



Fisheries Management and  
Evaluation for 2019  
Willamette River Spring Chinook

Oregon Department of Fish and Wildlife  
Ocean Salmon and Columbia River Program  
Columbia River Management

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## 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 of 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, Willamette, and 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 voluntary 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.

## **2019 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 27,400.

The estimated number of Willamette River spring Chinook returning to the Columbia River in 2019 was 29,314 fish which is the second lowest count on record (Figure 1, Table 1). This was approximately 52% of the previous 5-year average and 47% of the previous 10-year average (Table 1). The return was made up of 2,022 Age-3, 17,163 Age-4, 9,884 Age-5, and 245 Age-6 fish (Table 2). Approximately 34% (10,097) of the 2019 Willamette spring Chinook returning to the mouth of the Columbia River were unmarked (i.e. no fin clip), well above the previous five and ten year averages of 20.2% and 19.9%, respectively (Table 1). The estimated return to the Columbia River mouth includes fish destined for the Clackamas River.

The 2019 preseason forecast developed by ODFW was for a return of 42,490 spring Chinook entering the Columbia River with the wild population estimated at 20% or 8,498 fish (Figure 2, Table 2). The actual return was 29,314 fish or 69% of the forecast with the wild population estimate of 10,097 or 119% of the preseason forecast. The primary age class missing in the 2019 run were age-4 where an estimated 17,163 spring Chinook returned to the mouth of the Columbia River, 56% of the preseason forecast of 30,690 (Table 2).

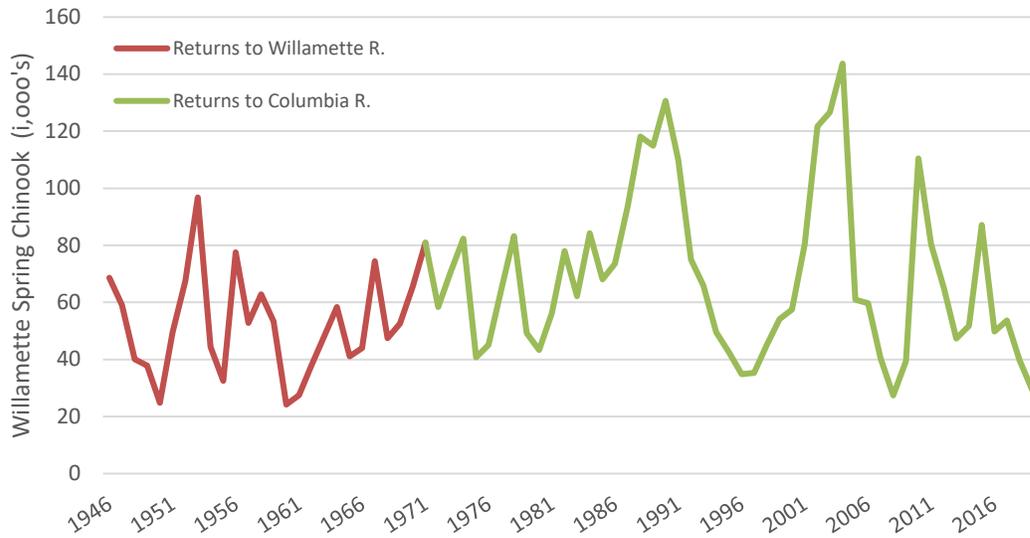


Figure 1. Historic Willamette spring Chinook returns, 1946-2019. From 1946 -1970 (red line) return numbers are to the mouth of the Willamette River and from 1971 – present (green line) returns are to the mouth of the Columbia River.

Table 1. Estimates of the number of Willamette River spring Chinook to the mouth of the Columbia River for marked and unmarked fish with previous five and ten year averages, 2009-2019.

YEAR	HATCHERY/MARKED		WILD/UNMARKED		Total
	Est. Number	Percent	Est. Number	Percent	
2009	30,527	77.5%	8,883	22.5%	39,410
2010	93,999	85.0%	16,537	15.0%	110,536
2011	63,657	79.3%	16,597	20.7%	80,254
2012	53,698	82.5%	11,417	17.5%	65,115
2013	36,910	78.0%	10,401	22.0%	47,311
2014	43,119	83.3%	8,675	16.7%	51,794
2015	73,552	84.5%	13,519	15.5%	87,071
2016	38,170	76.7%	11,598	23.3%	49,768
2017	42,914	80.0%	10,739	20.0%	53,653
2018	29,562	74.5%	10,098	25.5%	39,660
2019	19,217	65.6%	10,097	34.4%	29,314
<b>5-YR. AVE.</b>	45,463	79.8%	10,926	20.2%	56,389
<b>10-YR. AVE</b>	50,611	80.1%	11,846	19.9%	62,457

