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | Dam Count | Nat. Spawn | Rel. Mort | Total | Dam Count | Nat. Spawn | Harvest | Hatch. Returns | Total | Total Run | Percent Wild |
| **2011** | 1,637 | 21 | 15 | 1,673 | 2,593 | 34 | 488 | 1,728 | 4,843 | 6,516 | 26% |
| **2012** | 1,647 | 30 | 20 | 1,697 | 1,684 | 30 | 545 | 1,683 | 3,942 | 5,639 | 30% |
| **2013** | 2,126 | 7 | 16 | 2,149 | 1,388 | 4 | 368 | 1,870 | 3,630 | 5,779 | 37% |
| **2014** | 888 | 14 | 5 | 907 | 1,210 | 19 | 307 | 2,937 | 4,473 | 5,380 | 17% |
| **2015** | 2,310 | 5 | 6 | 2,321 | 1,944 | 4 | 412 | 3,448 | 5,808 | 8,129 | 29% |
| **2016** | 3,481 | 6 | 3 | 3,490 | 846 | 1 | 42 | 1,186 | 2,075 | 5,565 | 63% |
| **2017** | 3,586 | 6 | 17 | 3,609 | 201 | 0 | 86 | 470 | 757 | 4,366 | 83% |
| **2018** | 2,313 | 15 | 1 | 2,329 | 77 | 1 | 7 | 114 | 199 | 2,528 | 92% |
| **2019** | 2,278 | 18 | 1 | 2,297 | 52 | 2 | 0 | 138 | 192 | 2,489 | 92% |
| **2020** | 4,092 | 2 | 0 | 4,094 | 145 | 0 | 0 | 620 | 765 | 4,859 | 84% |
| **2021** | 2,857 | 0 | 1 | 2,858 | 165 | 0 | 4 | 355 | 524 | 3,382 | 85% |
| **5-YR AVE** | | | | 3,164 | | | | | 798 | 3,961 | 83% |
| **10-YR AVE.** | | | | 2,457 | | | | | 2,668 | 5,125 | 55% |

Table 5. Age distribution of marked adult and jack spring Chinook returning to the Clackamas River, Oregon, 2021.

| | NUMBER | PERCENT |
|---|---|---|
| **AGE 3** | 351 | 9.4 |
| **AGE 4** | 1,990 | 53.3 |
| **AGE 5** | 1,392 | 37.3 |
| **AGE 6** | 0 | 0.0 |
| **TOTAL** | 5,033 | |

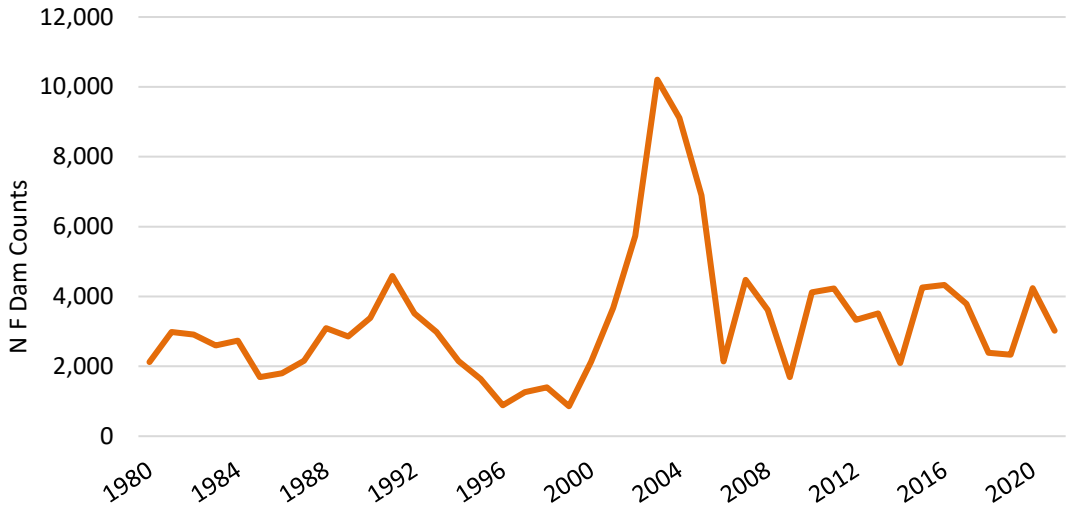


Figure 7. Historic Willamette spring Chinook escapement to North Fork Dam, Clackamas River, Oregon, 1946-2021.

Table 6. Adult spring Chinook returns to the North Fork Dam with previous five- and ten-year averages, Clackamas River, Oregon, 2011-2021

| | HATCHERY/MARKED | | WILD/UNMARKED | | |
|---|---|---|---|---|---|
| **YEAR** | **Dam Count** | **Percent** | **Dam Count** | **Percent** | **Total** |
| **2011** | 2,593 | 61% | 1,637 | 39% | 4,230 |
| **2012** | 1,684 | 51% | 1,647 | 49% | 3,331 |
| **2013** | 1,388 | 39% | 2,126 | 61% | 3,514 |
| **2014** | 1,210 | 58% | 888 | 42% | 2,098 |
| **2015** | 1,944 | 46% | 2,310 | 54% | 4,254 |
| **2016** | 846 | 20% | 3,481 | 80% | 4,327 |
| **2017** | 201 | 5% | 3,586 | 95% | 3,787 |
| **2018** | 77 | 3% | 2,313 | 97% | 2,390 |
| **2019** | 52 | 2% | 2,278 | 98% | 2,330 |
| **2020** | 145 | 3% | 4,092 | 97% | 4,237 |
| **2021** | 165 | 5% | 2,857 | 95% | 3,022 |
| **5-YR AVE** | 264 | 7% | 3,150 | 93% | 3,414 |
| **10-YR AVE** | 1,014 | 29% | 2,436 | 71% | 3,450 |

## North Santiam River

The North Santiam River is a tributary of the Santiam River which enters the Willamette River at river kilometer 174, approximately 19 river kilometers north of the city of Albany, Oregon. Historically the North Santiam River is one of the five major basins identified in the FMEP as producing UWR spring Chinook. Currently it is still considered one of the primary basins that continue to support natural production, although it most likely does not meet critical and interim

viability thresholds for abundance (ODFW 2001). With the construction of Detroit and Big Creek Dams in the 1950's over 70% of the historic spawning habitat was lost. The remaining habitat below the dams is adversely affected by warm water discharges and managed flow regulations.

Beginning in 1999, all hatchery fish released in the North Santiam River were marked with an adipose fin clip. The first year all returning hatchery origin jack and adults were marked was 2004, after which time estimates of returning wild and hatchery spring Chinook was possible. Since that time, both the marked and unmarked populations have shown high variability in annual adult returns (Figure 8, Appendix 4). Unmarked adult estimates ranged 113 in 2008 to 1,681 in 2014 and averaged 799 ± 197 annually. The marked population has shown similar variability with estimates ranging from 1,295 in 2008 to 16,068 in 2004 and averaging 5,273 ± 1,450 annually.

The estimated return of spring Chinook to the North Santiam River in 2021 was 4,030 adults (Table 7). This estimate is 76% of the previous five-year average of 5,311 adults and 65% of the previous ten-year average of 6,212 adults. The estimated number of unmarked (i.e., no adipose fin clip) adult spring Chinook returning to the North Santiam River mouth was 541 which is the lowest since 2009 (Appendix 4) and is 54% of the 5-year average of 1,007 returns and 51% of the 10-year average of 1,064. The estimated number of marked adults returning was 3,488 which is 81% of the 5-year age of 4,304 and 68% of the 10-year average of 5,147 adults.

A total of 3,629 adult spring Chinook were reported passing the upper and lower Bennett Dams in 2021 (Table 8). These counts are 75% of the previous five-year average of 4,841 fish and 66% of the previous ten-year average of 5,458 fish. A total 529 unmarked spring Chinook adults were counted at the dam which is 53% of the previous five-year average of 990 and 51% of ten-year average of 1,035. Marked counts at the Bennett Dams were 3,100 adults which is 80% of the 5-year average of 3,851 and 70% of the 10-year average of 4,423 adults. Dam counts are not available for the lower and upper Bennett Dams from 2006 – 2009 and were estimated using methods described in Oregon 2020.

Redd counts of spring Chinook salmon in the North Santiam River were not conducted by the Oregon Department of Fish and Wildlife in 2021. Counts from the previous ten years with five- and ten-year averages are presented in Table 9. The number of naturally spawning fish used in the South Santiam run reconstruction (Table 7) is an average of the previous 5-years for both 2020 and 2021.

