Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2019 Run

Klamath River Technical Team
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Summary

The number of Klamath River fall Chinook Salmon returning to the Klamath River Basin (Basin) in 2019 was estimated to be:

	Run Size	
Age	*Number*	*Proportion*
2	9,991	0.21
3	30,304	0.64
4	6,867	0.15
5	99	0.00
Total	47,261	1.00

Preseason forecasts of the number of fall Chinook Salmon adults returning to the Basin and the corresponding post-season estimates are:

	Adults		
Sector	*Preseason Forecast*	*Postseason Estimate*	*Pre / Post*
Run Size	97,900	37,300	2.62
Fishery Mortality			
Tribal Harvest	32,400	6,000	5.40
Recreational Harvest	7,600	5,400	1.41
Drop-off Mortality	3,000	500	6.00
	43,000	11,900	3.61
Escapement			
Hatchery Spawners	14,200	5,200	2.73
Natural Area Spawners	40,700	20,200	2.01
	54,900	25,400	2.16

Introduction

This report describes the data and methods used by the Klamath River Technical Team (KRTT) to estimate age-specific numbers of fall Chinook Salmon returning to the Basin in 2019. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFW 2020) and with the 2020 forecast of ocean stock abundance (KRTT 2020).

Age-specific escapement estimates for 2019 and previous years, coupled with the coded-wire tag (CWT) recovery data from Basin hatchery stocks, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall Chinook Salmon (Goldwasser et al. 2001, Mohr 2006a, KRTT 2020). Cohort reconstruction enables forecasts to be developed for the current year's ocean stock abundance, ocean fishery contact rates, and percent of spawners expected in natural areas (KRTT 2020). These forecasts are necessary inputs to the Klamath Ocean Harvest Model (Mohr 2006b), the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on Klamath River fall Chinook Salmon.

Methods

The KRTT obtained estimates of abundance and age composition separately for each sector of harvest and escapement. Random and nonrandom sampling methods of various types were used throughout the Basin (Table 1) to estimate the numbers of fall Chinook Salmon and to obtain the data from which the Klamath Basin Megatable totals and estimates of age composition were derived. The KRTT relied on surrogate data for estimating age composition where the sample of scales was insufficient, or altogether lacking, within a particular sector.

Estimates of age composition were based on random samples of scales (Table 2) whenever possible. Generally, each scale is aged independently by two trained readers. In cases of disagreement, a third read is used to arbitrate. Statistical methods (Cook and Lord 1978, Cook 1983, Kimura and Chikuni 1987) were used to correct the reader-assigned age composition estimates for potential bias based on the known-age vs. read-age validation matrices. The method used to combine the random sample's known ages (for CWT fish) and unknown read ages for estimation of the escapement or harvest age composition is described in Appendix A.

For cases in which scales were believed to be non-representative of the age-2 component, the KRTT relied on analysis of length-frequency histograms. In these cases, all fish less than or equal to a given fork-length "cutoff" were assumed to be age-2, and all fish greater than the cutoff length were assumed to be adults. The cutoff value varied by sector, and was based on location of the length-frequency nadir and, if appropriate, the length-frequency of known-age fish. As before, scales were used to estimate the age composition of adults (Appendix A).

An indirect method was used to estimate age composition for natural spawners in the Trinity River above the Willow Creek Weir (WCW). Age-specific numbers of fall Chinook Salmon that immigrated above WCW were estimated by applying the age composition from scales collected at the weir to the estimate of total abundance above the weir. Next, the age composition of returns to Trinity River Hatchery and the harvest above WCW were estimated. The age composition of natural spawners above the weir was then estimated as the age-specific abundances above the WCW, minus the age-specific hatchery and harvest totals.

In 2019, as in 2018, an opportunistic redd survey was performed on the mainstem Klamath River from Persido Bar to Big Bar, reaches where surveys generally do not occur. A total of 76 redds were identified in this survey in 2019. After substantial discussion, the KRTT decided to be

consistent with the decision made in 2018 to not include the results of this survey in the run size estimate. The KRTT noted that inclusion of this survey would not be consistent with the set of surveys that have contributed to the long term Klamath River fall Chinook dataset that has been used to inform the estimation of biological reference points and parameterize the Klamath Ocean Harvest Model. However, the KRTT appreciates the effort put forth to conduct this survey and is open to potentially including estimates from this area in the future.

The specific protocols used to develop estimates of age composition for each sector are provided in Table 3. A summary of the KRTT methods specific to each sector is given in Appendix B for the Klamath River and Appendix C for the Trinity River.

Results

A total of 6,730 scales from 16 different sectors were aged for this analysis (Table 2). Of these, 537 were from known-age CWT fish. Known-age scales provide a direct check, or "validation", of accuracy of the scale-based age estimates (Table 4, Appendices D and E). Overall, the scale-based ages were generally accurate. Accuracy within the Trinity Basin was 100% for age-2 fish, 97% for age-3 fish, and 90% for age-4 fish. Accuracy within the Klamath River Basin was 100% for age-2 fish, 94% for age-3 fish, and 81% for age-4 fish. The age-5 component of the run was very small in 2019 and no known-age-5 fish were available for the scale validation matrices (Table 4). As a result, accuracy could not be assessed for the age-5 component of the 2019 run. The statistical bias-adjustment methods employed are intended to correct for scale-reading bias, but the methods assume that the known-age versus read-age validation matrices are themselves well estimated (Kimura and Chikuni 1987).

Table 5 presents estimates of age-specific returns to Basin hatcheries and spawning grounds, as well as Basin harvest by tribal and recreational fisheries and the drop-off mortality associated with those fisheries. Table 6 displays the Table 5 estimates as proportions. Calculations underlying the results summarized in Table 5 are presented in Appendix F.

The final estimates of the 2018 Klamath Basin age composition are presented in Appendix G.

List of Acronyms and Abbreviations

ad-clipped	adipose fin removed
CDFW	California Department of Fish and Wildlife
CWT	coded-wire tag
EST	Klamath River estuary
FL	fork length
HVT	Hoopa Valley Tribe
IGH	Iron Gate Hatchery
KRTAT	Klamath River Technical Advisory Team
KRTT	Klamath River Technical Team
KT	Karuk Tribe
LRC	Lower Klamath River Creel
MKWC	Mid-Klamath Watershed Council
M&U	Klamath River below Weitchpec: "middle" section (Hwy 101–Surpur Cr.) and "upper" section (Surpur Cr.—Trinity River)
NCRC	Northern California Resource Center
QVIR	Quartz Valley Indian Reservation
SCS	Siskiyou County Schools
SRCD	Siskiyou Resource Conservation District
SRRC	Salmon River Restoration Council
TRH	Trinity River Hatchery

UR TRIBS	Upper Klamath River Tributaries
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WCW	Willow Creek Weir
WSP	AmeriCorps Watershed Stewards Program
YT	Yurok Tribe
YTFP	Yurok Tribal Fisheries Program

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Table 1. Estimation and sampling methods used for the 2019 Klamath River fall Chinook run assessment.