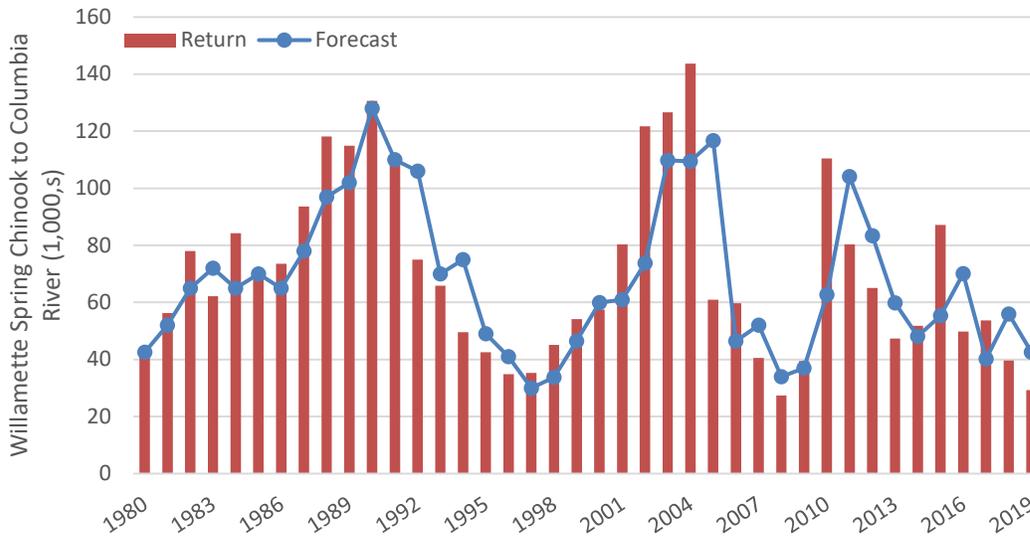


Figure 2. Predicted and observed Willamette River spring Chinook returns to the Columbia River mouth, 1980-2019.

Table 2. Forecast and reconstructed run estimates for Willamette River spring Chinook to the Columbia River mouth, 2019.

	AGE 3	AGE 4	AGE 5	AGE 6	TOTAL
<b>2019 FORECAST</b>	2,290	30,690	9,430	80	42,490
<b>95% CI</b>	1,080 - 3,850	15,700 - 46,810	1,750 - 19,410	0 - 170	
<b>2019 RECONSTRUCTED RETURN</b>	2,022	17,163	9,884	245	29,314

## Willamette Falls

Willamette Falls is a natural falls 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 barrier to fish passage requiring the use of a fishway in order to pass above the falls. Fish passing Willamette Falls are counted at a viewing window within the fishway which is monitored using a digital camera to record daily passage 24-hours a day, 7 days a week. 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 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 counts (Figure 3). In 2019 the escapement was 20,617 fish which is 57% of the previous five year average of 36,081 and 53% of the previous ten year average of 38,790 (Table 3). The 2019 counts at Willamette Falls indicated that 34.0% of the spring Chinook were unmarked (i.e. no fin clip), well above the previous five and ten year averages of 19.6% and 22.4%, respectively.

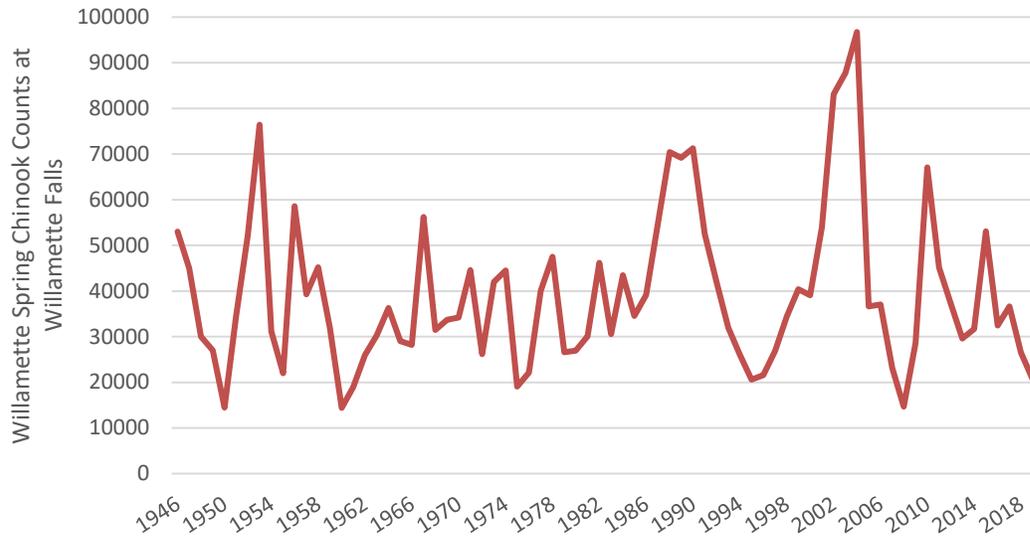


Figure 3. Historic Willamette spring Chinook escapement to Willamette Falls, 1946-2019.