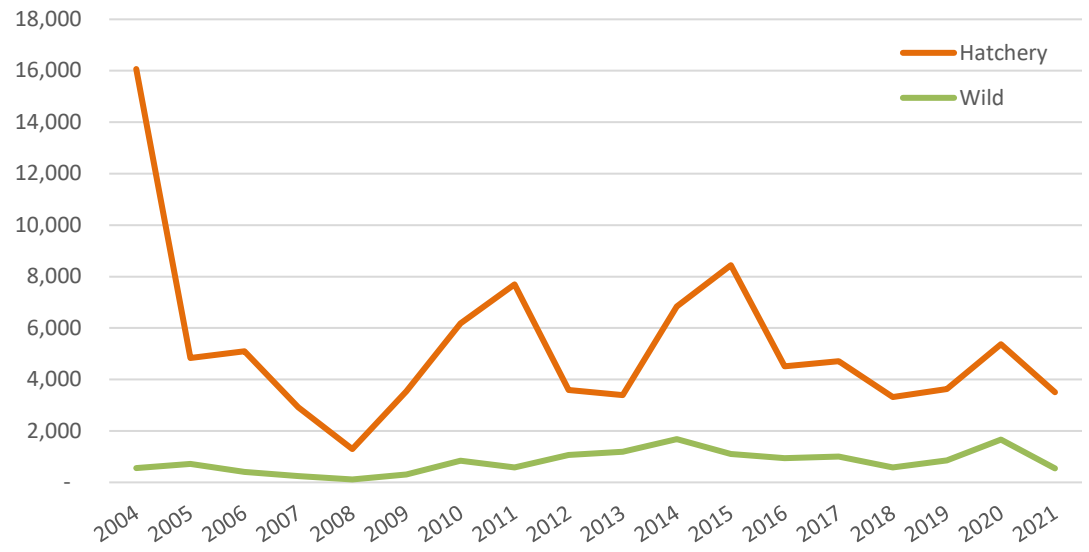


Figure 8. Estimate of adult spring Chinook escapement, by origin, to the North Santiam River, Oregon, 2004-2021.

Table 7. Run reconstruction for adult spring Chinook, by origin, with previous five- and ten-year averages, North Santiam River, Oregon, 2011 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | Dam Count | Nat. Spawn | Rel. Mort. | Total | Dam Count | Nat. Spawn | Harvest | Total | Total Run | Percent Wild |
| **2011** | 515 | 54 | 6 | 575 | 6,846 | 191 | 651 | 7,688 | 8,263 | 7.0% |
| **2012** | 1,014 | 24 | 22 | 1,059 | 2,923 | 55 | 600 | 3,578 | 4,638 | 22.8% |
| **2013** | 1,167 | 6 | 12 | 1,186 | 3,100 | 2 | 293 | 3,395 | 4,580 | 25.9% |
| **2014** | 1,630 | 9 | 42 | 1,681 | 5,421 | 11 | 1,403 | 6,835 | 8,516 | 19.7% |
| **2015** | 1,074 | 5 | 28 | 1,107 | 6,687 | 10 | 1,747 | 8,444 | 9,551 | 11.6% |
| **2016** | 921 | 5 | 14 | 940 | 3,941 | 6 | 565 | 4,512 | 5,451 | 17.2% |
| **2017** | 987 | 2 | 13 | 1,002 | 4,204 | 5 | 499 | 4,708 | 5,710 | 17.5% |
| **2018** | 573 | 4 | 7 | 583 | 3,022 | 29 | 314 | 3,365 | 3,948 | 14.9% |
| **2019** | 829 | 11 | 13 | 853 | 3,149 | 31 | 459 | 3,640 | 4,493 | 19.1% |
| **2020**[1] | 1,638 | 5 | 15 | 1,658 | 4,941 | 16 | 403 | 5,360 | 7,018 | 23.6% |
| **2021**[1] | 529 | 5 | 7 | 541 | 3,100 | 17 | 371 | 3,488 | 4,030 | 13.4% |
| **5 YR AVE** | | | | 1,007 | | | | 4,304 | 5,311 | 18.5% |
| **10 YR AVE** | | | | 1,064 | | | | 5,147 | 6,212 | 17.9% |

[1] Number of natural spawners were estimated using previous 5-year averages

Table 8. Combined adult spring Chinook counts at the lower and upper Bennett Dams with previous five- and ten-year averages, North Santiam River, Oregon, 20011-2021.

| | HATCHERY/MARKED | | WILD/UNMARKED | | |
|---|---|---|---|---|---|
| **YEAR** | **Dam Count** | **Percent** | **Dam Count[1]** | **Percent** | **Total** |
| **2011** | 6,846 | 93.0% | 515 | 7.0% | 7,361 |
| **2012** | 2,923 | 74.2% | 1,014 | 25.8% | 3,937 |
| **2013** | 3,100 | 72.7% | 1,167 | 27.3% | 4,267 |
| **2014** | 5,421 | 76.9% | 1,630 | 23.1% | 7,051 |
| **2015** | 6,687 | 86.2% | 1,074 | 13.8% | 7,761 |
| **2016** | 3,941 | 81.1% | 921 | 18.9% | 4,862 |
| **2017** | 4,204 | 81.0% | 987 | 19.0% | 5,191 |
| **2018** | 3,022 | 84.1% | 573 | 15.9% | 3,595 |
| **2019** | 3,149 | 79.2% | 829 | 20.8% | 3,978 |
| **2020** | 4,941 | 74.7% | 1,638 | 25.3% | 6,579 |
| **2021** | 3,100 | 85.4% | 529 | 14.6% | 3,629 |
| **5-YR AVE** | 3,851 | 80.1% | 990 | 19.9% | 4,841 |
| **10-YR AVE** | 4,423 | 80.3% | 1,035 | 19.7% | 5,458 |

Table 9. Redd counts of spring Chinook salmon in the North Santiam River, 2011-2021.

| **YEAR** | NORTH SANTIAM: STAYTON TO MINTO | LITTLE NORTH FORK OF THE SANTIAM | TOTAL |
|---|---|---|---|
| **2011** | 568 | -- | 568 |
| **2012** | 548 | -- | 548 |
| **2013** | 362 | -- | 362 |
| **2014** | 478 | -- | 478 |
| **2015** | 239 | -- | 239 |
| **2016** | 411 | -- | 411 |
| **2017** | 230 | -- | 230 |
| **2018** | 198 | -- | 198 |
| **2019** | 351 | -- | 351 |
| **2020[1]** | --- | -- | --- |
| **2021[2]** | --- | -- | --- |
| **5-YR AVE** | | | 298 |
| **10-YR AVE** | | | 376 |

[1]Counts were not conducted in 2020 due to wildfires.
[2]Counts not conducted in 2021.

**McKenzie River**

The McKenzie River is a major tributary of the Willamette River with its confluence at river kilometer 282 near the city of Eugene. Historically the McKenzie River was one of five basins that produced wild upper Willamette spring chinook. Today, the McKenzie River is considered to be the most important of these basins accounting for half the production potential for the UWR ESU and a wild population that exceeds critical viability thresholds for abundance and productivity (ODFW 2001). Limiting this population of spring Chinook is the loss of available habitat to two thirds of its original capacity and dam operations that reduced habitat quality due to thermal and flow effects (NMFS 2000).

Beginning with the 1997 brood year (1999 release year) all hatchery origin spring Chinook released in the Willamette basin were marked, which includes the McKenzie River. The first year all returning hatchery origin jack and adults were marked was 2004, after which time estimates of returning wild and hatchery spring Chinook to the McKenzie River were possible. Since 2004, both the marked and unmarked populations have demonstrated similar variability in annual adult returns (Figure 9, Appendix 5). The unmarked population ranged from 1,088 to 5,082 and averaged 2,458 ± 482 adults. The marked population ranged from 3,664 to 14,342 and averaged 6,187 adults ± 1,287 adults.

The 2021 estimated return to the McKenzie River was 4,989 adult spring Chinook (Table 10). This estimate is 65% of the previous 5-year average of 7,701 fish and 62% of the previous 10-year average of 8,001 fish. An estimated 1,088 returning adults were unmarked (i.e., no adipose fin clip), which is the lowest estimate since 2004 when distinguishing between hatchery and wild spring Chinook became possible. This total is approximately 54% of the previous five- and 10-year averages of 2,023 and 2,053, respectively. The estimated return of marked adults was 3,901 which is 69% of the 5-year average of 5,678 adult returns and 66% of the 10-year average of 5,949 adults returning to the McKenzie River.

Counts of spring Chinook at Leaburg Dam were not available in 2021 due to problems with video equipment. These counts are an integral part in building run reconstructions for the McKenzie River by accounting for the number of fish escaping above the McKenzie and Leaburg Hatcheries to spawn naturally. Fortunately, spawning surveys were conducted by ODFW staff above Leaburg Dam which included documenting counts and the origin of carcasses of spawned out spring Chinook as well as the number of redds encountered. The number of fish per redd was estimated using 2.5 fish/redd (Gallagher et al. 2007). The estimate of 2.5 fish per redd is supported by Boydstun and McDonald (2005) and has been used previously to estimate run size in the Sandy and Willamette basins (L. Whitman, personal communication, 1/28/2020). Using the percentage of carcasses that were recorded as marked and unmarked, the estimated total number of spring Chinook spawning naturally was separated accordingly.

Returns to McKenzie Hatchery have been greatly reduced for both the 2020 and 2021 return years due to very limited attractant water at the hatchery. This has resulted in in the need to collect broodstock from Leaburg Dam and Leaburg Hatchery to supplement the lower numbers returning to the McKenzie Hatchery. The decrease in the number of fish entering the hatchery has also coincided with increased numbers of marked fish spawning naturally below Leaburg Dam (Table 10). Spawning surveys conducted by ODFW indicate an increased number of redds per mile and a large percentage of marked carcasses observed below Leaburg Dam.

