Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2018 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 2018 was estimated to be:

	Run Size	
Age	*Number*	*Proportion*
2	11,114	0.11
3	86,717	0.84
4	5,567	0.05
5	9	0.00
Total	103,407	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	91,900	92,300	1.00
Fishery Mortality			
Tribal Harvest	18,100	14,800	1.22
Recreational Harvest	3,500	4,100	0.85
Drop-off Mortality	1,600	1,300	1.23
	23,200	20,200	1.15
Escapement			
Hatchery Spawners	27,900	18,600	1.50
Natural Area Spawners	40,700	53,600	0.76
	68,600	72,200	0.95

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 2018. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFW 2019) and with the 2019 forecast of ocean stock abundance (KRTT 2019).

Age-specific escapement estimates for 2018 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 2019). 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 2019). 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. For all sectors of the Trinity River, and escapement sectors of the Klamath River (excluding Blue Creek), scale aging was performed as described above in 2018. However, scale ages from the Klamath River harvest sectors and from Blue Creek were determined by a single reader. 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 2018, an opportunistic redd survey was performed on the mainstem Klamath River from Persido Bar to Big Bar, a reach where surveys generally do not occur. A total of 99 redds were identified in this survey. After substantial debate, the KRTT decided to not include the results of this survey in

the 2018 run size estimate. The KRTT noted that inclusion of this one-time 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.

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 10,026 scales from 16 different sectors were aged for this analysis (Table 2). Of these, 1,115 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, though accuracy for some sectors and ages was lower than previous years. Accuracy within the Trinity Basin was 97% for age-2 fish, 99% for age-3 fish, and 79% for age-4 fish. Accuracy within the escapement component of the Klamath River Basin was 100% for age-2 fish, 97% for age-3 fish, and 86% for age-4 fish. Accuracy within the harvest component of the Klamath River Basin was 94% for age-2 fish, 81% for age-3 fish, and 84% for age-4 fish. The age-5 component of the run was nearly absent in 2018 and no known-age-5 fish were sampled. As a result, accuracy could not be assessed for the age-5 component of the 2018 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 2017 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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Klamath River Technical Team
Participants

California Department of Fish and Wildlife
Alex Letvin
Vanessa Gusman
Morgan Knechtle
Kenneth Lindke
Dan Troxel
Mary Claire Kier
Domenic Giudice