Sampling Location	Estimation and Sampling Methods	Agency
Hatchery Spawners		
Iron Gate Hatchery (IGH)	Direct count. All fish examined for fin-clips, tags, and marks. Bio-samples[a] collected from a systematic random sample of 10% of the fish. Additionally, all ad-clipped fish were bio-sampled.	CDFW, WSP
Trinity River Hatchery (TRH)	Direct count. All fish examined for fin-clips, tags, and marks. Bio-samples collected from a systematic random sample of 20% of the fish. Additional non-random ad-clipped fish were bio-sampled.	CDFW, HVT
Natural Spawners		
Salmon River Basin	Redd surveys of the upper and lower mainstem and tributaries, including Wooley Creek. Total redd count in Wooley Creek was adjusted to remove redds thought to be attributed to spring Chinook Salmon. Total run based on expanded redd count and last day live adults (2*total redd count+last day live adults)/(1-proportion of jacks). Bio-samples collected from all carcasses recovered.	CDFW, USFS, USFWS, KT, SRRC, SCS, WSP, MKWC, NCRC
Scott River Basin	Combination SONAR and video count above weir at river mile 18 and redd survey below the weir. Total run based on ARIS acoustic and video count through the weir and redd survey (Total run below the weir = (2*total redd count)/(1-proportion jacks)). Bio-samples collected from all carcasses recovered.	CDFW, QVIR, USFS, KT, NCRC, SRCD, WSP
Shasta River Basin	Video count above weir. Bio-samples collected from all carcasses upstream of video weir site, a 20% systematic random sample of carcasses stranded on weir, and all fish captured in a trap immediately upstream of video chute. No ad-clipped fish were recovered.	CDFW, WSP
Bogus Creek Basin	Video count above weir and twice weekly direct carcass count below weir. Bio-samples collected from all carcasses observed during surveys above and below weir, including all ad-clipped fish.	CDFW, WSP
Klamath River mainstem (IGH to Shasta R.)	Hierarchical latent variable model from weekly mark-recapture carcass surveys. Bio-samples collected from all fresh carcasses encountered.	USFWS, YT
Klamath River mainstem (Shasta R. to Wingate Bar)	Weekly redd surveys. Total run = (2*total redd count)/(1-proportion jacks). Jacks estimated from Klamath River mainstem (IGH to Shasta R.) scale-age data.	USFWS, KT
Klamath Tributaries above Trinity	Periodic redd surveys. Total run = (2*total redd count + last day live adults)/(1-proportion jacks). Jacks estimated from Klamath tributary scale-age data. Bio-samples collected from all carcasses recovered.	USFS, CDFW, KT, YT, MKWC, WSP
Blue Creek	Total estimated using the maximum count from dive surveys conducted between 23 October and 11 December.	YT
Trinity River (mainstem above WCW)	Mark-recapture (unstratified Petersen); marks applied at WCW and recovered at TRH. All fish bio-sampled and scales collected from every other Chinook in good condition. Natural area spawning escapement estimated by subtracting age-specific estimates of hatchery returns and recreational harvest above WCW from age-specific estimates of the total run upstream of WCW.	CDFW, HVT
Trinity River (mainstem below WCW)	Bi-weekly redd surveys. Total run = (2*total redd count)/(1-proportion jacks) using proportion of jacks in natural area spawning in Trinity River mainstem above WCW.	HVT, USFWS
Trinity Tributaries (above Reservation; below WCW)	Periodic redd surveys. Total run = (2*total redd count + last day live adults)/(1-proportion jacks) using proportion of jacks in natural area spawning in Trinity River mainstem above WCW.	CDFW, USFS, WSP
Hoopa Reservation Tributaries	Periodic redd surveys. Total run = (2*total redd count)/(1-proportion jacks) using proportion of jacks in natural area spawning in Trinity River mainstem above WCW.	HVT
Recreational Harvest		
Klamath River (below Hwy 101 bridge)	Jack and adult estimates based on access point and roving creel survey during 3 randomly selected days per Julian week through JW 40, then 2 days per week after JW 40. Bio-samples collected during angler interviews.	CDFW
Klamath River (Hwy 101 to Weitchpec)	Jack and adult estimates based on access point and roving creel survey during 3 randomly selected days per Julian week through JW 40, then 2 days per week after JW 40. Bio-samples collected during angler interviews.	CDFW
Klamath River (Weitchpec to IGH)	No survey. Upper Klamath adult harvest estimated using the ratio of lower river to total adult river harvest during the years 1999-2002 (Appendix B). Jacks estimated from IGH, Klamath mainstem, Shasta River, and Bogus Creek weighted average age compositions.	CDFW
Trinity River Basin (above WCW)	Jack and adult harvest estimates based on estimated harvest rates from angler return of reward and non-reward tags applied at WCW.	CDFW, HVT
Trinity River Basin (below WCW)	Roving access creel survey during three randomly selected days per statistical week stratified by weekdays (M-Th) and weekend (F-Su) days (1 weekday and 2 weekend). Bio-samples collected during angler interviews.	HVT
Tribal Harvest		
Klamath River (below Hwy 101)	Daily harvest estimates based on effort and catch-per-effort surveys. Bio-samples collected during harvest surveys.	YT
Klamath River (Hwy 101 to Trinity mouth)	Daily harvest estimates based on effort and catch-per-effort surveys. Bio-samples collected during harvest surveys.	YT
Trinity River (net and hook-and-line)	Roving effort and catch-per-effort surveys during four randomly selected days per statistical week for the net fishery, and three randomly selected days for the hook-and-line fishery, plus census count of hook-and-line and net fishery downstream of harvest weir to Tish Tang Creek. Bio-samples collected during harvest surveys.	HVT
Trinity River (harvest weir)	Direct count of all harvested fish. Bio-samples collected from all harvested fish.	HVT
Fishery Dropoff Mortality		
Recreational Angling Dropoff Mortality 2.04%	Not directly estimated. Assumed rate relative to fishery impacts = .02; relative to fishery harvest = .02/(1-.02).	KRTAT
Tribal Net Dropoff Mortality 8.7%	Not directly estimated. Assumed rate relative to fishery impacts = .08; relative to fishery harvest = .08/(1-.08).	KRTAT

[a] Bio-samples generally includes: fork length, scale, sex, tags or marks, and CWT recovery from dead ad-clipped fish.

Table 2. Scale sampling locations and numbers of scales collected for the 2019 Klamath Basin fall Chinook age-composition assessment.