Counts of spring Chinook at Leaburg Dam on the McKenzie River have been recorded since 1990 (Figure 9). During that time there has been a wide fluctuation in recorded totals ranging from 1,176 to 9,913. The number of spring Chinook escaping to Leaburg Dam in 2021 was estimated at 1,999 adults which is 69% of the previous five-year average of 2,906 and 80% of the ten-year average of 2,504 (Table 11). An estimated 937 unmarked spring Chinook escaped to Leaburg Dam which is 50% of the previous 5-year average of 1,879 adults and 55% of the previous 10-year average of 1,717 adults, respectively (Table 11). The number of unmarked spring Chinook escaping above Leaburg Dam is less than the escapement goal of 3,000-5,000 fish specified in the McKenzie River Basin Fish Management Plan for Spring Chinook (ODFW 1998), but well above the viable salmonid population threshold of 600 UWR spring Chinook outlined in the FMEP (ODFW 2001).

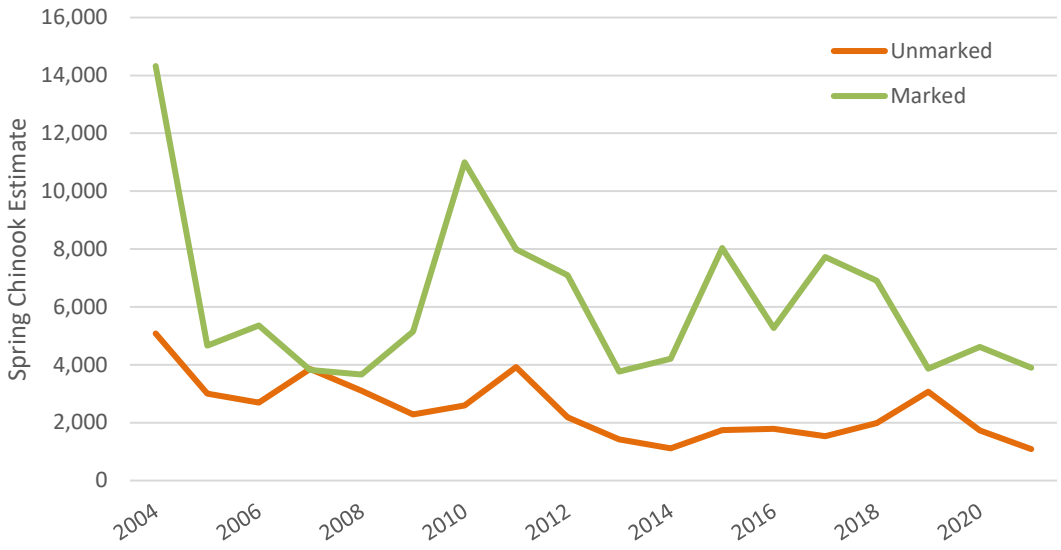


Figure 9. Estimate of adult spring Chinook returns, by origin, to the McKenzie River, Oregon, 2004-2021.

Table 10. Run reconstruction for adult spring Chinook, by origin, with previous five- and ten-year averages, McKenzie River, Oregon, 2011 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **YEAR** | **Dam Count** | **Nat. Spawn** | **Rel. Mort.** | **Total** | **Dam Count** | **Nat. Spawn** | **Harvest** | **Hatch Returns** | **Total** | **Total Run** | **Percent Wild** |
| **2011** | 2,288 | 1,562 | 77 | 3,927 | 548 | 374 | 1,289 | 5,784 | 7,995 | 11,922 | 33% |
| **2012** | 1,654 | 490 | 45 | 2,189 | 323 | 1,737 | 1,201 | 3,838 | 7,099 | 9,288 | 24% |
| **2013** | 1,236 | 158 | 28 | 1,422 | 293 | 502 | 604 | 2,367 | 3,766 | 5,188 | 27% |
| **2014** | 1,003 | 94 | 20 | 1,117 | 487 | 374 | 626 | 2,718 | 4,205 | 5,322 | 21% |
| **2015** | 1,589 | 143 | 18 | 1,749 | 1,092 | 233 | 645 | 6,070 | 8,040 | 9,788 | 18% |
| **2016** | 1,698 | 67 | 25 | 1,790 | 1,360 | 408 | 604 | 2,899 | 5,271 | 7,061 | 25% |
| **2017** | 1,477 | 33 | 19 | 1,529 | 425 | 80 | 783 | 6,442 | 7,730 | 9,258 | 17% |
| **2018** | 1,838 | 115 | 34 | 1,987 | 469 | 345 | 960 | 5,135 | 6,909 | 8,896 | 22% |
| **2019** | 2,882 | 114 | 76 | 3,072 | 1,853 | 243 | 782 | 986 | 3,864 | 6,937 | 44% |
| **2020** | 1,502 | 196 | 39 | 1,737 | 1,025 | 1,439 | 842 | 1,309 | 4,615 | 6,352 | 27% |
| **2021**[1] | 937 | 122 | 29 | 1,088 | 1,062 | 1,062 | 861 | 884 | 3,901 | 4,989 | 22% |
| **5-YEAR AVE** | | | | 2,023 | | | | | 5,678 | 7,701 | 27% |
| **10-YEAR AVE** | | | | 2,052 | | | | | 5,949 | 8,001 | 26% |

[1] Dam counts for marked and unmarked spring Chinook to Leaburg Dam were not available in 2021. Counts were estimated by expanding ODFW spawning survey redd counts.

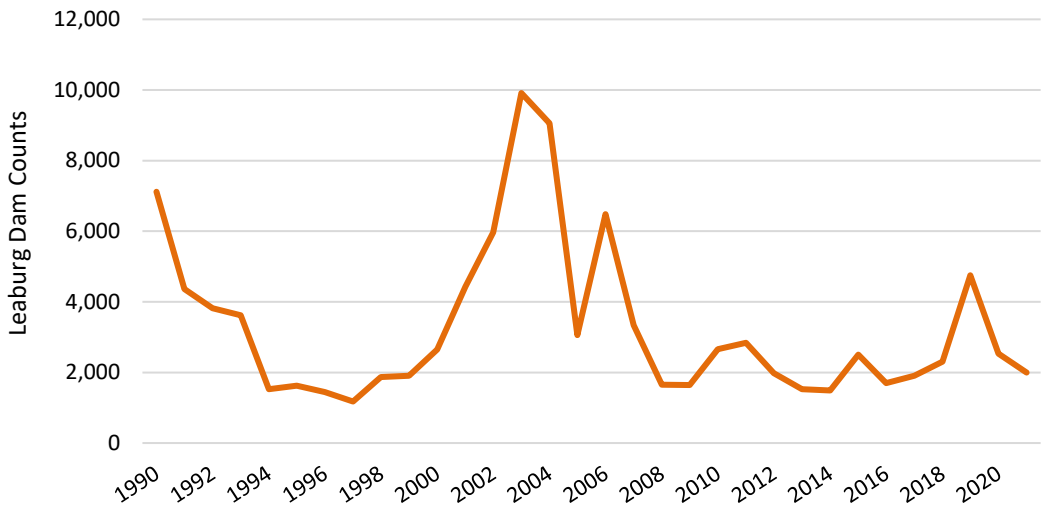


Figure 10. Spring Chinook returns to Leaburg Dam, McKenzie River, Oregon, 1990-2021.

Table 11. Adult spring Chinook counts at Leaburg Dam with previous five- and ten-year averages, McKenzie River, Oregon, 2011-2021.

| | WILD/UNMARKED | | HATCHERY/MARKED | | |
|---|---|---|---|---|---|
| **YEAR** | **Number** | **Percent** | **Number** | **Percent** | **Total** |
| **2011** | 2,288 | 81% | 548 | 19% | 2,836 |
| **2012** | 1,654 | 84% | 323 | 16% | 1,977 |
| **2013** | 1,236 | 81% | 293 | 19% | 1,529 |
| **2014** | 1,003 | 67% | 487 | 33% | 1,490 |
| **2015** | 1,589 | 59% | 1,092 | 41% | 2,681 |
| **2016** | 1,698 | 56% | 1,360 | 44% | 3,058 |
| **2017** | 1,477 | 78% | 425 | 22% | 1,902 |
| **2018** | 1,838 | 80% | 469 | 20% | 2,307 |
| **2019** | 2,882 | 61% | 1,853 | 39% | 4,735 |
| **2020** | 1,502 | 59% | 1,025 | 41% | 2,527 |
| **2021**[1] | 937 | 47% | 1,062 | 53% | 1,999 |
| **5 YR. AVE.** | 1,879 | 67% | 1,026 | 33% | 2,906 |
| **10 YR. AVE** | 1,717 | 70% | 788 | 20% | 2,504 |

[1] Counts estimated by expanding results from ODFW spawning survey redd counts.

# 2021 Fisheries Indicators

## Introduction

The Willamette FMEP, implemented in 2001, calls for mark-selective fisheries for hatchery spring Chinook. Beginning in 2001, only adipose fin-clipped spring Chinook were allowed to be retained in freshwater recreational fisheries and in 2002 freshwater commercial fisheries followed suit. All unmarked fish must be released unharmed in these fisheries. The goal of Willamette Basin fishery management for spring Chinook is to limit fishery impacts on wild fish to levels that ensure the survival and rebuilding of wild populations while providing fishery access to abundant hatchery fish. An average annual impact rate of less than 15% in combined freshwater fisheries in the Willamette Basin and lower Columbia was established to achieve this goal. The expectation for fisheries is described in detail in ODFW/WDFW February 2022 Joint Staff Report.