Hoopa Valley Tribe
George Kautsky
Bob Campbell
Michael Macon

National Marine Fisheries Service
Michael O'Farrell

U.S. Fish and Wildlife Service
Stephen Gough

Yurok Tribe
Desma Williams
Keith Parker

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Table 1. Estimation and sampling methods used for the 2018 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-data 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-data collected from a systematic random sample of 20% of the fish. Additionally, all 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 cut in half to remove redds thought to be attributable 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-data collected from all carcasses recovered.	CDFW, USFS, USFWS, KT, SRRC, SCS, WSP, MKWC, NCRC
Scott River Basin	Combination video count above weir at river mile 18 and redd survey below the weir. Total run based on video count through the weir and redd survey (Total run below the weir = (2*total redd count)/(1-proportion jacks)). Bio-data collected from all carcasses recovered.	CDFW, QVIR, USFS, KT, NCRC, SRCD, WSP
Shasta River Basin	Video count above weir. Bio-data collected from all carcasses upstream of video weir site, and a 20% systematic random sample of carcasses stranded on weir. Additionally, all ad-clipped fish were bio-sampled.	CDFW, WSP
Bogus Creek Basin	Video count above weir and twice weekly direct carcass count below weir. Bio-data collected from a systematic random sample (33%) of all carcasses observed during surveys above and below weir. Additionally, all ad-clipped fish were bio-sampled.	CDFW, WSP
Klamath River mainstem (IGH to Shasta R.)	Hierarchical latent variables model from weekly mark-recapture carcass surveys. Bio-data collected from systematic samples of fresh carcasses. Systematic sample rates varied by week (Appendix B).	USFWS, YT
Klamath River mainstem (Ash Cr. 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-data collected from all carcasses recovered.	USFS, CDFW, KT, YT, MKWC, WSP
Blue Creek	Total estimated using the maximum count from dive surveys conducted between 30 October and 11 December. Bio-data was collected from all carcasses recovered.	YT
Trinity River (mainstem above WCW)	Mark-recapture (stratified Petersen); marks applied at WCW and recovered at TRH. All fish bio-sampled and scales collected from every other Chinook in good condition at WCW. 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 39, then 2 days per week after JW 39. Bio-data 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 39, then 2 days per week after JW 39. Bio-data 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 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-data collected during angler interviews.	HVT
Tribal Harvest		
Klamath River (below Hwy 101)	Daily harvest estimates based on effort and catch-per-effort surveys during the net fishery. Bio-data collected during net harvest surveys.	YT
Klamath River (Hwy 101 to Trinity mouth)	Daily harvest estimates based on effort and catch-per-effort surveys. Bio-data collected during harvest interviews	YT
Trinity River (net and hook-and-line)	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. Bio-data collected during net harvest interviews.	HVT
Trinity River (harvest weir)	Direct count of all harvested fish. Bio-data 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-data 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 2018 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)	869	92	961	1,152	CDFW
Trinity River Hatchery (TRH)	1,087	312	1,399	1,429	HVT
Natural Spawners					
Salmon River Carcass Survey	122	0	122	123	CDFW
Scott River Carcass Survey[d/]	149	0	149	152	CDFW
Shasta River Carcass[d/]	259	8	267	275	CDFW
Bogus Creek	627	111	738	766	CDFW
Klamath River mainstem	432	42	474	500	USFWS
Upper Klamath River tributaries	74	0	74	78	USFS
Blue Creek Snorkel	7	0	7	9	YT
Willow Creek Weir	750	31	781	796	CDFW, HVT
Lower Trinity River Carcass	0	0	0	0	HVT
Hoopa Reservation tributaries	0	0	0	0	HVT
Other Trinity River tributaries	0	0	0	1	USFS
Recreational Harvest					
Lower Klamath River Creel	926	29	955	992	CDFW
Lower Trinity River Creel	61	18	79	81	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	851	112	963	1,008	YT
Klamath River (Hwy 101 to Trinity R.)	1,137	49	1,186	1,247	YT
Trinity River (net and hook-and-line)	443	53	496	503	HVT
Trinity River (harvest weir)	1,117	258	1,375	1,390	HVT
TOTAL	8,911	1,115	10,026	10,502	

a/ Scales from non-ad-clipped fish and ad-clipped fish without valid CWT codes, mounted and read.
b/ Scales from all mounted and aged ad-clipped CWT fish with valid CWT codes; 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 due to over-representation of age-two fish.

Table 3. Age-composition methods used for the 2018 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	Jack/adult structure from scale-age analysis.
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 (Ash Cr. 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. Adult age structure surrogate from unweighted average of Scott and Salmon rivers.
Trinity River (above WCW)	Jack/adult structure derived from subtracting age-specific TRH returns 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. 2018 Klamath River Basin scale validation matrices used for *ESCAPEMENT* sectors.

Number

Read Age	Known Age 2	3	4	5	Total
2	11	0	0	0	
3	0	216	2	0	
4	0	7	12	0	
5	0	0	0	0	
Total	11	223	14	0	248

Percentage

Read Age	Known Age 2	3	4	5
2	1.00	0.00	0.00	0.00
3	0.00	0.97	0.14	0.00
4	0.00	0.03	0.86	0.00
5	0.00	0.00	0.00	1.00
Total	1.00	1.00	1.00	1.00

Table 4b. 2018 Klamath River Basin scale validation matrices used for *HARVEST* sectors.

Number

Read Age	Known Age 2	3	4	5	Total
2	16	6	0	0	
3	1	212	6	0	
4	0	42	31	0	
5	0	1	0	0	
Total	17	261	37	0	315

Percentage

Read Age	Known Age 2	3	4	5
2	0.94	0.02	0.00	0.00
3	0.06	0.81	0.16	0.00
4	0.00	0.16	0.84	0.00
5	0.00	0.00	0.00	1.00
Total	1.00	1.00	1.00	1.00

Table 4c. 2018 Trinity River Basin scale validation matrices.