Sampling Location	Aged			Total Collected[c/]	Agency
	Unknown-age[a/]	Known-age[b/]	Total		
Hatchery Spawners					
Iron Gate Hatchery (IGH)	307	35	342	397	CDFW
Trinity River Hatchery (TRH)	227	114	341	345	HVT
Natural Spawners					
Salmon River	144	0	144	148	CDFW/USFS
Scott River Carcass Survey[d/]	325	0	325	329	CDFW
Shasta River Carcass Survey[e/]	233	0	233	273	CDFW
Bogus Creek	484	26	510	525	CDFW
Klamath River mainstem	325	15	340	348	USFWS
Upper Klamath River tributaries	27	0	27	29	USFS
Blue Creek Dive Survey	0	0	0	2	YT
Willow Creek Weir	732	21	753	766	HVT
Lower Trinity River Carcass Survey	0	0	0	0	HVT/USFWS
Lower Trinity River tributaries	0	0	0	2	HVT/USFS
Recreational Harvest					
Lower Klamath River Creel	1,146	71	1,217	1,213	CDFW
Lower Trinity River Creel	79	15	94	95	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	731	60	791	826	YT
Klamath River (Hwy 101 to Trinity R)	213	8	221	232	YT
Trinity River (Hoopa Reservation)	1,004	172	1,176	1,200	HVT
TOTAL	5,977	537	6,514	6,730	

a/ Scales from non-ad-clipped fish and ad-clipped fish without CWTs, mounted and read.
b/ Scales from all mounted and aged ad-clipped CWT fish; non-random CWT fish used for validation but not age composition.
c/ Scales collected from the area.
d/ Weir washback collected scales were read but not used.
e/ Spawning ground survey and weir washback collected scales were read but not used. Scales from the trap were used.

Table 3. Age-composition methods used for the 2019 Klamath Basin fall Chinook run assessment.

Sampling Location	Age Composition Method
Hatchery Spawners	
Iron Gate Hatchery (IGH)	Jack/adult structure from scale-age analysis.
Trinity River Hatchery (TRH)	Jack/adult structure from scale-age analysis.
Natural Spawners	
Salmon River Basin	Jack/adult structure from scale-age analysis.
Scott River Basin	Jack/adult structure from scale-age analysis.
Shasta River Basin	Jacks estimated from length-frequency analysis, adult proportions based on scale-age analysis from trap data.
Bogus Creek Basin	Jack/adult structure from scale-age analysis.
Klamath River mainstem (IGH to Shasta R.)	Jack/adult structure from scale-age analysis.
Klamath River mainstem (Shasta R. to Wingate Bar)	Surrogate: Klamath mainstem (IGH to Shasta R.) age structure.
Klamath tributaries (above Trinity R.)	Jack/adult structure from scale-age analysis.
Blue Creek	Jacks estimated through direct observation. Unweighted average of scale-based adult age structure from Blue Ck. in 2007-2009, 2011-2015, and 2017.
Trinity River (above WCW)	Jack/adult structure derived from subtracting age-specific TRH counts and recreational harvest estimate above WCW from the age-specific total run estimate above WCW derived from scale-age analysis.
Trinity River (mainstem below WCW)	Surrogate: jack/adult structure from Trinity River (above WCW).
Trinity Tributaries (above Reservation to WCW)	Surrogate: jack/adult structure from Trinity River (above WCW).
Hoopa Reservation Tributaries	Surrogate: jack/adult structure from Trinity River (above WCW).
Recreational Harvest	
Klamath River (below Hwy 101 bridge)	Jack/adult structure from scale-age analysis.
Klamath River (Hwy 101 to Weitchpec)	Jack/adult structure from scale-age analysis.
Klamath River (Weitchpec to IGH)	Surrogate: jack/adult weighted average age proportions from Shasta River, IGH, Bogus Creek, and mainstem Klamath (IGH to Shasta R.).
Trinity River Basin (above WCW)	Jack component based on estimated jack harvest rate and total jack run estimate. Adult age structure surrogate from Trinity River recreational harvest below WCW.
Trinity River Basin (below WCW)	Jack/adult structure from scale-age analysis.
Tribal Harvest	
Klamath River (below Hwy 101)	Jack/adult structure from scale-age analysis.
Klamath River (Hwy 101 to Trinity mouth)	Jack/adult structure from scale-age analysis.
Trinity River (net and hook-and-line)	Jack/adult structure from scale-age analysis.
Trinity River (harvest weir)	Jack/adult structure from scale-age analysis.
Ich Disease Monitoring	
Klamath-Trinity Basin	No additional fish harvested for disease monitoring.

Table 4a. 2019 Klamath River Basin scale validation matrices

Number

		Known Age 2	3	4	5	
Read Age	2	10	12	0	0	
	3	0	273	15	0	
	4	0	5	64	0	
	5	0	1	0	0	Total
	Total	10	291	79	0	380

Percentage

		Known Age 2	3	4	5
Read Age	2	1.00	0.04	0.00	0.00
	3	0.00	0.94	0.19	0.00
	4	0.00	0.02	0.81	0.00
	5	0.00	0.00	0.00	1.00
	Total	1.00	1.00	1.00	1.00

Table 4b. 2019 Trinity River Basin scale validation matrices.

Number

		Known Age 2	3	4	5	
Read Age	2	26	4	0	0	
	3	0	253	5	0	
	4	0	3	47	0	
	5	0	0	0	0	Total
	Total	26	260	52	0	338

Percentage

		Known Age 2	3	4	5
Read Age	2	1.00	0.02	0.00	0.00
	3	0.00	0.97	0.10	0.00
	4	0.00	0.01	0.90	0.00
	5	0.00	0.00	0.00	1.00
	Total	1.00	1.00	1.00	1.00

Table 5. Age composition of the 2019 Klamath Basin fall Chinook run.

2/11/2020

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	249	2,825	972	0	3,797	4,046
Trinity River Hatchery (TRH)	205	1,182	199	0	1,381	1,586
Hatchery Spawner subtotal	**454**	**4,007**	**1,171**	**0**	**5,178**	**5,632**
Natural Spawners						
Salmon River Basin	686	790	167	0	957	1,643
Scott River Basin	409	1,596	85	0	1,681	2,090
Shasta River Basin	78	5,341	585	0	5,926	6,004
Bogus Creek Basin	148	872	118	0	990	1,138
Klamath River mainstem (IGH to Shasta R.)	169	879	262	8	1,149	1,318
Klamath River mainstem (Ash Cr. to Wingate Bar)	310	1,591	475	16	2,082	2,392
Klamath Tributaries (above Trinity River)	488	510	148	0	658	1,146
Blue Creek	26	24	61	6	91	117
Klamath Basin subtotal	2,314	11,603	1,901	30	13,534	15,848
Trinity River (mainstem above WCW)	3,765	5,545	996	17	6,558	10,323
Trinity River (mainstem below WCW)	22	32	6	0	38	60
Trinity Tributaries (above Reservation; below WCW)	15	22	4	1	27	42
Hoopa Reservation tributaries	51	74	14	0	88	139
Trinity Basin subtotal	3,853	5,673	1,020	18	6,711	10,564
Natural Spawners subtotal	**6,167**	**17,276**	**2,921**	**48**	**20,245**	**26,412**
Total Spawner Escapement	**6,621**	**21,283**	**4,092**	**48**	**25,423**	**32,044**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	246	617	144	3	764	1,010
Klamath River (Hwy 101 to Weitchpec)	2,239	2,261	318	0	2,579	4,818
Klamath River (Weitchpec to IGH)	91	1,408	275	2	1,685	1,776
Trinity River Basin (above WCW)	54	178	2	0	180	234
Trinity River Basin (below WCW)	78	155	2	0	157	235
Subtotals	**2,708**	**4,619**	**741**	**5**	**5,365**	**8,073**
Tribal Harvest						
Klamath River (below Hwy 101)	41	2,002	1,282	38	3,322	3,363
Klamath River (Hwy 101 to Trinity mouth)	51	331	254	2	587	638
Trinity River (net and hook-and-line)	94	518	158	0	676	770
Trinity River (harvest weir)	405	1,209	178	2	1,389	1,794
Subtotals	**591**	**4,060**	**1,872**	**42**	**5,974**	**6,565**
Total Harvest	**3,299**	**8,679**	**2,613**	**47**	**11,339**	**14,638**
Totals						
Harvest and Escapement	9,920	29,962	6,705	95	36,762	46,682
Recreational Angling Dropoff Mortality 2.04%	55	94	15	0	109	164
Tribal Net Dropoff Mortality 8.7%	16	248	147	4	399	415
Klamath-Trinity Basin Ich disease testing	0	0	0	0	0	0
Total River Run	**9,991**	**30,304**	**6,867**	**99**	**37,270**	**47,261**