Table 3. Counts of adult spring Chinook to Willamette Falls for both marked and unmarked fish with previous five and ten year averages, 2009-2019.

YEAR	MARKED/HATCHERY		UNMARKED/WILD		Total
	Count	Percent	Count	Percent	
2009	18,843	73.0%	6,952	27.0%	25,795
2010	51,447	78.8%	13,846	21.2%	65,293
2011	30,624	70.0%	13,124	30.0%	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
<b>5-YR. AVE.</b>	<b>27,444</b>	<b>80.3%</b>	<b>6,588</b>	<b>19.7%</b>	<b>34,032</b>
<b>10-YR. AVE</b>	<b>28,656</b>	<b>77.5%</b>	<b>8,224</b>	<b>22.5%</b>	<b>36,879</b>

### 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. 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.

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.

The estimated return to the Clackamas River mouth in 2019 was 2,489 adult spring Chinook which is 48% of the previous five year average of 5,194 fish and 43% of the previous ten year average of 5,802 fish (Table 4). An estimated 92% of the 2019 spring Chinook returning to the Clackamas River mouth were unmarked (i.e. no fin clip), well above the previous five and ten year averages of 57% and 40%, respectively (Table 4). Age distribution was estimated as 4.9% Age-3, 74.0% Age-4, 21.1% Age-5, and 0.0% Age-6 fish (Table 5).

The return to North Fork Dam on the Clackamas River in 2019 was 2,330 adult fish which is 68% of the previous five year average of 3,418 fish (Figure 4 and Table 6). Sampling showed an adult return of 52 hatchery/marked fish or 2% of the run and 2,278 wild/unmarked fish or 98% of the run. Adipose fin-clipped 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.

Table 4. Run reconstruction for adult wild and hatchery spring Chinook with previous five and ten year averages, Clackamas River, 2009 – 2019.

YEAR	WILD/UNMARKED				HATCHERY/MARKED					TOTALS	
	Dam Count	Nat. Spawn	Rel. Mort	Total	Dam Count	Nat. Spawn	Harvest	Hatch. Returns	Total	Total Run	Percent Wild
2009	590	20	7	617	1,101	37	208	1,609	2,955	3,572	17%
2010	1,140	12	12	1,164	2,976	33	707	5,664	9,380	10,544	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%
5-YR AVE.				2,531					2,662	5,194	57%
10- YR AVE.				1,996					3,806	5,802	40%

Table 5. Age distribution of adult and jack spring Chinook returning to the Clackamas River, 2019.

	NUMBER	PERCENT
AGE 3	122	4.9
AGE 4	1,842	74.0
AGE 5	525	21.1
AGE 6	0	0.0
<b>TOTAL</b>	<b>2,489</b>	

Table 6. Adult spring Chinook returns to North Fork Dam with previous five and ten year averages, Clackamas River, Oregon, 2009-2019

YEAR	HATCHERY/MARKED		WILD/UNMARKED		Total
	Dam Count	Percent	Dam Count	Percent	
2009	1,101	65%	590	35%	1,691
2010	2,976	72%	1,140	28%	4,116
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
<b>5-YR AVE</b>	<b>624</b>	<b>15%</b>	<b>2,794</b>	<b>85%</b>	<b>3,418</b>
<b>10-YR AVE</b>	<b>1,297</b>	<b>36%</b>	<b>2,141</b>	<b>64%</b>	<b>3,438</b>

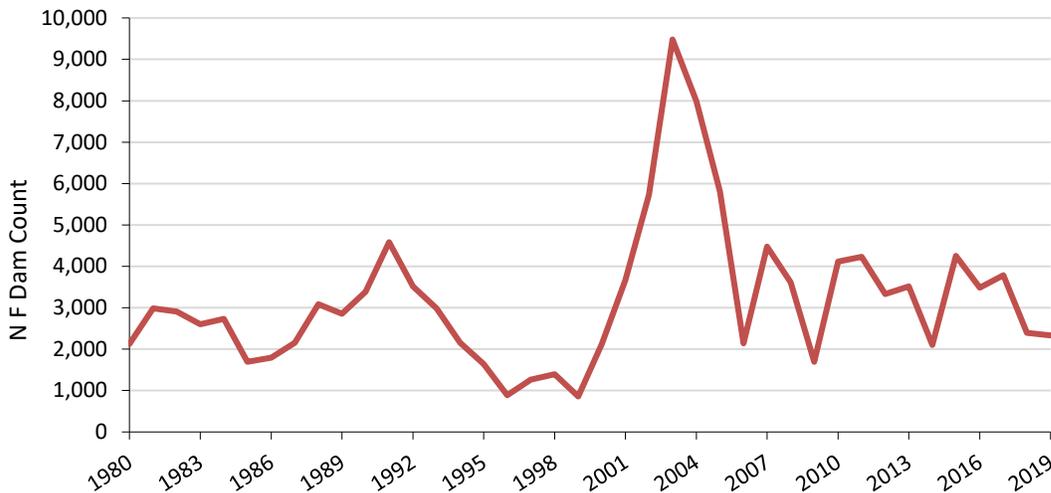


Figure 4. Total adult spring Chinook returns (wild and hatchery) to North Fork Dam, 1980-2019.