Number

Read Age	Known Age 2	3	4	5	Total
2	29	5	0	0	
3	1	622	3	0	
4	0	1	11	0	
5	0	0	0	0	
Total	30	628	14	0	672

Percentage

Read Age	Known Age 2	3	4	5
2	0.97	0.01	0.00	0.00
3	0.03	0.99	0.21	0.00
4	0.00	0.00	0.79	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 2018 Klamath Basin fall Chinook run. 2/8/2019

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	7,054	85	0	7,139	7,310
Hatchery Spawner subtotal	**606**	**17,720**	**844**	**0**	**18,564**	**19,170**
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	2,016	17,713	960	0	18,673	20,689
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	3,490	35,083	2,411	9	37,503	40,993
Trinity River (mainstem above WCW)	4,352	15,617	156	0	15,773	20,125
Trinity River (mainstem below WCW)	57	206	2	0	208	265
Trinity Tributaries (above Reservation; below WCW)	21	76	0	0	76	97
Hoopa Reservation tributaries	17	63	1	0	64	81
Trinity Basin subtotal	4,447	15,962	159	0	16,121	20,568
Natural Spawners subtotal	**7,937**	**51,045**	**2,570**	**9**	**53,624**	**61,561**
Total Spawner Escapement	**8,543**	**68,765**	**3,414**	**9**	**72,188**	**80,731**
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)	169	726	0	0	726	895
Trinity River Basin (below WCW)	59	284	0	0	284	343
Subtotals	**2,206**	**3,896**	**179**	**0**	**4,075**	**6,281**
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	**2,514**	**16,850**	**1,994**	**0**	**18,844**	**21,358**
Totals						
Harvest and Escapement	11,057	85,615	5,408	9	91,032	102,089
Recreational Angling Dropoff Mortality 2.04%	45	79	4	0	83	128
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	**11,114**	**86,717**	**5,567**	**9**	**92,293**	**103,407**

Table 6. Age proportion of the 2018 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5
Hatchery Spawners				
Iron Gate Hatchery (IGH)	0.04	0.90	0.06	0.00
Trinity River Hatchery (TRH)	0.02	0.96	0.01	0.00
Hatchery Spawner subtotal	0.03	0.92	0.04	0.00
Natural Spawners				
Salmon River Basin	0.19	0.77	0.04	0.00
Scott River Basin	0.06	0.85	0.09	0.01
Shasta River Basin	0.10	0.86	0.05	0.00
Bogus Creek Basin	0.05	0.92	0.03	0.00
Klamath River mainstem (IGH to Shasta R.)	0.06	0.85	0.09	0.00
Klamath River mainstem (Ash Cr. to Wingate Bar)	0.06	0.85	0.09	0.00
Klamath tributaries (above Trinity River)	0.09	0.86	0.05	0.00
Yurok Reservation tributaries	0.38	0.58	0.04	0.00
Klamath Basin subtotal	0.09	0.86	0.06	0.00
Trinity River (mainstem above WCW)	0.22	0.78	0.01	0.00
Trinity River (mainstem below WCW)	0.22	0.78	0.01	0.00
Trinity tributaries (above Reservation)	0.22	0.78	0.00	0.00
Hoopa Reservation tributaries	0.21	0.78	0.01	0.00
Trinity Basin subtotal	0.22	0.78	0.01	0.00
Natural Spawners subtotal	0.13	0.83	0.04	0.00
Total Spawner Escapement	0.11	0.85	0.04	0.00
Recreational Harvest				
Klamath River (below Hwy 101 bridge)	0.22	0.68	0.10	0.00
Klamath River (Hwy 101 to Weitchpec)	0.53	0.46	0.02	0.00
Klamath River (Weitchpec to IGH)	0.07	0.87	0.06	0.00
Trinity River Basin (above WCW)	0.19	0.81	0.00	0.00
Trinity River Basin (below WCW)	0.17	0.83	0.00	0.00
Subtotals	0.35	0.62	0.03	0.00
Tribal Harvest				
Klamath River (below Hwy 101)	0.01	0.87	0.12	0.00
Klamath River (Hwy 101 to Trinity mouth)	0.01	0.81	0.18	0.00
Trinity River (net and hook-and-line)	0.01	0.93	0.06	0.00
Trinity River (harvest weir)	0.12	0.86	0.02	0.00
Subtotals	0.02	0.86	0.12	0.00
Total Harvest	0.12	0.79	0.09	0.00
Totals				
Harvest and Escapement	0.11	0.84	0.05	0.00
Recreational Angling Dropoff Mortality 2.04%	0.35	0.62	0.03	0.00
Tribal Net Dropoff Mortality 8.7%	0.01	0.86	0.13	0.00
Total River Run	0.11	0.84	0.05	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 – 2018 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[1] was obtained from every tenth Chinook Salmon returning to IGH in 2018. 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 to collect bio-samples. Bio-samples were obtained at a 1:3 systematic random sampling rate and from every (i.e., non-random) ad-clipped fish 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 Shasta River mainstem, Yreka Creek, Big Springs Creek, Little Springs Creek, and Parks Creek. Biosamples were also obtained from a 1:5 systematic sample of carcasses and all ad-clipped fish not falling within the systematic sample that washed back onto the counting weir. Scale-based age compositions from samples collected during spawning ground surveys were used to apportion all age classes.