Table 6. Age proportion of the 2019 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5
Hatchery Spawners				
Iron Gate Hatchery (IGH)	0.06	0.70	0.24	0.00
Trinity River Hatchery (TRH)	0.13	0.75	0.13	0.00
Hatchery Spawner subtotal	0.08	0.71	0.21	0.00
Natural Spawners				
Salmon River Basin	0.42	0.48	0.10	0.00
Scott River Basin	0.20	0.76	0.04	0.00
Shasta River Basin	0.01	0.89	0.10	0.00
Bogus Creek Basin	0.13	0.77	0.10	0.00
Klamath River mainstem (IGH to Shasta R.)	0.13	0.67	0.20	0.01
Klamath River mainstem (Ash Cr. to Wingate Bar)	0.13	0.67	0.20	0.01
Klamath tributaries (above Trinity River)	0.43	0.45	0.13	0.00
Yurok Reservation tributaries	0.22	0.21	0.52	0.05
Klamath Basin subtotal	0.15	0.73	0.12	0.00
Trinity River (mainstem above WCW)	0.36	0.54	0.10	0.00
Trinity River (mainstem below WCW)	0.37	0.53	0.10	0.00
Trinity tributaries (above Reservation)	0.36	0.52	0.10	0.02
Hoopa Reservation tributaries	0.37	0.53	0.10	0.00
Trinity Basin subtotal	0.36	0.54	0.10	0.00
Natural Spawners subtotal	0.23	0.65	0.11	0.00
Total Spawner Escapement	0.21	0.66	0.13	0.00
Recreational Harvest				
Klamath River (below Hwy 101 bridge)	0.24	0.61	0.14	0.00
Klamath River (Hwy 101 to Weitchpec)	0.46	0.47	0.07	0.00
Klamath River (Weitchpec to IGH)	0.05	0.79	0.15	0.00
Trinity River Basin (above WCW)	0.23	0.76	0.01	0.00
Trinity River Basin (below WCW)	0.33	0.66	0.01	0.00
Subtotals	0.34	0.57	0.09	0.00
Tribal Harvest				
Klamath River (below Hwy 101)	0.01	0.60	0.38	0.01
Klamath River (Hwy 101 to Trinity mouth)	0.08	0.52	0.40	0.00
Trinity River (net and hook-and-line)	0.12	0.67	0.21	0.00
Trinity River (harvest weir)	0.23	0.67	0.10	0.00
Subtotals	0.09	0.62	0.29	0.01
Total Harvest	0.23	0.59	0.18	0.00
Totals				
Harvest and Escapement	0.21	0.64	0.14	0.00
Recreational Angling Dropoff Mortality 2.04%	0.34	0.57	0.09	0.00
Tribal Net Dropoff Mortality 8.7%	0.04	0.60	0.35	0.01
Total River Run	0.21	0.64	0.15	0.00

Appendix A: Estimation of escapement age-composition from a random sample containing known-age (CWT) and unknown read-age fish.

Denote the escapement at age as $\{N_a, a = 2,3,4,5\}$, $N = \sum N_a$, and for the random sample of size $(n+m)$ fish, denote the following quantities:

- known-age fish: number at age $\{n_a, a = 2,3,4,5\}$, $n = \sum n_a$, $p_a = n_a / n$.
- unknown read-age fish: number at age $\{m_a, a = 2,3,4,5\}$, $m = \sum m_a$, $r_a = m_a / m$.
- bias-corrected unknown read-age proportions: $\{r_a^*, a = 2,3,4,5\}$, $r_A^* = r_3^* + r_4^* + r_5^*$.
- age-2 proportion as estimated by size-frequency: s_2.

1. Age 2–5 escapement by scales. Estimate N_a as the sample of known-age *a* fish plus the unknown age portion of the escapement times the estimated age *a* proportion (bias-corrected):

   $$N_a = np_a + (N-n)r_a^*, \; a = 2,3,4,5.$$

2. Age-2 escapement by size-frequency; age 3–5 escapement by scales. Estimate N_2 as the total escapement times the size-frequency based estimated age-2 proportion. Estimate N_a for $a = 3,4,5$ as the sample known-age *a* fish plus the unknown age portion of the adult escapement times the age *a* proportion among adults (bias-corrected):

   $$N_a = \begin{cases} Ns_2, & a = 2 \\ np_a + [N(1-s_2) - n(1-p_2)](r_a^* / r_A^*), & a = 3,4,5 \end{cases}$$

Appendix B. Klamath River – 2019 methodology details.

Iron Gate Hatchery (IGH)

Escapement to IGH is a direct count of the number of fall Chinook Salmon entering the hatchery over the duration of the spawning season. A systematic random bio-sample was obtained from every tenth Chinook Salmon returning to IGH. Heads were also collected for CWT analysis from all ad-clipped fish not included in the systematic sample. Scale-based age compositions were used to apportion all age classes.

Bogus Creek

Escapement was estimated by summing carcasses encountered during spawning ground surveys below the video weir and videography counts above the weir. Spawning ground surveys were also conducted upstream of the weir and bio-samples were collected from every carcass encountered. Scale-based age compositions were used to apportion all age classes.

Shasta River

Escapement was estimated by videography as the net count of fish moving upstream (total observed moving upstream minus total moving downstream). Bio-samples were collected from all carcasses encountered during surveys in the lower seven miles of the Shasta River, five reaches in the upper mainstem Shasta River, Big Springs Creek, Little Springs Creek, and Parks Creek. Bio-samples were also obtained from a 1:5 systematic sample of carcasses that washed back onto the counting weir. A trap was also installed on the upstream end of the video flume to bolster scale sample collection for a total of 68 hours of effort between September 24 and October 23. Every fish was bio-sampled from the video flume trap. No ad-clipped fish were recovered. Scale-based age compositions from samples collected from the trap were used to apportion adult age classes. The age-2 proportion was estimated based on a length-frequency cut-off for jacks (<50 cm FL) because the corrected scale-age proportion produced an unrealistic result of no fish at age-2.