The majority of catch in these fisheries occurs well before the peak of migration over Willamette Falls and up the Clackamas River. This late migration precludes early updating of the run size for use in in-season management. As a result, these fisheries are managed based on preseason expectations (Figure 3, Table 2). The 2021 preseason forecast for Willamette River spring Chinook was for a total of 52,400 fish to the Columbia River mouth, 27% (14,140) of the run was expected to be of wild origin and 73% (38,260) hatchery origin (Table 2). To allocate how many fish are available for commercial and recreational harvest below Willamette Falls on a given year, the UWR FMEP developed a sliding scale allocation schedule which uses the predicted hatchery population and allocates shares (Appendix 6). For 2021, using the allocation schedule for the predicted return of 38,260 hatchery origin Willamette spring Chinook to the mouth of the Columbia River, a total of 20,000 hatchery spring Chinook was required to pass Willamette Falls and another 3,000 to the Clackamas River for a total of 23,000 fish. A projected surplus of 15,260 hatchery fish were available for harvest. The surplus was to be allocated 100% to recreational fisheries downstream of Willamette Falls including the lower Columbia River with less than 1% (< 380) of the available fish allocated to commercial fisheries in the lower Columbia River.

Standardized mortality rates for captured and released fish were established to estimate the impact the fishery has on the wild UWR spring Chinook population. For released salmon in Columbia River recreational fisheries the mortality rate is assumed to be 10%. Estimated commercial fishery release mortality rates for spring Chinook are 40% in large-mesh gill nets and 14.7% in tangle nets (ODFW/WDFW 2008). In the Willamette Basin, the estimated mortality rate for released fish in the Willamette Basin recreational fisheries is 12.2% (Lindsay et al. 2003).

Identifying Willamette River spring Chinook in the lower Columbia River fisheries is one of the challenges in determining a final impact rate. Stock separations are made by field staff monitoring the commercial and recreational harvest using the visual stock identification (VSI) method and verified by coded-wire-tag (CWT) analyses (WDF, 1990). The CWT corrected VSI stock ratio was applied to the final wild release mortality estimates in the lower Columbia River to determine the impact rates for Willamette River spring Chinook in the lower Columbia River recreational fishery.

## Lower Columbia Commercial Fishery

No spring commercial gillnetting occurred on the mainstem Columbia River in 2021. Existing Commission guidance limits the commercial upriver spring Chinook impact allocation to 20% of the non-treaty total and prioritizes use of these impacts in Select Area commercial fisheries.

## Select Area Fishery

Commercial fisheries for net-pen reared spring Chinook occurred in 2021 in Youngs Bay, Blind Slough/Knappa Slough and Tongue Point/South Channel (collectively known as the Select Area fishery). The Select Area fisheries are not mark-selective. These off-channel net pen and fishing sites are dominated by returns of local hatchery origin spring Chinook released in these areas to provide commercial fishing opportunities without having large impacts on wild stocks. A total of 6,227 Chinook were caught in 2021 winter/spring/summer Select Area commercial fisheries, including an estimated 262 adult Willamette spring Chinook. Catch rates for the lower Columbia River sport fishery were used as a surrogate to estimate the percent of the Willamette River spring Chinook that were captured in the Select Area Fisheries that were wild origin. Using this information, an estimated 11% of the adult Willamette spring Chinook catch in the Select Area fishery was comprised of wild/unmarked fish which resulted in an estimated mortality of 30 fish in 2021 (Table 12).

## Lower Columbia Recreational Fishery

The 2021 lower Columbia River recreational spring Chinook fishery was open under mark-selective, adipose fin-clipped-only regulations. The fishery was managed under a pre-season forecast of 143,200 fish to the mouth of the Columbia River which included 50,000 adult spring Chinook destined for the Willamette River. The sport fishery was open seven days per week during the months of January and February under permanent regulations with a two fish bag limit from Buoy 10 to the I-5 Bridge. The season was extended from March 1–April 4 for the lower Columbia River between Buoy 10 and Beacon Rock, plus the Oregon and Washington banks between Beacon Rock and Bonneville Dam. A boat angling closure around the mouth of the Cowlitz River was implemented to provide conservation for that stock. The two-fish daily bag limit was modified to one adult spring Chinook effective March 1. A second extension adopted for an additional 19 fishing days during May 21-23, May 29, and June 1-15 from Tongue Point upstream to Bonneville Dam with the continued closure at the mouth of the Cowlitz River. The final catch in the 2021 recreational fishery below Bonneville Dam through June 15 was 6,813 adult spring Chinook (5,385 kept and 1,428 released) from 67,219 angler trips (ODFW/WDFW 2022).

Catch estimates are derived from creel surveys on the Columbia River below Bonneville Dam. Of the 2021 catch in the lower Columbia River an estimated 1,073 adipose fin-clipped adult Willamette spring Chinook were retained and 140 adult Willamette spring Chinook were released. Applying the standard post release mortality rate for the lower Columbia River of 10%, the estimated mortality for unmarked Willamette spring Chinook was 14 adult fish (Table 12).

## Lower Willamette Recreational Fishery

The 2021 lower Willamette River (below Willamette Falls) opened for retention of spring Chinook seven days per week the entire year. This was the twentieth consecutive year of full implementation of a mark-selective spring Chinook fishery. Partial-season mark-selective fisheries occurred in 2000 and 2001.

ODFW Research and District staff conducted a study of post-release mortality of Chinook in the lower Willamette recreational fishery during 1998-2000 (Lindsay et al. 2003). Estimates of hooking mortality by anatomical hook locations were made from catch and release of recreational caught fish immediately below Willamette Falls and compared to uncaught fish in a control situation from a trap in the Willamette Fall's fishway. Concurrently, ODFW sport fish samplers in the lower Willamette recreational fishery noted anatomical hooking locations from landed Chinook. Applying the estimates of hooking mortality rates made at Willamette Falls to the distribution of hook locations in the recreational fishery provided an estimated 12.2% catch-and-release hooking mortality in the lower Willamette River recreational fishery. The 12.2% rate has been used to estimate the fishery impact on released fish in the lower Willamette River, upper Willamette, and Willamette tributary recreational fisheries since 2002.

Catch estimates are derived from angler creel surveys with all unmarked fish released by anglers assumed to be wild fish. The effect of unmarked hatchery fish being included in this group has not yet been analyzed. An estimated 76,802 angler trips were made to catch 7,382 adult spring Chinook in 2021. A total of 6,259 (85%) were kept adipose fin clipped adults and 1,123 (15%) were released unmarked adults. Applying the standard post release mortality rate for the Willamette River of 12.2%, the mortality of Willamette wild adult spring Chinook was estimated at 137 adult fish (Table 12).

## Clackamas Recreational Fishery

The lower Clackamas River fishery was open to salmon angling seven days per week the entire year, catch limits were consistent with the lower Willamette River recreational fishery. Catch estimates are derived from angler creel surveys with all unmarked fish released by anglers assumed to be wild origin. There were an estimated 16 spring Chinook caught in the 2021 lower Clackamas River recreational fishery from 282 anglers. A total of 4 (25%) spring Chinook were kept adipose fin-clipped adults and 12 (75%) were released unmarked adults. Applying the standard post release mortality rate for the Willamette River and its tributaries of 12.2%, the mortality of adult Clackamas wild spring Chinook was estimated at 1 fish (Table 12).

## Upper Willamette Mainstem Recreational Fishery

The 2021 upper Willamette mainstem recreational fishery (from Willamette Falls upstream to the mouth of the McKenzie River) was restricted to retention of adipose fin-clipped Chinook the entire year. This fishery was open seven days per week with regulations consistent with the lower Willamette River. Participation in the recreational fishery in the upper Willamette is typically much less than what is witnessed in the lower Willamette.

The recreational fisheries above Willamette Falls have not been sampled for harvest since 2004 which makes estimating the impacts to wild fish above Willamette Falls problematic. To estimate wild impacts, encounter rates of hatchery fish in these fisheries have been used as a surrogate for wild fish. Harvest data derived from angler harvest cards were used to calculate hatchery impact rates which were then applied to the estimated number of unmarked fish returning to each basin. The resultant product was then multiplied by the standard mortality rate for the Willamette River (12.2%) to estimate wild impacts. Because this method calculates the number of wild fish released based on encounter rates, the estimate should not be influenced by unmarked hatchery fish being counted in the catch, as is the case with estimates generated by creel surveys. Key assumptions for this method are that the encounter rates for hatchery and wild fish in the fishery are equivalent and angler harvest cards provide an accurate accounting of the number of fish harvested, both of which are untested at this time.

The estimated 2021 catch of adult spring Chinook in the mainstem Willamette River above Willamette Falls was 435 fish (Table 12). Of the total, 386 (89%) were estimated to be kept adipose fin-clipped adults and 49 (11%) were released unmarked adults. Applying the standard post release mortality rate for the Willamette River of 12.2%, the estimated mortality of wild spring Chinook from the 2021 sport fishery in the upper Willamette was 6 adults (Table 12).