Scott River

Independent estimates from above and below the weir were combined to estimate total escapement. Escapement above the weir was estimated using videography as the net count of fish moving upstream. 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. Spawning ground surveys were also conducted upstream of the weir to collect bio-samples. 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), adding the number of live adult fish observed on the last survey. Total escapement was then estimated by

[1] Biological samples ("bio-samples") of live fish or carcasses generally included: sex, fork length, tags or marks, a scale sample, and CWT recovery codes from adipose fin-clipped fish.

applying the scale-based age-2 proportion to adult escapement. Bio-samples were obtained from most recovered carcasses. Scale-based age compositions were used to apportion jack and adult age classes. Wooley Creek redd and live fish counts were adjusted to account for presence of spring-run Chinook Salmon by reducing total number of redds and live adults by 50%.

Klamath River Tributaries

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

Klamath River Mainstem (IGH to Shasta River)

A hierarchical latent variables model based on weekly carcass counts and mark-recapture data was used to estimate escapement. All observed carcasses were sampled during the first three survey weeks. Carcasses were systematically sampled at 1:5 during weeks 4, 5, 6, and 8 and 1:10 in week 7. Scale-based age proportions were used to assign all age classes.

Klamath River Mainstem (Ash Creek to Wingate Bar)

Total escapement was estimated by expanding total redd counts (redds X 2) from surveys conducted weekly as conditions allowed and applying the jack proportion from the upper reach. Age assignments were based on age proportions from scales collected in the upper reach.

Lower Klamath River Creel

Total harvest was estimated by combining creel census 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 through JW 39, then two days per week after JW 39. Bio-samples were collected from as many fish as possible during angler interviews. Scale-based age proportions from scale samples were used to apportion all age classes.

Upper Klamath River Recreational Fishery

A creel census in this sub-area was not conducted in 2018. Creel census data were available for the lower and upper river fisheries in 1999 through 2002. The ratio of average adult harvest in the entire Klamath mainstem to the average harvest in the lower Klamath River Creel area from these years was applied to the 2018 lower Klamath River Creel harvest to estimate the 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 main stem 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), Bogus Creek, and Iron Gate Hatchery. 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)

Yurok harvest in this sub-area was estimated by hourly effort and catch-per-effort analyses, stratified by day and night. Catch-per-effort was accounted for as fish per net-hour. 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 effort and catch-per-effort analyses. Scale-based age composition was used to apportion all age classes.

Blue Creek

The total run was estimated using the maximum single-day count from dive surveys conducted between 30 October and 11 December. Bio-data was collected from all carcasses recovered. The jack proportion was based on visual determination during dive surveys. Adult age proportions were estimated as the unweighted average of age-specific proportions from the Scott and Salmon rivers.

Appendix C. Trinity River – 2018 details.