## 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. 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.

The North Santiam spring Chinook returns were monitored from 2002 – 2005 and from 2010 – 2019 at the upper and lower Bennett dams by ODFW staff. Counts were not conducted from 2006 – 2009. To estimate counts for the missing time period a regression analysis was conducted using known counts of adult spring Chinook from lower and upper Bennett Dams and from Willamette Falls (Figure 5). A period of 3 years before and after 2006-2009 were used for the analysis (e.g. 2003-2005 and 2010-2012). The resultant regression equation was used to estimate Bennett Dam counts for the period counts were not conducted using known adult spring Chinook counts from Willamette Falls. The estimated counts are 4,655 for 2006, 2,629 for 2007, 1,373 for 2008, and 3,057 for 2009. During 2003-2005 and 2010-2011, an average of 92% of the fish returning to the North Santiam were hatchery origin (Table 7). The average value was applied to the 2006-2009 estimates to designate fish as hatchery or wild.

The estimated return of adult spring Chinook to the North Santiam River mouth in 2019 was 4,493 which is 68% of the previous five year average of 6,635 fish and 73% of the previous ten year average of 6,152 (Table 7). An estimated 19.0% of the 2019 adult spring Chinook returning to the North Santiam River mouth were unmarked (i.e. no fin clip), which is higher than the previous five and ten year averages of 16.2% and 15.7%, respectively.

A total of 3,978 fish were reported passing the upper and lower Bennett Dams in 2019 which is 70% of the previous five year average of 5,692 fish and 75% of the previous ten year average of 5,289 fish (Table 8). An estimated 829 wild, unclipped spring Chinook were counted at the dam which is slightly lower than the five and ten year averages of 1,037 and 887, respectively.

Redd counts of spring Chinook salmon in the North Santiam River were conducted by the Oregon Department of Fish and Wildlife in 2019 (Table 9). These counts are conducted annually to determine the number of fish spawning naturally within the North Santiam Basin. A total of 351 redds were recorded in the North Fork Santiam River from Stayton to Minto. No surveys were conducted in the Little North Fork of the Santiam River in 2019. The total number of redds counted in 2019 represents 113% of the previous five year average and 95% of the previous ten year average.

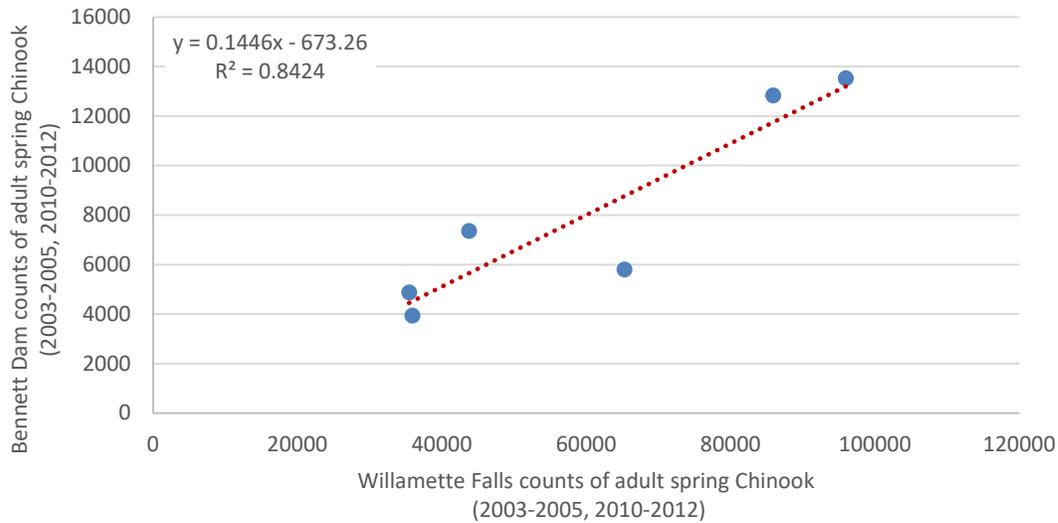


Figure 5. Regression of Upper and Lower Bennett Dam Counts and Willamette Falls Counts for adult spring Chinook for the time period 2003-2005 and 2010-2012.

Table 7. Run reconstruction for adult wild and hatchery spring Chinook with previous five and ten year averages, North Santiam River, Oregon, 2003 – 2019.