**Upper Willamette Tributary Recreational Fishery**

All tributary recreational fisheries in the Willamette Basin have been restricted to retention of adipose fin-clipped spring Chinook since 2002. In 2021, the North Santiam fishery was open from Jan 1 – August 31 and October 15 – December 31 for hatchery, adipose fin-clipped Chinook salmon while the McKenzie River was open all year for hatchery, adipose fin-clipped Chinook. Angler surveys are not conducted in these areas so estimates of impacts on Willamette wild spring Chinook in the North Santiam and McKenzie rivers were made using methods described for the upper Willamette mainstem recreational fishery.

The estimated 2021 catch of spring Chinook in the North Santiam River was 428 adult fish (Table 12). Of the total 371 (87%) were kept adipose fin-clipped and 57 (13%) were released unclipped fish. Applying the standard post release mortality rate of 12.2%, the estimated mortality of wild spring Chinook in the North Santiam was 7 fish (Table 12).

The estimated 2021 catch of spring Chinook in the McKenzie River was 1,099 adult fish (Table 12). Of the total 861 (78%) were kept adipose fin-clipped and 238 (22%) were released unmarked fish. The estimated mortality of wild spring Chinook in the McKenzie River was 29 adult fish (Table 12).

Table 12. 2021 adult Willamette spring Chinook freshwater catches and impacts on wild fish returns.

| Fishery | Catch | | Wild Mortalities [1] | Percent Impact on Wild Return [2] |
|---|---|---|---|---|
| | Kept | Released | | |
| Select Area Commercial | 262 | 0 | 30 | 0.38% |
| Lower Columbia Recreational | 1,073 | 140 | 14 | 0.18% |
| Lower Willamette Recreational | 6,259 | 1,123 | 137 | 1.75% |
| | 7,594 | 1,263 | 181 | 2.31% |
| Clackamas Recreational | 4 | 12 | 1 | 0.01% |
| Upper Willamette Recreational | 386 | 49 | 6 | 0.08% |
| North Santiam Recreational | 371 | 57 | 7 | 0.09% |
| McKenzie Recreational | 861 | 238 | 29 | 0.37% |
| | 1,622 | 356 | 43 | 0.55% |
| Totals by Population | | | | |
| Clackamas | | | | 2.33% |
| North Santiam | | | | 2.48% |
| McKenzie | | | | 2.76% |

*[1] Estimated release mortality rates are 10% in the lower Columbia recreational fisheries and 12.2% in the Willamette and tributary recreational fisheries. Release mortalities for commercial fisheries vary by gear type used (14.7% and 40%).*

*[2] Aggregate wild return estimated at 7,812 adults at the mouth of the Columbia River (18.9%) of the total 2021 Willamette spring Chinook adult run of 41,308. Wild return to the Clackamas River estimated at 2,874 adults (85.0%) of the 3,382 Clackamas adult return.*

# 2021 Total Wild Impacts

The goal of Willamette Basin fishery management for spring Chinook is to limit fishery impacts on wild fish to an average annual impact rate of less than 15% in the Willamette Basin and lower Columbia Rivers. For 2021, the impact from the combined Columbia and Willamette freshwater fishery was 3.0% (Table 13). This is the second lowest impact rate during the past 10 years, with only 2016 with a 2.8% impact rate lower. The lower Willamette recreational fishery had the highest wild impact rate in 2021 with 1.8%, which represents 60% of the total. The average impacts over the last ten years indicates that the lower Columbia River commercial and lower Willamette recreational fishery account for most of the wild impacts on the Willamette River spring Chinook population with a combined total impact rate of 77% of the total. The total impact rates for the three primary tributaries remained low in 2021 with the Clackamas, North Santiam, and McKenzie Rivers of 3.7%, 3.9% and 4.1%, respectively (Table 13). The majority of the impacts to these populations are occurring outside the tributaries as the in-river impact rates are low (0.0%, 0.1%, 0.4% for the Clackamas, North Santiam, and McKenzie Rivers, respectively). The Clackamas River has seen very little fishing pressure with the collapse of the hatchery spring Chinook run which has resulted in low or no impact on the wild population. Of the three tributaries the McKenzie has the most angling pressure which is evidenced by the higher impact rates.

The estimated number of wild adult Willamette spring Chinook returning to the mouth of the Columbia River is used to calculate the wild impact rates for the Willamette and lower Columbia fisheries. This rate is calculated by combining escapement to Willamette Falls and the Clackamas River and adding estimated mortality from the lower Willamette and Columbia Rivers (Table 14). For 2021 the estimated number of wild adult Willamette spring Chinook to the mouth of the Columbia River was 7,812. This is the lowest total estimate over the last ten years and represents a 41% decrease from the 2021 total of 13,278 (Table 14).

Estimates of wild fish handled in fisheries where catch is estimated by creel surveys (or observer programs) are derived by assuming that 100% of released fish are wild. Calculating the true number of wild fish handled by such fisheries is confounded by the presence of a small number of unmarked hatchery fish, which would be counted as wild. This would cause the handle and mortality of wild fish to be slightly overestimated and would also slightly overestimate the abundance of wild fish. Whether these two effects cancel each other out, result in additive errors, or cause directional bias has not been evaluated.

Table 13. Freshwater fishery percent impact on wild Willamette River spring Chinook, 2011-2021.

| FISHERY | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | AVERAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **L. COL. COMMERCIAL [1]** | 1.9 | 1.6 | 3.1 | 1.4 | 1.3 | 0.8 | 0.9 | 0.9 | 1.3 | 1.6 | 0.4 | **1.5** |
| **L. COL. RECREATIONAL** | 0.3 | 0.6 | 0.3 | 0.5 | 0.3 | 0.2 | 0.1 | 0.3 | 0.1 | 0.1 | 0.2 | **0.3** |
| **L. WILLAMETTE** | 2.7 | 2.8 | 1.6 | 2.0 | 1.6 | 1.3 | 1.5 | 1.6 | 2.3 | 1.7 | 1.8 | **1.9** |
| **CLACKAMAS** | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | **0.1** |
| **U. WILLAMETTE** | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | **0.1** |
| **N. SANTIAM** | 0.1 | 0.2 | 0.1 | 0.5 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | **0.2** |
| **MCKENZIE** | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.8 | 0.2 | 0.4 | **0.3** |
| ***TOTAL*** | ***5.7*** | ***5.9*** | ***5.7*** | ***4.8*** | ***3.7*** | ***2.8*** | ***3.1*** | ***3.3*** | ***4.8*** | ***3.8*** | ***3.0*** | ***4.4*** |
| | | | | | | | | | | | | |
| **TOTALS BY POPULATION** | | | | | | | | | | | | |
| **CLACKAMAS** | 5.0 | 5.2 | 5.1 | 4.0 | 3.2 | 2.3 | 2.6 | 2.8 | 3.7 | 3.4 | 2.3 | **3.7** |
| **NORTH SANTIAM** | 5.1 | 5.3 | 5.1 | 4.5 | 3.4 | 2.5 | 2.7 | 2.9 | 4.0 | 3.6 | 2.5 | **3.9** |
| **MCKENZIE** | 5.5 | 5.6 | 5.3 | 4.2 | 3.3 | 2.6 | 2.8 | 3.1 | 4.6 | 3.7 | 2.8 | **4.1** |

*[1] Includes mainstem commercial and SAFE salmon fisheries through 2016. Beginning in 2017 includes SAF fisheries only.*

Table 14. Run reconstructions for wild, adult Willamette River adult spring Chinook, 2011-2021.

| | Escapement | | Mortality Below Falls | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Willamette Falls | Clackamas R. | Sea Lion | Pre-Spawn | Willamette Fishery | L. Columbia Fishery | Commercial | Total Columbia River Return |
| 2011 | 13,011 | *1,791* | 276 | 26 | 434 | 44 | 305 | 15,887 |
| 2012 | 8,400 | 1,871 | 143 | 27 | 310 | 67 | 178 | 10,997 |
| 2013 | 6,974 | 2,258 | 138 | 31 | 157 | 27 | 306 | 9,892 |
| 2014 | 6,405 | 946 | 571 | 29 | 169 | 38 | 115 | 8,273 |
| 2015 | 9,065 | 2,467 | 920 | 115 | 226 | 39 | 175 | 13,007 |
| 2016 | 6,548 | 3,488 | 639 | 54 | 142 | 19 | 92 | 10,983 |
| 2017 | 5,914 | 3,603 | 375 | 46 | 150 | 9 | 90 | 10,188 |
| 2018 | 5,007 | 2,329 | 1,931 | 51 | 151 | 28 | 85 | 9,582 |
| 2019 | 6,429 | 2,297 | 249 | 19 | 210 | 12 | 123 | 9,340 |
| 2020 | 8,564 | 4,094 | 150 | 25 | 224 | 10 | 211 | 13,278 |
| 2021 | 4,511 | 2,874 | 217 | 29 | 137 | 14 | 39 | 7,812 |

## 2021 Angler Compliance with Regulations

Oregon State Police (OSP) Fish and Wildlife Division officers and their volunteers, with assistance from ODFW fish checkers and commercial fishery observers, enforce Willamette spring Chinook angling regulations. A priority task is enforcement of the regulation requiring release of non-adipose-fin-clipped spring Chinook in recreational fisheries. In 2021, the 2-rod validation was approved by the Oregon Fish Commission and was available for anglers to purchase. Compliance in both the sport and commercial fisheries was relatively high again in 2021.