Scott River

Independent estimates from above and below the weir were combined to estimate total escapement. Escapement above the weir was estimated using videography and SONAR as the net count of fish moving upstream. During periods when the video monitoring station was inoperable (6.25 hours in total), fish passage was interpolated by averaging the two days prior and two days following the outage. Adult escapement below the weir was estimated by expanding the total redd count (redds X 2). Total escapement below the weir was then estimated by applying the scale-based age-2 proportion to adult escapement. Bio-samples were obtained from all non-deteriorated carcasses recovered above and below the weir. Scale-based age compositions were used to apportion all age classes.

Salmon River

Adult escapement was estimated by expanding the total redd count (redds X 2) and then adding the number of live adult fish observed on the last survey. Total escapement was then estimated by expanding adult escapement by the scale-based age-2 proportion. Bio-samples

were obtained from recovered carcasses. Scale-based age compositions were used to apportion all age classes. Total redd count in Wooley Creek was adjusted to remove redds thought to be attributed to spring-run Chinook Salmon.

Klamath River Tributaries

Adult escapement was estimated by expanding the total redd count (redds X 2) and then adding the number of live adult fish observed on the last survey. Total escapement was then estimated by expanding adult escapement by the scale-based age-2 proportion. Scale-based age compositions were used to apportion all age classes.

Klamath River Mainstem (IGH to Shasta River)

A hierarchical latent variable model based on weekly carcass counts and mark-recapture data was used to estimate escapement. All surveyed fresh carcasses were bio-sampled. Scale-based age proportions were used to assign all age classes.

Klamath River Mainstem (Ash Creek to Wingate Bar)

Adult escapement was estimated by expanding total redd counts (redds X 2) from weekly surveys. Total escapement was then estimated by expanding adult escapement by the scale-based age-2 proportion from the upper reach. Age assignments were based on age proportions from scales collected in the IGH-Shasta reach.

Lower Klamath River Creel

Total harvest was estimated by combining creel estimates from the two sub-areas (above the Highway 101 Bridge to Weitchpec and below the Highway 101 Bridge to the mouth). In each sub-area, jack and adult estimates were based on access point and roving creel surveys during three randomly selected days per Julian week (JW) through JW 40, then during two days per week after JW 40. Bio-samples were collected from every fish possible during angler interviews. Scale-based age proportions from scale samples were used to apportion all age classes in each sub-area.

Upper Klamath River Recreational Fishery

A creel survey in this sub-area was not conducted in 2019. Creel data were available for the lower and upper river fisheries from 1999 to 2002. The ratio of average adult harvest in the entire Klamath mainstem to average harvest in the lower Klamath River creel area from these years was applied to the 2019 lower Klamath River creel harvest to estimate total adult harvest in the Klamath River mainstem. Adult harvest for the upper Klamath River recreational fishery was then estimated by subtracting the estimated lower Klamath River creel estimate from the Klamath mainstem total harvest. Finally, the combined adult and jack harvest was obtained by dividing the adult harvest by the proportion of adults from the weighted average scale-age composition of the upper Klamath River mainstem (IGH to Shasta River), Shasta River, Bogus Creek, and IGH. This weighted scale-based age composition was used to apportion all age classes in this fishery.

Yurok Tribal Estuary Fishery (Klamath mouth to Hwy 101)

Subsistence Yurok harvest in this sub-area was estimated by hourly net-fishing effort and catch-per-effort (fish per net-hour) analyses, stratified by day and night. The commercial harvest period was not diurnally stratified. Scale-based age composition was used to apportion all age classes.

Yurok Tribal Fishery Above Hwy 101

Yurok harvest in this sub-area was estimated by daily net-fishing effort and catch-per-effort (fish per net-day) analyses. Scale-based age composition was used to apportion all age classes.

Blue Creek

Total escapement was estimated using the maximum single-day count from dive surveys conducted between October 23 and December 11. Bio-samples were collected from two recovered carcasses. Jacks were identified by visual determination during dive surveys and apportioned from the total count. Adult age proportions were estimated as the unweighted average of age-specific proportions in Blue Creek from years when scales were used to apportion adult age classes (2007-2009, 2011-2015, and 2017).

Appendix C. Trinity River – 2019 methodology details.

Trinity River Natural Escapement (above WCW)

Escapement was estimated using a Petersen mark-recapture estimator. The methods used for estimating age structure within the Trinity River run above WCW were similar to those used in the population estimate, apportioned into three general recovery areas: TRH, Trinity basin natural spawning escapement above WCW, and recreational harvest. Scales were collected from every other Chinook Salmon (1:2 systematic sample) at WCW. Validation of WCW scales was accomplished with known-age fish recovered throughout all sectors of the Trinity River.

The age structure for fish passing above WCW was estimated using scales collected at WCW and TRH. Age-specific abundances for all fish passing above WCW were estimated from scales collected at WCW. Next, age-specific abundances of fish returning to TRH and fish harvested in the recreational fishery were estimated. Finally, age-specific abundances from TRH and the recreational fishery were subtracted from age-specific abundances of fish passing above WCW to yield age-specific abundances of fish returning to natural spawning areas above WCW.

Trinity River Hatchery (TRH)

Escapement to TRH is a direct count of the number of fall Chinook Salmon entering the hatchery over the duration of the spawning season. Scales were sampled systematically (1:5), ad-clipped and non-ad-clipped fish included. Additionally, a non-random sample of ad-clipped fish was drawn during the latter three weeks of spawning to further validate scale ages. Scale samples were used to apportion the hatchery return into age classes.

Upper Trinity River Recreational Harvest

The method for estimating the upper Trinity River recreational harvest depends on the application of program tags at WCW and subsequent returns by anglers. In 2019 CDFW estimated a 2.213% harvest rate on adult Chinook Salmon based on the return of program reward and non-reward tags (22 of 994) applied at WCW. The jack harvest rate of 1.344% was based on return of program reward tags (7 of 521). No scales were recovered from this fishery since no creel survey was implemented in 2019. Adult age proportions were determined using surrogate scales aged from recreational harvest below WCW.

Lower Trinity River Creel

A roving creel survey was implemented in the Trinity River downstream of WCW. Sampling was temporally stratified by weekend (Friday-Sunday) and weekday, with sampling occurring on 2 and 1 randomly selected days per stratum, respectively. Scale samples were used to apportion all age classes.

Trinity Mainstem Natural Escapement (below WCW)

Total escapement was estimated by expanding total redd counts (redds X 2) from surveys conducted biweekly as conditions allowed and applying the jack proportion from the upper Trinity River natural escapement. No scales were collected in this sector. The upper Trinity River natural escapement age structure was used as a surrogate to apportion all ages.

Trinity Tributaries (above Reservation; below WCW)

Total escapement was estimated by expanding total redd counts (redds X 2) and applying the jack proportion from the upper Trinity River natural escapement. Only one scale sample was collected in this sector, therefore age proportions from the upper Trinity River natural escapement sector were used to apportion all age classes.