Trinity River Natural Escapement (above WCW)

Total run was estimated using a Petersen mark-recapture estimator, stratified by jacks and adults. 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: Trinity River Hatchery, Trinity basin natural spawning escapement above WCW, and recreational harvest. Bio-samples were collected from every other Chinook Salmon (systematic sampling of 1:2) 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. Sampling for scales was conducted in a systematic (1:5) random manner including ad-clipped and non-ad-clipped fish. 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 the Willow Creek Weir (WCW) and subsequent returns by anglers. In 2018, CDFW estimated a 3.07% harvest rate on adult Chinook Salmon based on the return of program reward tags (20 of 651) applied at WCW. The jack harvest rate of 3.60% was based on return of program reward tags (4 of 111). There were no scales recovered from this fishery as no creel survey was implemented in 2018. The 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 (Fri, Sat, and Sun) and weekday, with sampling occurring on 2 and 1 randomly selected days per stratum, respectively. Scales collected during this survey were used to apportion the age structure in this sector.

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)

Adult escapement was estimated by expanding the total redd count (redds X 2), adding the number of live adult fish observed on the last survey. Total escapement was then estimated by applying the scale-based age-2 proportion to adult escapement. Age proportions from the upper Trinity River natural escapement sector were used to apportion all age classes.

Hoopa Reservation Tributaries

Adult escapement was estimated by expanding the total redd count (redds X 2). Total escapement was then estimated by applying the scale-based age-2 proportion to adult escapement. 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 harvest is a composite of the gill net and hook-and-line fisheries conducted by Tribal members. Fisheries are monitored by censusing daily effort on three (hook-and-line) or four (gill net) randomly selected days per week. Total harvest was estimated by expansion of randomly selected days and effort to weekly totals. Scale age proportions were used to apportion all ages.

Hoopa Valley Tribal Harvest (harvest weir)

Direct count of all Chinook harvested. Scale samples attempted to be taken from all harvested fish. Scale age proportions were used to apportion all ages.

Appendix D. 2018 Klamath age analysis.

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	34	561	32	0	627
IGH	33	766	70	0	869
SALMON	23	92	7	0	122
SCOTT	8	121	15	1	145
SHASTA	19	163	13	0	195
MAINSTEM	24	363	45	0	432
UR TRIBS	7	62	5	0	74
LRC EST	79	208	68	1	356
LRC UP	288	232	50	0	570
YTFP EST	25	621	203	2	851
YTFP M&U	33	781	322	1	1,137
BLUE CRK	3	4	0	0	7
	576	3,974	830	5	5,385

Unknown scales corrected age proportions (Kimura method)

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0.0542	0.9199	0.0259	0.0000	1.0
IGH	0.0380	0.9010	0.0610	0.0000	1.0
SALMON	0.1885	0.7728	0.0386	0.0000	1.0
SCOTT	0.0552	0.8483	0.0896	0.0069	1.0
SHASTA	0.0974	0.8561	0.0464	0.0000	1.0
MAINSTEM	0.0556	0.8542	0.0902	0.0000	1.0
UR TRIBS	0.0946	0.8580	0.0474	0.0000	1.0
LRC EST	0.2191	0.6842	0.0966	0.0002	1.0
LRC UP	0.5268	0.4557	0.0175	0.0000	1.0
YTFP EST	0.0099	0.8730	0.1171	0.0000	1.0
YTFP M&U	0.0112	0.8052	0.1836	0.0000	1.0
BLUE CRK	0.4286	0.5714	0.0000	0.0000	1.0

Known CWT ages [a/]

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	11	242	15	0	268
IGH	68	1,950	169	0	2,187
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	2	12	0	0	14
MAINSTEM	2	38	3	0	43
UR TRIBS	0	0	0	0	0
LRC	14	22	3	0	39
YTFP EST	1	105	17	0	123
YTFP M&U	0	57	5	0	62
BLUE CRK	0	0	0	0	0
	98	2,426	212	0	2,736
Breakout within strata					
Bogus1	7	109	11	0	127
Bogus2	4	133	4	0	141
LRC - lo	1	7	2	0	10
LRC - mid	13	15	1	0	29
YTFP MID	0	23	4	0	27
YTFP UP	0	34	1	0	35

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

Appendix E. 2018 Trinity age analysis.