## Outlook for 2022 Willamette Spring Chinook Management

The 2022 Willamette spring Chinook run size forecast is for a total run of 52,918 fish, including 13,828 (~26%) unmarked and 39,090 (~74%) marked fish. The forecast includes 1,740 age-3, 34,962 age-4, 16,109 age-5, and 107 age-6 fish. In December 2001, the Oregon Fish and Wildlife Commission established a long-term allocation plan between the lower Columbia commercial fishery and the recreational fishery below Willamette Falls (including the lower Columbia River) for sharing of the harvestable surplus of Willamette River hatchery spring Chinook (Appendix 6). Harvestable surplus is calculated by subtracting the hatchery allocation goals from the total forecasted hatchery component of the run. For 2022, based on a forecast of 39,090 hatchery origin returns of UWR spring Chinook forecasted to the Columbia River the escapement goals to Willamette Falls and the Clackamas River are 20,000 and 3,000, respectively. This results in a harvestable surplus of 16,090 which is allocated 100% to the sport harvest and <1% for incidental take in other fisheries (Appendix 6).

Mainstem and tributary spring Chinook fisheries will continue to be mark-selective for adipose fin-clipped fish in 2022. All Willamette Basin recreational fisheries are restricted to adipose fin-clipped fish under permanent rule and regulations are printed as such in the *2022 Oregon Sport Fishing Regulations* pamphlet.

The cumulative freshwater fishery impact on Willamette wild spring Chinook is expected to be below the maximum impact rate of 15% specified in the FMEP.

ODFW
February 2022

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# Appendices

Appendix 1. Estimates of Willamette River spring Chinook to the Columbia River mouth with averages, 95% confidence intervals (95% CI), and coefficient of variation (CV) for marked and unmarked adults, 2004-2021.

| | HATCHERY/MARKED | | WILD/UNMARKED | | |
|---|---|---|---|---|---|
| **YEAR** | **Est. Number** | **Percent** | **Est. Number** | **Percent** | **Total** |
| **2004** | 116,151 | 81.1% | 27,091 | 18.9% | 143,242 |
| **2005** | 45,529 | 76.6% | 13,942 | 23.4% | 59,471 |
| **2006** | 47,324 | 79.8% | 11,988 | 20.2% | 59,311 |
| **2007** | 30,187 | 75.6% | 9,756 | 24.4% | 39,943 |
| **2008** | 19,160 | 72.0% | 7,453 | 28.0% | 26,614 |
| **2009** | 27,062 | 76.4% | 8,370 | 23.6% | 35,432 |
| **2010** | 91,465 | 84.9% | 16,210 | 15.1% | 107,675 |
| **2011** | 60,662 | 79.2% | 15,887 | 20.8% | 76,549 |
| **2012** | 52,040 | 82.6% | 10,997 | 17.4% | 63,037 |
| **2013** | 34,988 | 78.0% | 9,892 | 22.0% | 44,880 |
| **2014** | 41,492 | 83.4% | 8,273 | 16.6% | 49,765 |
| **2015** | 71,525 | 84.6% | 13,007 | 15.4% | 84,532 |
| **2016** | 36,242 | 76.7% | 10,983 | 23.3% | 47,225 |
| **2017** | 40,586 | 79.9% | 10,188 | 20.1% | 50,774 |
| **2018** | 27,859 | 74.4% | 9,582 | 25.6% | 37,441 |
| **2019** | 18,131 | 65.8% | 9,437 | 34.2% | 27,568 |
| **2020** | 32,786 | 71.1% | 13,309 | 28.9% | 46,095 |
| **2021** | 33,496 | 81.1% | 7,812 | 18.9% | 41,308 |
| **AVERAGE** | 45,927 | | 11,899 | | |
| **95% CI** | 11,381 | | 2,064 | | |

Appendix 2. Estimates of adult Willamette River spring Chinook to Willamette Falls with averages, 95% confidence intervals (95% CI), and coefficient of variation (CV) for marked and unmarked adults, 2004-2021.

| | MARKED/HATCHERY | | UNMARKED/WILD | | |
|---|---|---|---|---|---|
| **YEAR** | **Count** | **Percent** | **Count** | **Percent** | **Total** |
| **2004** | 75,876 | 79.1% | 20,091 | 20.9% | 95,967 |
| **2005** | 25,233 | 71.2% | 10,220 | 28.8% | 35,453 |
| **2006** | 26,655 | 72.3% | 10,196 | 27.7% | 36,851 |
| **2007** | 15,233 | 66.8% | 7,585 | 33.2% | 22,818 |
| **2008** | 8,845 | 62.5% | 5,306 | 37.5% | 14,151 |
| **2009** | 18,549 | 71.9% | 7,246 | 28.1% | 25,795 |
| **2010** | 51,447 | 78.8% | 13,846 | 21.2% | 65,293 |
| **2011** | 30,737 | 70.3% | 13,011 | 29.7% | 43,748 |
| **2012** | 27,499 | 76.6% | 8,400 | 23.4% | 35,899 |
| **2013** | 20,923 | 75.0% | 6,974 | 25.0% | 27,897 |
| **2014** | 23,666 | 78.7% | 6,405 | 21.3% | 30,071 |
| **2015** | 41,979 | 82.2% | 9,065 | 17.8% | 51,044 |
| **2016** | 23,769 | 78.4% | 6,548 | 21.6% | 30,317 |
| **2017** | 28,272 | 82.7% | 5,914 | 17.3% | 34,186 |
| **2018** | 19,536 | 79.6% | 5,007 | 20.4% | 24,543 |
| **2019** | 12,455 | 66.0% | 6,428 | 34.0% | 18,883 |
| **2020** | 25,323 | 74.7% | 8,564 | 25.3% | 33,887 |
| **2021** | 24,135 | 84.3% | 4,511 | 15.7% | 28,646 |
| **AVERAGE** | 27,785 | | 8,629 | | |
| **95% CI** | 6,968 | | 1,726 | | |

Appendix 3. Run reconstruction for adult spring Chinook by origin with averages, 95% confidence intervals (95% CI), and coefficient of variation (CV), Clackamas River, Oregon, 2004 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | Dam Count | Nat. Spawn | Rel. Mort | Total | Dam Count | Nat. Spawn | Harvest | Hatch. Returns | Total | Total Run | Percent Wild |
| **2004** | 5,176 | 390 | 30 | 5,596 | 7,854 | 592 | 1,379 | 11,395 | 21,220 | 26,816 | 21% |
| **2005** | 2,882 | 350 | 38 | 3,270 | 2,914 | 353 | 1,254 | 4,714 | 9,235 | 12,505 | 26% |
| **2006** | 798 | 205 | 14 | 1,017 | 1,339 | 345 | 404 | 7,247 | 9,335 | 10,352 | 10% |
| **2007** | 1,178 | 13 | 7 | 1,198 | 3,302 | 36 | 205 | 3,732 | 7,275 | 8,473 | 14% |
| **2008** | 1,276 | 25 | 11 | 1,312 | 2,336 | 47 | 202 | 3,522 | 6,107 | 7,419 | 18% |
| **2009** | 590 | 20 | 7 | 617 | 1,101 | 37 | 207 | 1,609 | 2,954 | 3,571 | 17% |
| **2010** | 1,140 | 12 | 12 | 1,164 | 2,976 | 33 | 710 | 5,664 | 9,383 | 10,547 | 11% |
| **2011** | 1,637 | 21 | 15 | 1,673 | 2,593 | 34 | 488 | 1,728 | 4,843 | 6,516 | 26% |
| **2012** | 1,647 | 30 | 20 | 1,697 | 1,684 | 30 | 545 | 1,683 | 3,942 | 5,639 | 30% |
| **2013** | 2,126 | 7 | 16 | 2,149 | 1,388 | 4 | 368 | 1,870 | 3,630 | 5,779 | 37% |
| **2014** | 888 | 14 | 5 | 907 | 1,210 | 19 | 307 | 2,937 | 4,473 | 5,380 | 17% |
| **2015** | 2,310 | 5 | 6 | 2,321 | 1,944 | 4 | 412 | 3,448 | 5,808 | 8,129 | 29% |
| **2016** | 3,481 | 6 | 3 | 3,490 | 846 | 1 | 42 | 1,186 | 2,075 | 5,565 | 63% |
| **2017** | 3,586 | 6 | 17 | 3,609 | 201 | 0 | 86 | 470 | 757 | 4,366 | 83% |
| **2018** | 2,313 | 15 | 1 | 2,329 | 77 | 1 | 7 | 114 | 199 | 2,528 | 92% |
| **2019** | 2,278 | 18 | 1 | 2,297 | 52 | 2 | 0 | 138 | 192 | 2,489 | 92% |
| **2020** | 4,092 | 2 | 0 | 4,094 | 145 | 0 | 0 | 620 | 765 | 4,859 | 84% |
| **2021** | 2,857 | 0 | 1 | 2,858 | 165 | 0 | 4 | 355 | 524 | 3,382 | 85% |
| **AVERAGE** | | | | 2,311 | | | | | 5,151 | | |
| **95% CI** | | | | 588 | | | | | 2,294 | | |