YEAR	WILD/UNMARKED				HATCHERY/MARKED				TOTALS	
	Dam Count <sup>1</sup>	Nat. Spawn	Rel. Mort.	Total	Dam Count <sup>1</sup>	Nat. Spawn	Harvest	Total	Total Run	Percent Wild
2003	271	7	103	846 <sup>2</sup>	12,561	64	4,903	17,528	18,374	4.6%
2004	489	17	48	553	13,042	53	2,973	16,068	16,621	3.3%
2005	667	46	8	721	4,215	175	441	4,831	5,552	13.0%
2006	349	30	6	385	4,306	113	673	5,092	5,476	7.0%
2007	197	35	4	235	2,432	131	356	2,919	3,154	7.5%
2008	103	3	0	106	1,270	13	12	1,295	1,401	7.6%
2009	229	59	5	293	2,828	210	503	3,541	3,834	7.6%
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	14.8%
2019	829	11	13	853	3,149	31	459	3,640	4,493	19.0%
<b>5 YR AVE</b>				1,063				5,573	6,635	16.2%
<b>10 YR AVE</b>				929				5,260	6,183	15.6%

<sup>1</sup> Dam counts for 2006-2009 are estimates, see text for interpolation methods.

<sup>2</sup> Minimum estimate based on the total handle by the fishery.

Table 8. Adult spring Chinook returns to the lower and upper Bennett Dams with previous five and ten year averages, North Santiam River, Oregon, 2009-2019.

YEAR	HATCHERY/MARKED		WILD/UNMARKED		Total
	Dam Count <sup>1</sup>	Percent	Dam Count <sup>1</sup>	Percent	
2009	2,812	92.0%	245	8.0%	3,061
2010	5,065	87.2%	744	12.8%	5,809
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	18.1%	4,811
2017	4,204	81.0%	987	17.4%	5,087
2018	3,022	84.1%	573	15.9%	3,595
2019	3,149	79.2%	829	20.8%	3,978
5-YR AVE	4,655	81.8%	1,037	18.2%	5,692
10-YR AVE	4,402	82.8%	887	17.2%	5,289

<sup>1</sup> Dam counts for 2009 are estimates, see text for interpolation methods.

Table 9. Redd counts of spring Chinook salmon in the North Santiam River, 2005-2019.

YEAR	NORTH SANTIAM: STAYTON TO MINTO	LITTLE NORTH FORK OF THE SANTIAM	TOTAL
2009	251	26	277
2010	396	na	396
2011	568	na	568
2012	548	na	548
2013	362	na	362
2014	478	na	478
2015	239	na	239
2016	411	na	411
2017	230	na	230
2018	198	na	198
2019	351	na	351
5-YR AVE			311
10-YR AVE			371

## 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. 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 in those areas due to thermal and flow effects (NMFS 2000).

The 2019 estimated return to the McKenzie River was 6,886 adult Chinook which is 86% of the previous 5-year average of 8,041 fish and 79% of the previous 10-year average of 8,763 fish (Table 10). An estimated 3,069 (45%) of the population was unmarked (i.e. no fin clip), well above the previous five and ten year averages of 1,633 (21%) and 2,058 (24%), respectively. Hatchery returns to McKenzie Hatchery were reduced from previous years due to very limited attractant water to bring fish into the hatchery. Additional fish were collected at Leaburg Dam to supplement the lower numbers to the hatchery.

A total of 4,735 fish were counted passing Leaburg Dam in 2019 which is well above the previous five and ten year averages of 2,288 and 2,208, respectively (Table 11, Figure 6). An estimated 2,882 wild, unclipped spring Chinook were counted at the dam which is significantly higher than the previous five average of 1,521 and the previous ten year average of 1,533 (Table 11). The preliminary unmarked fish escapement above Leaburg Dam is only slightly 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) and well above the viable salmonid population threshold of 600 UWR spring Chinook outlined in the FMEP.

The reduced number of hatchery returns to the McKenzie Hatchery witnessed in 2019 was most likely due to very limited attractant water available at the hatchery entrance that failed to bring fish into the facility. These fish appear to have been encountered at Leaburg Dam where counts for hatchery origin fish were much higher than counts conducted in 2017 and 2018 that had higher total run size estimates. The most accurate assessment of the total run size is likely displayed in the run reconstruction (Table 10) which takes into consideration both the decreased hatchery return and the inflated dam counts.

Table 10. Run reconstruction for wild and hatchery spring Chinook (adults only), and fishery impacts to wild run, McKenzie River, 2002-2019.