Hoopa Reservation Tributaries

Total escapement was estimated by expanding total redd counts (redds X 2) and applying the jack proportion from the upper Trinity River natural escapement. Only one scale sample was collected in this sector, therefore age proportions from the upper Trinity River natural escapement sector were used to apportion all age classes.

Hoopa Valley Tribal Harvest (net and hook-and-line)

Hoopa Valley Tribal member gill net and hook-and-line harvest is monitored by estimating effort and catch from three (hook-and-line) or four (gill net) randomly selected days per week. Total harvest was estimated by expanding randomly selected days and effort to weekly totals. A census of the Tribal net and hook-and-line fisheries was also implemented in the area immediately downstream of the Hoopa selective harvest weir to Tish Tang Creek. Scale-age proportions were used to apportion all ages.

Hoopa Valley Tribal Harvest (harvest weir)

Total harvest was a direct count of all Chinook Salmon taken at the weir. Scale samples were attempted to be taken from every other harvested fish. Scale-age proportions were used to apportion all ages.

Appendix D. 2019 Klamath age analysis.

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	68	13	0	144	225
IGH	237	15	0	326	578
SALMON	128	14	0	147	289
SCOTT	215	56	3	325	599
SHASTA	12	3	0	27	42
MAINSTEM	214	46	2	363	625
UR TRIBS	333	42	0	742	1,117
LRC EST	447	217	9	699	1,372
LRC UP	119	70	1	212	402
YTFP EST	0	0	0	0	0
YTFP M&U	128	14	0	147	289
BLUE CRK	0	0	0	0	0
	1,901	490	15	3,132	5,538

Unknown scales corrected age proportions (Kimura method)

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0.1337	0.7651	0.1012	0.0000	1.0
IGH	0.0695	0.6834	0.2471	0.0000	1.0
SALMON	0.4177	0.4810	0.1013	0.0000	1.0
SCOTT	0.1955	0.7639	0.0406	0.0000	1.0
SHASTA	0.0000	0.9014	0.0986	0.0000	1.0
MAINSTEM	0.1295	0.6650	0.1986	0.0069	1.0
UR TRIBS	0.4260	0.4461	0.1278	0.0000	1.0
LRC EST	0.2480	0.6062	0.1427	0.0032	1.0
LRC UP	0.4697	0.4642	0.0661	0.0000	1.0
YTFP EST	0.0123	0.5970	0.3791	0.0116	1.0
YTFP M&U	0.0818	0.5207	0.3946	0.0029	1.0
BLUE CRK	0.2077	0.2068	0.5286	0.0569	1.0

Known CWT ages [a/]

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	1	29	6	0	36
IGH	20	573	158	0	751
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	0	0	0	0	0
MAINSTEM	0	13	3	0	16
UR TRIBS	0	0	0	0	0
LRC	6	70	6	0	82
YTFP EST	0	36	33	0	69
YTFP M&U	0	6	7	0	13
BLUE CRK	0	0	0	0	0
	27	727	213	0	967
Breakout within strata					
Bogus1	1	19	5	0	25
Bogus2	0	10	1	0	11
LRC - lo	0	16	2	0	18
LRC - mid	6	54	4	0	64
YTFP MID	0	0	0	0	0
YTFP UP	0	6	7	0	13

a/ Table includes known-age fish whose scales were not mounted / read.

Appendix E. 2019 Trinity age analysis.

WCW = Willow Ck. Weir — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	13	0	0	0	0	13
2	249	4	0	0	0	253
3	412	0	15	1	0	428
4	70	0	0	1	0	71
5	1	0	0	0	0	1
732	745	4	15	2	0	766

LOWTRINREC = Lower Trinity Recreational — Cwt Age

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	1	0	0	0	0	1
2	28	2	0	0	0	30
3	50	0	11	0	0	61
4	1	0	1	1	0	3
5	0	0	0	0	0	0
79	80	2	12	1	0	95

HUPAHARV = Hoopa Tribal Net Harvest plus Tribal Hook-and-Line — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	12	0	0	1	0	13
2	50	3	1	0	0	54
3	242	0	41	1	0	284
4	68	0	0	14	0	82
5	0	0	0	0	0	0
360	372	3	42	16	0	433

TRH = Trinity River Hatchery — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	4	0	1	1	0	6
2	33	7	2	0	0	42
3	166	0	86	0	0	252
4	28	0	2	17	0	47
5	0	0	0	0	0	0
227	231	7	91	18	0	347

LOWTRINTRIBS = Lower Trinity Tribs - Includes samples taken by U *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	0	0	0	0	0	0
2	1	0	0	0	0	1
3	0	0	0	0	0	0
4	1	0	0	0	0	1
5	0	0	0	0	0	0
2	2	0	0	0	0	2

0 NO DATA — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable						
2						
3						
4						
5						
0	0	0	0	0	0	0

HVTSELECTHARV = Hoopa Tribal Weir Harvest — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable	8	0	0	0	0	8
2	196	10	1	0	0	207
3	501	0	100	3	0	604
4	71	0	0	14	0	85
5	1	0	0	0	0	1
769	777	10	101	17	0	905

0 NO DATA — *Cwt Age*

Scale Ages	no cwt age	2	3	4	5	Total
Scale unreadable						
2						
3						
4						
5						
0	0	0	0	0	0	0

POOLED data from all areas: Scale age-CWT age matrix.
(Includes only fish with both scale age and CWT known age.)

	VALIDATION MATRIX	2	3	4	5	
	2	26	4	0	0	
	3	0	253	5	0	
4x4	4	0	3	47	0	
	5	0	0	0	1E-10	0.96

(B)
Scale-CWT age matrix of proportions of column sums.

	2	3	4	5
2	1.0000	0.0154	0.0000	0.0000
3	0.0000	0.9731	0.0962	0.0000
4	0.0000	0.0115	0.9038	0.0000
5	0.0000	0.0000	0.0000	1.0000

Corrected Scale age proportion vectors for scale-aged 2 - 5 fish.

# known scales	21	61	15	116				0	128
# unknown scales	732	360	79	227				2	769
Age	Willow Creek Weir WCW	Hoopa Tribal NET HARV	Lower Trinity REC HARV	TRH HATCHERY	Lower Trinity Mainstem	Upper Trinity REC HARV	Upper Trin NATURAL	Lower Trin Tribs	
2	0.3314	0.1286	0.3444	0.1340	0.0000	-	0.3648	0.5000	
3	0.5687	0.6710	0.6499	0.7390	0.0000	0.9913	0.5372	0.0000	
4	0.0985	0.2004	0.0057	0.1270	0.0000	0.0087	0.0964	0.5000	
5	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0000	
	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	1.00000	

Correction Matrix for ages 2,3,4,5.
(Inverse of Scale-CWT age proportion matrix.)