Appendix 4. Run reconstruction for adult spring Chinook by origin with averages, 95% confidence intervals (95% CI), and coefficient of variation (CV), North Santiam River, Oregon, 2004 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | Dam Count | Nat. Spawn | Rel. Mort. | Total | Dam Count | Nat. Spawn | Harvest | Total | Total Run | Percent Wild |
| **2004** | 489 | 17 | 48 | 553 | 13,042 | 53 | 2,973 | 16,068 | 16,621 | 3.3% |
| **2005** | 667 | 46 | 8 | 721 | 4,215 | 175 | 448 | 4,838 | 5,559 | 13.0% |
| **2006** | 372 | 30 | 7 | 409 | 4,306 | 113 | 673 | 5,092 | 5,500 | 7.4% |
| **2007** | 210 | 35 | 4 | 249 | 2,432 | 131 | 356 | 2,919 | 3,168 | 7.9% |
| **2008** | 110 | 3 | 0 | 113 | 1,270 | 13 | 12 | 1,295 | 1,408 | 8.1% |
| **2009** | 245 | 59 | 5 | 309 | 2,828 | 210 | 503 | 3,541 | 3,850 | 8.0% |
| **2010** | 744 | 87 | 13 | 844 | 5,065 | 308 | 807 | 6,180 | 7,024 | 12.0% |
| **2011** | 515 | 54 | 6 | 575 | 6,846 | 191 | 651 | 7,688 | 8,263 | 7.0% |
| **2012** | 1,014 | 24 | 22 | 1,059 | 2,923 | 55 | 600 | 3,578 | 4,638 | 22.8% |
| **2013** | 1,167 | 6 | 12 | 1,186 | 3,100 | 2 | 293 | 3,395 | 4,580 | 25.9% |
| **2014** | 1,630 | 9 | 42 | 1,681 | 5,421 | 11 | 1,403 | 6,835 | 8,516 | 19.7% |
| **2015** | 1,074 | 5 | 28 | 1,107 | 6,687 | 10 | 1,747 | 8,444 | 9,551 | 11.6% |
| **2016** | 921 | 5 | 14 | 940 | 3,941 | 6 | 565 | 4,512 | 5,451 | 17.2% |
| **2017** | 987 | 2 | 13 | 1,002 | 4,204 | 5 | 499 | 4,708 | 5,710 | 17.5% |
| **2018** | 573 | 4 | 7 | 583 | 3,022 | 29 | 314 | 3,365 | 3,948 | 14.9% |
| **2019** | 829 | 11 | 13 | 853 | 3,149 | 31 | 459 | 3,640 | 4,493 | 19.1% |
| **2020** | 1,638 | 6 | 15 | 1,659 | 4,941 | 22 | 403 | 5,366 | 7,025 | 23.6% |
| **2021** | 529 | 7 | 7 | 543 | 3,100 | 27 | 371 | 3,498 | 4,041 | 13.4% |
| **AVERAGE** | | | | 799 | | | | 5,273 | | |
| **95% CI** | | | | 197 | | | | 1,450 | | |

Appendix 5. Run reconstruction for adult spring Chinook by origin with averages, 95% confidence intervals (95% CI), and coefficient of variation (CV), McKenzie River, Oregon, 2004 – 2021.

| | WILD/UNMARKED | | | | HATCHERY/MARKED | | | | | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **YEAR** | **Dam Count** | **Nat. Spawn** | **Rel. Mort.** | **Total** | **Dam Count** | **Nat. Spawn** | **Harvest** | **Hatch Returns** | **Total** | **Total Run** | **Percent Wild** |
| **2004** | 4,419 | 426 | 237 | 5,082 | 4,615 | 445 | 2,683 | 6,581 | 14,324 | 19,406 | 26% |
| **2005** | 2,435 | 519 | 52 | 3,006 | 659 | 141 | 655 | 3,213 | 4,668 | 7,674 | 39% |
| **2006** | 2,189 | 438 | 67 | 2,694 | 981 | 196 | 1,086 | 3,092 | 5,355 | 8,049 | 33% |
| **2007** | 2,757 | 1,032 | 70 | 3,859 | 558 | 209 | 567 | 2,485 | 3,819 | 7,678 | 50% |
| **2008** | 1,365 | 1,742 | 2 | 3,109 | 290 | 370 | 16 | 2,988 | 3,664 | 6,773 | 46% |
| **2009** | 1,185 | 1,059 | 43 | 2,287 | 460 | 411 | 796 | 3,477 | 5,144 | 7,431 | 31% |
| **2010** | 1,357 | 1,183 | 52 | 2,592 | 1,298 | 1,131 | 1,794 | 6,779 | 11,002 | 13,594 | 19% |
| **2011** | 2,288 | 1,562 | 77 | 3,927 | 548 | 374 | 1,289 | 5,784 | 7,995 | 11,922 | 33% |
| **2012** | 1,654 | 490 | 45 | 2,189 | 323 | 1,737 | 1,201 | 3,838 | 7,099 | 9,288 | 24% |
| **2013** | 1,236 | 158 | 28 | 1,422 | 293 | 502 | 604 | 2,367 | 3,766 | 5,188 | 27% |
| **2014** | 1,003 | 94 | 20 | 1,117 | 487 | 374 | 626 | 2,718 | 4,205 | 5,322 | 21% |
| **2015** | 1,589 | 143 | 18 | 1,749 | 1,092 | 233 | 645 | 6,070 | 8,040 | 9,788 | 18% |
| **2016** | 1,698 | 67 | 25 | 1,790 | 1,360 | 408 | 604 | 2,899 | 5,271 | 7,061 | 25% |
| **2017** | 1,477 | 33 | 19 | 1,529 | 425 | 80 | 783 | 6,442 | 7,730 | 9,258 | 17% |
| **2018** | 1,838 | 115 | 34 | 1,987 | 469 | 345 | 960 | 5,135 | 6,909 | 8,896 | 22% |
| **2019** | 2,882 | 114 | 76 | 3,072 | 1,853 | 243 | 782 | 986 | 3,864 | 6,937 | 44% |
| **2020** | 1,502 | 196 | 39 | 1,737 | 1,025 | 1,439 | 842 | 1,309 | 4,615 | 6,352 | 27% |
| **2021** | 937 | 122 | 29 | 1,088 | 1,062 | 1,062 | 861 | 884 | 3,901 | 4,989 | 22% |
| **AVERAGE** | | | | 2,458 | | | | | 6,187 | | |
| **95% CI** | | | | 482 | | | | | 1,287 | | |

Appendix 6. Willamette River spring Chinook allocation schedule.