YEAR	WILD RUN				HATCHERY RUN					TOTALS	
	Dam Count	Nat. Spawn	Rel. Mort.	Total	Dam Count	Nat. Spawn	Harvest	Hatch Returns	Total	Total Run	Percent Wild
2009	1,185	1,059	43	2,287	460	411	796	3,477	5,144	7,431	31%
2010	1,357	1,183	52	2,591	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	1,197	3,838	7,095	9,283	24%
2013	1,236	158	28	1,423	293	502	613	2,367	3,775	5,197	27%
2014	1,003	94	20	1,117	487	374	621	2,718	4,200	5,317	21%
2015	1,589	143	18	1,749	1092	233	675	6,070	8,070	9,819	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	29	1,982	469	345	820	5,135	6,769	8,751	23%
2019	2,882	114	72	3,069	1,853	243	736	986	3,818	6,886	45%
5-YEAR AVE				1,633					6,408	8,041	21%
10-YEAR AVE				2,058					6,705	8,763	24%

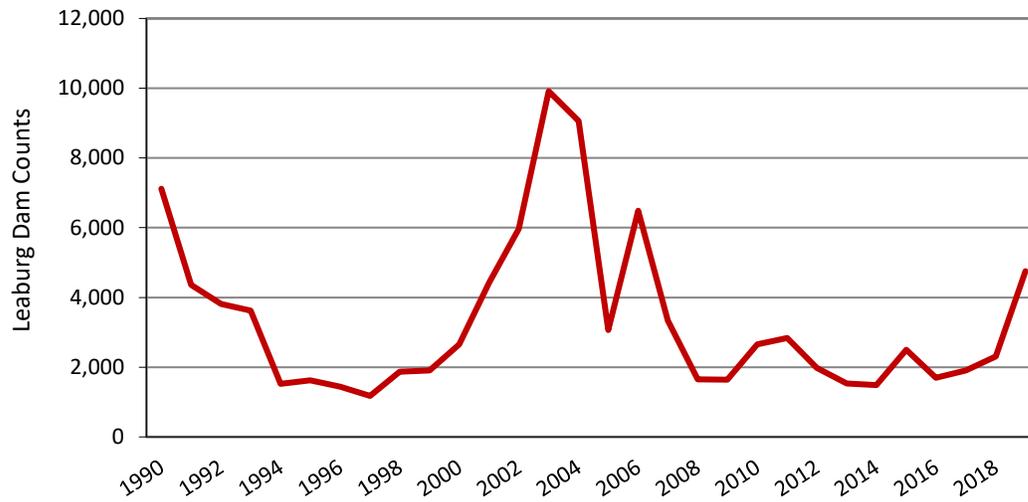


Figure 6. Spring Chinook returns to Leaburg Dam (McKenzie River), 1990-2019.

Table 11. Adult spring Chinook counts at Leaburg Dam on the McKenzie River, 1994-2018.

YEAR	WILD/UNMARKED		HATCHERY/MARKED		Total
	Number	Percent	Number	Percent	
2009	1,185	72%	460	28%	1,645
2010	1,357	51%	1,298	49%	2,655
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
5 YR. AVE.	1,521	68%	767	32%	2,288
10 YR. AVE	1,533	71%	676	29%	2,208

## 2019 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 expectations for fisheries is described in detail in ODFW/WDFW February 2020 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 2, Table 2). The 2019 preseason forecast for Willamette River spring Chinook was for a total of 42,490 fish to the Columbia River mouth, 20% (8,510) of the run was expected to be of wild origin and 80% (33,980) 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 (Table 15). For 2019, using the allocation schedule for the predicted return of 33,980 hatchery origin Willamette spring Chinook to the mouth of the Columbia River, a total of 20,000 hatchery spring Chinook are required to pass Willamette Falls

and another 3,000 are needed for Clackamas harvest and broodstock requirements for a total of 23,000 fish. This leaves a projected harvestable surplus of 10,980 hatchery fish (Table 15). This surplus was to be allocated 100% to recreational fisheries downstream of Willamette Falls including the lower Columbia River with less than 1% of the available fish allocated to commercial fisheries in the lower Columbia River.

In order to estimate the impact the fishery has on the population of wild UWR spring Chinook standardized mortality rates for captured and released fish were established. 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 all 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 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 gill-netting occurred on the mainstem Columbia River in 2019. 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 2019 in Youngs Bay, Blind Slough/Knappa Slough and Tongue Point/South Channel. 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 3,140 Chinook were caught in 2019 winter/spring/summer Select Area commercial fisheries, including 325 adult Willamette spring Chinook. Approximately 37% of this catch was estimated to be comprised of wild/unmarked fish; therefore the estimated mortality of Willamette wild spring Chinook was 122 adults (Table 12).

### **Lower Columbia Recreational Fishery**

The 2019 lower Columbia River recreational spring Chinook fishery was open under mark-selective, adipose fin-clipped-only regulations for the eighteenth consecutive year. The 2019 lower Columbia River recreational fishery was structured to maximize opportunity on an expected upriver spring Chinook return of 99,300 adult fish and a Willamette spring Chinook return of 40,200 adult fish.

The 2019 lower Columbia recreational fishery from Buoy 10 to the I-5 Bridge was open seven days per week during the months of January and February under permanent regulations (two fish bag limit). Beginning March 1, anglers could only keep one hatchery Chinook per day. The fishery was open March 1-April 10, April 13-14, April 20-21, and April 27-28 from the Warrior Rock line upstream to the Beacon Rock with the Oregon and Washington banks open for angling between Beacon Rock and Bonneville Dam. The total catch for the 2019 spring Chinook fishery below Bonneville Dam was 2,157 adult spring Chinook (1,677 kept and 480 released) from 39,409 angler trips.