	2	3	4	5
2	1.0000	-0.0158	0.0017	0.0000
3	0.0000	1.0290	-0.1095	0.0000
4	0.0000	-0.0131	1.1078	0.0000
5	0.0000	0.0000	0.0000	1.0000

CWTS Age	Willow Creek Weir WCW	Hoopa Tribal NET HARV	Lower Trinity REC HARV	TRH HATCHERY	Lower Trinity CARCASS	(Estimated) Upper Trinity REC HARV	(Estimated) Upper Trinity NATURAL	Hoopa Hook&Line
2	0	3	2	42	0	2	109	0
3	0	42	12	284	0	21	641	0
4	0	16	1	45	0	3	102	0
5	0	0	0	0	0	0	0	0
	0	61	15	371	0	26	851	0
# unknown ads	0	5	2	6	0	0	0	0
# total ads	0	66	17	377	0	paper CWTs		0

WCW scales

Age	WCW no cwts	known age cwts scales	Total age all scales	WCW age proportions
2	243	0	243	0.3314
3	416	0	416	0.5687
4	72	0	72	0.0985
5	1	0	1	0.0014
	732	0	732	1.0000

Natural Escapement, Trinity basin above WCW: Apportioned to age structure.

	Total Run
Rec above WCW	234
TRH	1586
Naturals	10323
Total	12143

Age	WCW proportions	TRH + Rec above WCW+Natural Escapement	**Apportioned Natural Escapement** minus TRH #s minus above WCW creel #s Escapement	Proportions
2	0.3314	4024	3765	0.3648
3	0.5687	6905	5545	0.5372
4	0.0985	1197	996	0.0964
5	0.0014	17	17	0.0016
		12143		

Appendix F. 2019 Klamath Basin fall Chinook age-composition calculation worksheet.

2/11/2020

Hatchery spawners	# Grilse	# Adults	Total Run	CALCULATED AGE 2	3	4	5	Total	SCALE AGE PROPORTIONS (unknowns)	2	3	4	5	Total	Unk. Age Scales Read	Redd Surveys Redds	Live	Video	Carcass
Iron Gate Hatchery (IGH)	249	3797	4046	249	2825	972	0	4046	scales	0.06954	0.68338	0.24708	0.00000	1.0	578				
									IGH cwts	20	573	158	0	751					
Trinity River Hatchery (TRH)	205	1381	1586	205	1182	199	0	1586	scales	0.13401	0.73896	0.12704	0.00000	1.0	227				
Hatchery spawner subtotal:	454	5178	5632	454	4007	1171	0	5632	TRH cwts	42	284	45	0	371					
	prop. hatchery grilse		0.081			proportion hatchery		0											
Natural Spawners																LAST DAY LIVES ARE ADULTS ONLY			
Trinity River mainstem above WCW	3765	6558	10323	3765	5545	996	17	10323	scales	0.36476	0.53719	0.09644	0.00161	1.0	732				
Trinity River mainstem below WCW	22	38	60	22	32	6	0	60	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	0	19			
Salmon River Basin (includes Wooley Cr)	686	957	1643	686	790	167	0	1643	scales	0.41766	0.48100	0.10133	0.00000	1.0	289	468	21		264
Scott River	409	1681	2090	409	1596	85	0	2090	scales	0.19549	0.76386	0.04064	0.00000	1.0	599	216		1553	235
									Scott CWT	0	0	0	0	0					
Shasta River	78	5926	6004	78	5341	585	0	6004	Adult scales only		0.90135	0.09865	0.00000	1.0	42			6004	
									Shasta CWT	0	0	0	0	0					
Bogus Creek	148	990	1138	148	872	118	0	1138	scales	0.13374	0.76507	0.10119	0.00000	1.0	225			971	167
									Bogus CWT	1	29	6	0	36					
Mainstem Klamath (IGH to Shasta R)	169	1149	1318	169	879	262	8	1318	scales	0.12950	0.66496	0.19859	0.00695	1.0	625				
									KR main CWT	0	13	3	0	16					
Mainstem Klamath (Ash Cr to Wingate Bar)	310	2082	2392	310	1591	475	16	2392	Up K main	0.12950	0.66496	0.19859	0.00695	1.0	IGH to Shasta	1041			
Mainstem Klamath (Persido Bar to Big Bar)	113	152	265	113	118	34	0	265	Klam tribs	0.42605	0.44614	0.12781	0.00000	1.0	Klam tribs	76			
Main basin subtotals:	5,587	19,381	24,968	5,587	16,646	2,694	41	24,968											
Klamath Tributaries																			
Aiken Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Beaver Cr	48	65	113	48	50	15	0	113	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	32	1		
Bluff Cr	13	17	30	13	13	4	0	30	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	1	15		
Boise Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Camp Cr	79	107	186	79	83	24	0	186	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	53	1		
Clear Cr	53	72	125	53	56	16	0	125	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	34	4		
Dillon Cr	37	50	87	37	39	11	0	87	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	25	0		
Elk Cr	30	40	70	30	31	9	0	70	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	19	2		
Ft. Goff Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Grider Cr	45	61	106	45	47	14	0	106	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	30	1		
Horse Cr	28	38	66	28	30	8	0	66	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	19	0		
Independence Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Indian Cr	62	83	145	62	64	19	0	145	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	39	5		
Irving Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Pearch Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117				
Red Cap Cr	53	71	124	53	55	16	0	124	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	35	1		
Rock Cr	3	4	7	3	3	1	0	7	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	2	0		
Slate Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Swillup Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117				
Thompson Cr	31	42	73	31	33	9	0	73	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	21	0		
Ti Cr	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Ukonom Cr	6	8	14	6	6	2	0	14	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	2	4		
Other	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0	0		
Pine Cr (formerly in Hoopa tribs)	0	0	0	0	0	0	0	0	scales	0.42605	0.44614	0.12781	0.00000	1.0	1,117	0			
Klamath trib subtotal:	488	658	1146	488	510	148	0	1146								312	34		
Trinity Tributaries																			
Horse Linto Cr	13	23	36	13	19	3	1	36	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	9	5		
Cedar Cr (trib to Horse Linto)	2	4	6	2	3	1	0	6	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	2	0		
Other (Willow & Madden creeks in Up TR nat estim)	0	0	0	0	0	0	0	0	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2				
Trinity trib subtotal:	15	27	42	15	22	4	1	42								11			
Non-reservation trib subtotal:	503	685	1188	503	532	152	1	1188											
Reservation Tributaries-Hoopa Valley																			
Campbell Cr	0	0	0	0	0	0	0	0	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	0			
Hostler Cr	0	0	0	0	0	0	0	0	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	0			
Mill Cr	14	24	38	14	20	4	0	38	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	12			
~~Pine Cr.~~ (moved in 2007 to Klam tribs)																			
Soctish Cr	0	0	0	0	0	0	0	0	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	0			
Supply Cr	30	52	82	30	44	8	0	82	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	26			
Tish Tang Cr	7	12	19	7	10	2	0	19	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2	6			
Other (Hospital Cr.)	0	0	0	0	0	0	0	0	Up T main	0.36476	0.53719	0.09644	0.00161	1.0	2				
HVT reservation trib subtotal:	51	88	139	51	74	14	0	139								44			
							0												
Reservation Tributaries-Yurok									SURROGATE - Unweighted avg of Blue Ck adults from 2007-09, 11-15, 17 (years w/ surrogates omitted)										
Blue Cr	26	91	117	26	24	61	6	117	**count**	0.26099	0.66715	0.07186		1.0	0				
									0.222										
Reservation tributaries subtotal:	77	179	256	77	98	75	6	256											
Natural spawner subtotal:	6167	20245	26412	6167	17276	2921	48	26412											
Total spawners:	**6621**	**25423**	**32044**	**6621**	**21283**	**4092**	**48**	**32044**											
Angler Harvest																			
Klamath River (below Hwy 101)	246	764	1010	246	617	144	3	1010	scales	0.24797	0.60621	0.14265	0.00317	1.0	1372				
									est-LRC CWT	0	16	2	0	18					
Klamath River (Hwy 101 to Weitchpec)	2239	2579	4818	2239	2261	318	0	4818	scales	0.46975	0.46420	0.06606	0.00000	1.0	402				
									mid-LRC CWT	6	54	4	0	64					
		Upper Klam							SURROGATE - IGH+Bogus+Klamath Mainstem+Shasta Weighted Totals							IGH+BOG+Kmain+Shasta			
		ratio estimator							IGH+Bog+Klam+Sha	644	9917	1937	8	12506		12506			
Klamath River (Weitchpec to IGH)	91	1685	1776	91	1408	275	2	1776		0.0515	0.7930	0.1549	0.0006	1.0		1776	0.14201		
									SURROGATE - Trinity Rec. Harvest below WCW - adults only										
Trinity River (above Willow Cr. Weir)	54	180	234	54	178	2	0	234	TR LRC	count	0.99129	0.00871	0.00000	1.0					
									don't use paper TR CWTs in age calculations										
Trinity River (below Willow Cr. Weir)	78	157	235	78	155	2	0	235	scales	0.34443	0.64986	0.00571	0.00000	1.0	79				
									TR-low CWT	2	12	1	0	15					
Angler harvest subtotal:	2,708	5365	8,073	2,708	4,619	741	5	8073											
Tribal Harvest																			
Klamath River (Estuary)	41	3322	3363	41	2002	1282	38	3363	scales	0.01232	0.59696	0.37910	0.01163	1.0	0				
									YTFP EST CWT	0	36	33	0	69		Yurok harvest			
Klamath River (101 to Trinity R)	51	587	638	51	331	254	2	638	scales	0.08182	0.52066	0.39462	0.00291	1.0	289	189	MidKlm		
									YTFP MU CWT	0	6	7	0	13		449	UpKlm		
Trinity River (net and hook-and-line)	94	676	770	94	518	158	0	770	net scales	0.12857	0.67102	0.20042	0.00000	1.0	360				
									HVT net CWT	3	42	16	0	61					
Trinity River (harvest weir)	405	1389	1794	405	1209	178	2	1794	weir scales	0.24472	0.66026	0.09372	0.00130	1.0	769				
									HVT weir CWT	20	170	30	0	220					
Tribal harvest subtotal:	591	5974	6565	591	4060	1872	42	6565											
Total harvest:	**3299**	**11339**	**14638**	**3299**	**8679**	**2613**	**47**	**14638**											
Totals																			
Harvest and Escapement	9920	36762	46682	9920	29962	6705	95	46682											
Angling drop-off mortality (2.04%)	55	109	164	55	94	15	0	164	0.0204	angling drop-off mortality rate on harvest									
Net drop-off mortality (8.7%)*	16	399	415	16	248	147	4	415	0.0870	net drop-off mortality rate on harvest									
Ich Disease Testing (Tribal)																			
Klamath River	0	0	0	0	0	0	0	0	Klam CWTs	0	0	0	0	0					
Trinity River	0	0	0	0	0	0	0	0	YTFP MU scales	0.0818	0.5207	0.3946	0.0029	1.0000					
Total disease testing:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	HVT scales	0.1286	0.6710	0.2004	0.0000	1.0000					
									Trin CWTs	0	0	0	0	0					
Total in-river run	**9991**	**37270**	**47261**	**9991**	**30304**	**6867**	**99**	**47261**											