| Predicted Willamette Hatchery Run Size | Hatchery Fish Escapement Targets | | | Number of Hatchery Fish Available | Harvest Shares Below the Falls | | | |
|---|---|---|---|---|---|---|---|---|
| | Willamette Falls Escapement Target | Clackamas Escapement Target | Combined Escapement Target | | Recreational | | Commercial | |
| | | | | | Share | Catch | Share | Catch |
| 23,000 | 20,000 | 3,000 | 23,000 | 0 | <1% | <230 | <1% | <230 |
| 24,000 | 20,000 | 3,000 | 23,000 | 1,000 | 100% | 1,000 | <1% | <240 |
| 25,000 | 20,000 | 3,000 | 23,000 | 2,000 | 100% | 2,000 | <1% | <250 |
| 26,000 | 20,000 | 3,000 | 23,000 | 3,000 | 100% | 3,000 | <1% | <260 |
| 27,000 | 20,000 | 3,000 | 23,000 | 4,000 | 100% | 4,000 | <1% | <270 |
| 28,000 | 20,000 | 3,000 | 23,000 | 5,000 | 100% | 5,000 | <1% | <280 |
| 29,000 | 20,000 | 3,000 | 23,000 | 6,000 | 100% | 6,000 | <1% | <290 |
| 30,000 | 20,000 | 3,000 | 23,000 | 7,000 | 100% | 7,000 | <1% | <300 |
| 31,000 | 20,000 | 3,000 | 23,000 | 8,000 | 100% | 8,000 | <1% | <310 |
| 32,000 | 20,000 | 3,000 | 23,000 | 9,000 | 100% | 9,000 | <1% | <320 |
| 33,000 | 20,000 | 3,000 | 23,000 | 10,000 | 100% | 10,000 | <1% | <330 |
| 34,000 | 20,000 | 3,000 | 23,000 | 11,000 | 100% | 11,000 | <1% | <340 |
| 35,000 | 20,000 | 3,000 | 23,000 | 12,000 | 100% | 12,000 | <1% | <350 |
| 36,000 | 20,000 | 3,000 | 23,000 | 13,000 | 100% | 13,000 | <1% | <360 |
| 37,000 | 20,000 | 3,000 | 23,000 | 14,000 | 100% | 14,000 | <1% | <370 |
| 38,000 | 20,000 | 3,000 | 23,000 | 15,000 | 100% | 15,000 | <1% | <380 |
| 39,000 | 20,000 | 3,000 | 23,000 | 16,000 | 100% | 16,000 | <1% | <390 |
| 40,000 | 22,000 | 3,300 | 25,300 | 14,700 | 85% | 12,495 | 15% | 2,205 |
| 41,000 | 22,000 | 3,300 | 25,300 | 15,700 | 85% | 13,345 | 15% | 2,355 |
| 42,000 | 22,000 | 3,300 | 25,300 | 16,700 | 85% | 14,195 | 15% | 2,505 |
| 43,000 | 22,000 | 3,300 | 25,300 | 17,700 | 85% | 15,045 | 15% | 2,655 |
| 44,000 | 22,000 | 3,300 | 25,300 | 18,700 | 85% | 15,895 | 15% | 2,805 |
| 45,000 | 22,000 | 3,300 | 25,300 | 19,700 | 80% | 15,760 | 20% | 3,940 |
| 46,000 | 22,000 | 3,300 | 25,300 | 20,700 | 80% | 16,560 | 20% | 4,140 |
| 47,000 | 22,000 | 3,300 | 25,300 | 21,700 | 80% | 17,360 | 20% | 4,340 |
| 48,000 | 22,000 | 3,300 | 25,300 | 22,700 | 80% | 18,160 | 20% | 4,540 |
| 49,000 | 22,000 | 3,300 | 25,300 | 23,700 | 80% | 18,960 | 20% | 4,740 |
| 50,000 | 24,000 | 3,600 | 27,600 | 22,400 | 76% | 17,024 | 24% | 5,376 |
| 51,000 | 24,000 | 3,600 | 27,600 | 23,400 | 76% | 17,784 | 24% | 5,616 |
| 52,000 | 24,000 | 3,600 | 27,600 | 24,400 | 76% | 18,544 | 24% | 5,856 |
| 53,000 | 24,000 | 3,600 | 27,600 | 25,400 | 76% | 19,304 | 24% | 6,096 |
| 54,000 | 24,000 | 3,600 | 27,600 | 26,400 | 76% | 20,064 | 24% | 6,336 |
| 55,000 | 24,000 | 3,600 | 27,600 | 27,400 | 76% | 20,824 | 24% | 6,576 |
| 56,000 | 24,000 | 3,600 | 27,600 | 28,400 | 76% | 21,584 | 24% | 6,816 |
| 57,000 | 24,000 | 3,600 | 27,600 | 29,400 | 76% | 22,344 | 24% | 7,056 |
| 58,000 | 24,000 | 3,600 | 27,600 | 30,400 | 76% | 23,104 | 24% | 7,296 |
| 59,000 | 24,000 | 3,600 | 27,600 | 31,400 | 76% | 23,864 | 24% | 7,536 |
| 60,000 | 26,500 | 4,000 | 30,500 | 29,500 | 73% | 21,535 | 27% | 7,965 |
| 61,000 | 26,500 | 4,000 | 30,500 | 30,500 | 73% | 22,265 | 27% | 8,235 |
| 62,000 | 26,500 | 4,000 | 30,500 | 31,500 | 73% | 22,995 | 27% | 8,505 |
| 63,000 | 26,500 | 4,000 | 30,500 | 32,500 | 73% | 23,725 | 27% | 8,775 |
| 64,000 | 26,500 | 4,000 | 30,500 | 33,500 | 73% | 24,455 | 27% | 9,045 |
| 65,000 | 26,500 | 4,000 | 30,500 | 34,500 | 73% | 25,185 | 27% | 9,315 |
| 66,000 | 26,500 | 4,000 | 30,500 | 35,500 | 73% | 25,915 | 27% | 9,585 |
| 67,000 | 26,500 | 4,000 | 30,500 | 36,500 | 73% | 26,645 | 27% | 9,855 |
| 68,000 | 26,500 | 4,000 | 30,500 | 37,500 | 73% | 27,375 | 27% | 10,125 |
| 69,000 | 26,500 | 4,000 | 30,500 | 38,500 | 73% | 28,105 | 27% | 10,395 |

Appendix 6 (cont.)

| Predicted Willamette Hatchery Run Size | Hatchery Fish Escapement Targets | | | Number of Hatchery Fish Available | Harvest Shares Below the Falls | | | |
|---|---|---|---|---|---|---|---|---|
| | Willamette Falls Escapement Target | Clackamas Escapement Target | Combined Escapement Target | | Recreational | | Commercial | |
| | | | | | Share | Catch | Share | Catch |
| 70,000 | 29,000 | 4,400 | 33,400 | 36,600 | 73% | 26,718 | 27% | 9,882 |
| 71,000 | 29,000 | 4,400 | 33,400 | 37,600 | 73% | 27,448 | 27% | 10,152 |
| 72,000 | 29,000 | 4,400 | 33,400 | 38,600 | 73% | 28,178 | 27% | 10,422 |
| 73,000 | 29,000 | 4,400 | 33,400 | 39,600 | 73% | 28,908 | 27% | 10,692 |
| 74,000 | 29,000 | 4,400 | 33,400 | 40,600 | 73% | 29,638 | 27% | 10,962 |
| 75,000 | 29,000 | 4,400 | 33,400 | 41,600 | 73% | 30,368 | 27% | 11,232 |
| 76,000 | 29,000 | 4,400 | 33,400 | 42,600 | 70% | 29,820 | 30% | 12,780 |
| 77,000 | 29,000 | 4,400 | 33,400 | 43,600 | 70% | 30,520 | 30% | 13,080 |
| 78,000 | 29,000 | 4,400 | 33,400 | 44,600 | 70% | 31,220 | 30% | 13,380 |
| 79,000 | 29,000 | 4,400 | 33,400 | 45,600 | 70% | 31,920 | 30% | 13,680 |
| 80,000 | 32,000 | 4,900 | 36,900 | 43,100 | 70% | 30,170 | 30% | 12,930 |
| 81,000 | 32,000 | 4,900 | 36,900 | 44,100 | 70% | 30,870 | 30% | 13,230 |
| 82,000 | 32,000 | 4,900 | 36,900 | 45,100 | 70% | 31,570 | 30% | 13,530 |
| 83,000 | 32,000 | 4,900 | 36,900 | 46,100 | 70% | 32,270 | 30% | 13,830 |
| 84,000 | 32,000 | 4,900 | 36,900 | 47,100 | 70% | 32,970 | 30% | 14,130 |
| 85,000 | 32,000 | 4,900 | 36,900 | 48,100 | 70% | 33,670 | 30% | 14,430 |
| 86,000 | 32,000 | 4,900 | 36,900 | 49,100 | 70% | 34,370 | 30% | 14,730 |
| 87,000 | 32,000 | 4,900 | 36,900 | 50,100 | 70% | 35,070 | 30% | 15,030 |
| 88,000 | 32,000 | 4,900 | 36,900 | 51,100 | 70% | 35,770 | 30% | 15,330 |
| 89,000 | 32,000 | 4,900 | 36,900 | 52,100 | 70% | 36,470 | 30% | 15,630 |
| 90,000 | 35,000 | 5,400 | 40,400 | 49,600 | 70% | 34,720 | 30% | 14,880 |
| 91,000 | 35,000 | 5,400 | 40,400 | 50,600 | 70% | 35,420 | 30% | 15,180 |
| 92,000 | 35,000 | 5,400 | 40,400 | 51,600 | 70% | 36,120 | 30% | 15,480 |
| 93,000 | 35,000 | 5,400 | 40,400 | 52,600 | 70% | 36,820 | 30% | 15,780 |
| 94,000 | 35,000 | 5,400 | 40,400 | 53,600 | 70% | 37,520 | 30% | 16,080 |
| 95,000 | 35,000 | 5,400 | 40,400 | 54,600 | 70% | 38,220 | 30% | 16,380 |
| 96,000 | 35,000 | 5,400 | 40,400 | 55,600 | 70% | 38,920 | 30% | 16,680 |
| 97,000 | 35,000 | 5,400 | 40,400 | 56,600 | 70% | 39,620 | 30% | 16,980 |
| 98,000 | 35,000 | 5,400 | 40,400 | 57,600 | 70% | 40,320 | 30% | 17,280 |
| 99,000 | 35,000 | 5,400 | 40,400 | 58,600 | 70% | 41,020 | 30% | 17,580 |
| 100,000 | 39,000 | 6,000 | 45,000 | 55,000 | 70% | 38,500 | 30% | 16,500 |
| 101,000 | 39,000 | 6,000 | 45,000 | 56,000 | 70% | 39,200 | 30% | 16,800 |
| 102,000 | 39,000 | 6,000 | 45,000 | 57,000 | 70% | 39,900 | 30% | 17,100 |
| 103,000 | 39,000 | 6,000 | 45,000 | 58,000 | 70% | 40,600 | 30% | 17,400 |
| 104,000 | 39,000 | 6,000 | 45,000 | 59,000 | 70% | 41,300 | 30% | 17,700 |
| 105,000 | 39,000 | 6,000 | 45,000 | 60,000 | 70% | 42,000 | 30% | 18,000 |
| 106,000 | 39,000 | 6,000 | 45,000 | 61,000 | 70% | 42,700 | 30% | 18,300 |
| 107,000 | 39,000 | 6,000 | 45,000 | 62,000 | 70% | 43,400 | 30% | 18,600 |
| 108,000 | 39,000 | 6,000 | 45,000 | 63,000 | 70% | 44,100 | 30% | 18,900 |
| 109,000 | 39,000 | 6,000 | 45,000 | 64,000 | 70% | 44,800 | 30% | 19,200 |
| 110,000 | 39,000 | 6,000 | 45,000 | 65,000 | 70% | 45,500 | 30% | 19,500 |