Catch estimates are derived from creel surveys and all unmarked fish released by anglers are assumed to be wild fish. Of the 2019 kept catch, an estimated 201 adipose fin-clipped adult Willamette hatchery fish were retained and 120 non-clipped Willamette fish were released. The estimated post-release mortality of Willamette wild spring Chinook was 12 adult fish (Table 12).

### **Lower Willamette Recreational Fishery**

The 2019 lower Willamette River (below Willamette Falls) opened for retention of spring Chinook seven days per week the entire year. This was the eighteenth 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. Meanwhile, 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 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 contained in this group has not yet been analyzed. An estimated 62,525 angler trips were made to catch 6,202 adult spring Chinook in 2019; 4,459 (72%) were kept adipose fin-clipped adults and 1,743 (28%) were released non-adipose-fin-clipped adults. The estimated mortality of Willamette wild spring Chinook was 213 adult fish (Table 12).

### **Clackamas Recreational Fishery**

The lower Clackamas River fishery was open to salmon and steelhead angling seven days per week the entire year, catch limits were consistent with the lower Willamette River recreational fishery. Anglers in the 2019 lower Clackamas River recreational fishery caught an estimated 6 adult spring Chinook from 1,956 angler trips; 0 were adipose fin-clipped adults and 6 were released non-

adipose-fin-clipped adults. The estimated mortality of adult Clackamas wild spring Chinook was 1 fish (Table 12).

### **Upper Willamette Mainstem Recreational Fishery**

The 2019 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 similar to the lower Willamette River. The recreational fishery in the upper Willamette is generally smaller than the fishery in the lower Willamette.

The lower Willamette and Clackamas recreational fisheries have been monitored for many years while recreational fisheries above Willamette Falls have not been sampled since 2004. In order to estimate impacts to wild fish above Willamette Falls from 2005-2019 encounter rates of hatchery fish in these fisheries have been used as a surrogate. 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 2019 mortality of upper Willamette wild spring Chinook was 16 adult fish (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. This fishery was open seven days per week until December 31, 2019. Angler surveys are not conducted in these areas. 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 2019 mortality of wild spring Chinook in the North Santiam and McKenzie rivers were 13 adult fish and 72 adult fish, respectively (Table 12).

Table 12. 2019 adult Willamette spring Chinook freshwater catches and impacts on wild fish returns.

Fishery	Catch		Wild Fish Mortalities <sup>1</sup>	Percent Impact on Wild Return <sup>2</sup>
	Kept	Released		
Select Area Commercial	325	0	122	1.76%
Lower Columbia Recreational	196	120	12	0.17%
Lower Willamette Recreational	4,397	1,721	210	3.02%
	4,918	1,841	344	4.95%
Clackamas Recreational	0	6	1	0.01%
Upper Willamette Recreational	438	131	16	0.23%
North Santiam Recreational	459	107	13	0.19%
McKenzie Recreational	736	590	72	1.04%
	1,633	834	102	1.47%
<u>Totals by Population</u>				
Clackamas				4.97%
North Santiam				5.37%
McKenzie				6.22%

<sup>1</sup> 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%).

<sup>2</sup> Aggregate wild return estimated at 6,944 adults at the mouth of the Columbia River (25.4%) of the total 2019 Willamette spring Chinook adult run of 27,292. Wild return to the Clackamas River estimated at 2,297 adults (92.3%) of the 2,489 Clackamas adult return.

## 2019 Total Wild Impacts

The estimated wild fish impact totals by population from the 2019 freshwater fisheries are 5.0%, 5.4% and 6.2% for the Clackamas, North Santiam, and McKenzie populations, respectively (Table 12). These estimates are below the 15% maximum limit established in the FMEP. Wild impact rates since the implementation of the FMEP have been much lower than the average rates ranging from 37% to 54% from 1981-1997 (Table 13).

Because estimates of wild fish handled in fisheries where catch is estimated by creel survey (or observer programs) they 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. The discontinuation of unclipped double-index tagging (DIT) releases in the Clackamas River may provide an opportunity to examine this issue in the Clackamas River fishery. The handle rates for wild fish estimated by encounter rates for hatchery fish calculated from angler catch cards should not be affected by the presence of DIT fish in the same way but this method presents other difficulties that make the method less desirable for assessing wild fish impacts than are direct surveys, even considering the confounding issues of released DIT fish in surveyed fisheries.