Appendix G. Final age composition of the 2018 Klamath Basin fall Chinook run. 2/3/2020

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	435	10,666	759	0	11,425	11,860
Trinity River Hatchery (TRH)	171	7,057	85	0	7,142	7,313
Hatchery Spawner subtotal	**606**	**17,723**	**844**	**0**	**18,567**	**19,173**
Natural Spawners						
Salmon River Basin	285	1,169	59	0	1,228	1,513
Scott River Basin	71	1,085	115	8	1,208	1,279
Shasta River Basin	2,017	17,715	960	0	18,675	20,692
Bogus Creek Basin	196	3,379	103	0	3,482	3,678
Klamath River mainstem (IGH to Shasta R)	453	6,973	736	0	7,709	8,162
Klamath River mainstem (Ash Cr to Wingate Bar)	220	3,381	357	0	3,738	3,958
Klamath Tributaries (above Trinity River)	131	1,202	67	0	1,269	1,400
Blue Creek	118	181	14	1	196	314
Klamath Basin subtotal	3,491	35,085	2,411	9	37,505	40,996
Trinity River (mainstem above WCW)	4,075	14,355	144	0	14,499	18,574
Trinity River (mainstem below WCW)	58	206	2	0	208	266
Trinity Tributaries (above Reservation; below WCW)	21	75	1	0	76	97
Hoopa Reservation tributaries	18	64	0	0	64	82
Trinity Basin subtotal	4,172	14,700	147	0	14,847	19,019
Natural Spawners subtotal	**7,663**	**49,785**	**2,558**	**9**	**52,352**	**60,015**
Total Spawner Escapement	**8,269**	**67,508**	**3,402**	**9**	**70,919**	**79,188**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	121	380	55	0	435	556
Klamath River (Hwy 101 to Weitchpec)	1,780	1,543	60	0	1,603	3,383
Klamath River (Weitchpec to IGH)	77	963	64	0	1,027	1,104
Trinity River Basin (above WCW)	200	761	0	0	761	961
Trinity River Basin (below WCW)	59	284	0	0	284	343
Subtotals	**2,237**	**3,931**	**179**	**0**	**4,110**	**6,347**
Tribal Harvest						
Klamath River (below Hwy 101)	86	7,637	1,028	0	8,665	8,751
Klamath River (Hwy 101 to Trinity mouth)	42	3,084	695	0	3,779	3,821
Trinity River (net and hook-and-line)	7	1,035	66	0	1,101	1,108
Trinity River (harvest weir)	173	1,198	26	0	1,224	1,397
Subtotals	**308**	**12,954**	**1,815**	**0**	**14,769**	**15,077**
Total Harvest	**2,545**	**16,885**	**1,994**	**0**	**18,879**	**21,424**
Totals						
Harvest and Escapement	10,814	84,393	5,396	9	89,798	100,612
Recreational Angling Dropoff Mortality 2.04%	46	80	4	0	84	130
Tribal Net Dropoff Mortality 8.7%	12	1,023	155	0	1,178	1,190
Klamath-Trinity Basin Ich disease testing	0	0	0	0	0	0
Total River Run	**10,872**	**85,496**	**5,555**	**9**	**91,060**	**101,932**