More analysis is needed regarding the techniques for run reconstructions for Willamette River spring Chinook populations using currently available information. Estimates of wild and hatchery returns based upon run reconstructions from the tributaries downstream yield different total abundance estimates than estimates based on Willamette Falls' fish ladder counts. For instance, in 2019 the total estimated wild fish run to Willamette Falls based on tributary returns was 4,396 adult fish (Table 14) and the Willamette Falls counts of unmarked adult fish was 6,428 (Table 3). The disparity in these two methods may be attributable to several individual and combinations of factors including incomplete counting at upriver return sites and process errors in various components of the estimation. Given the fact that the current method of reconstructing the runs from the tributaries "backwards" (i.e. moving downstream) has been used since the initial ODFW annual FMEP report in 2001, this method was used once again for data collected in 2019 for the sake of consistency. However, the disparity between the two information sources highlights a need for further information in order to achieve more complete accounting of Willamette Basin returns.

Table 13. Freshwater fishery percent impact on wild Willamette River spring Chinook, 2009-2019.

FISHERY	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
L. COL. COMMERCIAL <sup>1</sup>	1.5	6.0	4.7	2.5	4.6	3.0	3.4	1.6	1.4	1.6	1.8
L. COL. RECREATIONAL	0.8	1.8	0.6	1.0	0.5	0.9	0.7	0.3	0.1	0.5	0.2
L. WILLAMETTE	3.6	6.9	6.2	4.5	2.8	3.9	4.0	2.2	2.4	2.9	3.0
L. CLACKAMAS	0.2	0.2	0.2	0.3	0.3	0.1	0.1	0.1	0.3	0.0	0.0
U. WILLAMETTE	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
N. SANTIAM	0.1	0.3	0.1	0.3	0.2	0.7	0.2	0.4	0.4	0.3	0.2
MCKENZIE	1.3	1.0	1.1	1.3	0.8	0.5	0.4	0.5	0.2	0.5	1.0
<b>SUM</b>	<b>7.6</b>	<b>16.4</b>	<b>13.0</b>	<b>10.0</b>	<b>9.3</b>	<b>9.2</b>	<b>8.9</b>	<b>5.2</b>	<b>4.9</b>	<b>5.9</b>	<b>6.4</b>
<b>TOTALS BY POPULATION</b>											
CLACKAMAS	6.1	14.8	11.7	8.3	8.2	7.9	8.3	4.2	4.2	5.1	5.0
NORTH SANTIAM	6.1	15.1	11.7	8.4	8.2	8.6	8.5	4.6	4.4	5.6	5.4
MCKENZIE	7.3	15.8	12.8	9.5	8.7	8.4	8.6	4.6	4.2	5.7	6.2

<sup>1</sup> Includes mainstem commercial and Select Area salmon fisheries through 2016. Beginning in 2017 includes Select Area fisheries only.

Table 14. Run reconstructions for Willamette River adult wild spring Chinook, 2009-2019.

Year	Above Falls			Below Falls				Total Col. River Return
	Tributary Returns	Fishery Mortalities	Sum	Clackamas Returns	Will. Fishery Mortalities	L. Col. Fishery Mortalities	Sum	
2009	3,899	8	3,907	617	122	74	813	4,720
2010	4,350	12	4,362	1,164	370	420	1,954	6,316
2011	6,121	16	6,137	1,673	434	371	2,478	8,615
2012	4,548	12	4,560	1,697	310	242	2,249	6,809
2013	4,074	8	4,082	2,149	157	284	2,590	6,672
2014	3,793	9	3,803	907	169	165	1,241	5,044
2015	3,840	6	3,846	2,321	226	233	2,780	6,626
2016	3,362	5	3,366	3,490	142	123	3,755	7,121
2017	3,121	12	3,133	3,609	150	99	3,858	6,991
2018	2,749	5	2,754	2,329	151	113	2,593	5,347
2019	4,382	17	4,399	2,297	210	41	2,548	6,947

## **2019 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 2019, anglers had a chance to fish with two rods, if they purchased a two rod validation. Compliance with these regulations was relatively high.

## **Outlook for 2020 Willamette Spring Chinook Management**

The 2020 Willamette spring Chinook run size forecast is for a total run of 43,430 fish, including 10,430 (24%) wild fish (Figure 2, Table 2). The forecast includes 2,680 age-3 fish, 29,780 age-4 fish, 10,860 age-5 fish and 110 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. The allocations used for 2020, based on the forecast of 33,000 hatchery fish are 10,000 hatchery fish to the recreational fishery downstream of Willamette Falls and 330 hatchery fish to the commercial fishery (Table 15).

Mainstem and tributary spring Chinook fisheries will continue to be mark-selective for adipose fin-clipped fish in 2020. All Willamette Basin recreational fisheries are restricted to adipose fin-clipped fish under permanent rule and regulations are printed as such in the *2020 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  
January 2020

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Appendix A

Table 15. 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

Table 15 continued.

Predicted Willamette Hatchery Run Size	Hatchery Fish Escapement Targets			Number of Hatchery Fish Available	Harvest Shares Below the Falls			
	Willamette Falls	Clackamas	Combined		Recreational		Commercial	
	Escapement Target	Escapement Target	Escapement Target		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