WCW = Willow Ck. Weir

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	13	0	2	0	0	15
	2	125	0	0	0	0	125
Scale	3	619	0	31	0	0	650
Ages	4	6	0	0	0	0	6
33	5	0	0	0	0	0	0
750		763	0	33	0	0	796

LOWTRINREC = Lower Trinity Recreational

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	0	1	1	0	0	2
	2	11	0	0	0	0	11
Scale	3	50	0	18	0	0	68
Ages	4	0	0	0	0	0	0
20	5	0	0	0	0	0	0
61		61	1	19	0	0	81

HUPAHARV = Hoopa Tribal Net Harvest plus Tribal Hook-and-Line

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	6	0	1	0	0	7
	2	6	0	0	0	0	6
Scale	3	416	0	48	2	0	466
Ages	4	21	0	0	3	0	24
54	5	0	0	0	0	0	0
443		449	0	49	5	0	503

TRH = Trinity River Hatchery

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	25	0	5	0	0	30
	2	33	9	4	0	0	46
Scale	3	1042	0	292	0	0	1334
Ages	4	12	0	0	7	0	19
317	5	0	0	0	0	0	0
1087		1112	9	301	7	0	1429

LOWTRINTRIBS = Lower Trinity Tribs - Includes samples taken by U

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

NO DATA

0

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

HVTSELECTHARV = Hoopa Tribal Weir Harvest

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	12	0	3	0	0	15
	2	152	20	1	0	0	173
Scale	3	945	1	233	1	0	1180
Ages	4	20	0	1	1	0	22
261	5	0	0	0	0	0	0
1117		1129	21	238	2	0	1390

NO DATA

0

Scale Ages		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable						
	2						
Scale	3						
Ages	4						
0	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	29	5	0	0	
	3	1	622	3	0	
4x4	4	0	1	11	0	
	5	0	0	0	1E-10	0.99

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

	2	3	4	5
2	0.9667	0.0080	0.0000	0.0000
3	0.0333	0.9904	0.2143	0.0000
4	0.0000	0.0016	0.7857	0.0000
5	0.0000	0.0000	0.0000	1.0000

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

# known scales	33	54	20	317			0	261
# unknown scales	750	443	61	1087			0	1117

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	0.1656	0.0063	0.1797	0.0235	0.0000	-	0.2162	0.0000
3	0.8259	0.9353	0.8203	0.9644	0.0000	1.0000	0.7760	0.0000
4	0.0085	0.0584	0.0000	0.0121	0.0000	0.0000	0.0078	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1.00000	1.00000	1.00000	1.00000	0.00000	1.00000	1.00000	0.00000

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

	2	3	4	5
2	1.0348	-0.0083	0.0023	0.0000
3	-0.0348	1.0104	-0.2756	0.0000
4	0.0001	-0.0020	1.2733	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	0	1	36	0	3	52	0
3	0	49	19	1502	0	107	1859	0
4	0	5	0	15	0	1	19	0
5	0	0	0	0	0	0	0	0
	0	54	20	1553	0	111	1929	0
# unknown ads	0	4	9	51	0	0	0	0
# total ads	0	58	29	1604	0	paper CWTs		0

WCW scales

Age	WCW no cwts	known age cwts scales	Total age all scales	WCW age proportions
2	124	0	124	0.1656
3	619	0	619	0.8259
4	6	0	6	0.0085
5	0	0	0	0.0000
	750	0	750	1.0000

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

	Total Run
Rec above WCW	895
TRH	7310
Naturals	20125
Total	28330

Age	WCW proportions	TRH + Rec above WCW+Natural Escapement	Apportioned Natural Escapement minus TRH #s minus above WCW creel #s	Proportions
2	0.1656	4692	4352	0.2162
3	0.8259	23397	15617	0.7760
4	0.0085	241	156	0.0078
5	0.0000	0	0	0.0000
		28330		

Appendix F. 2018 Klamath Basin fall Chinook age-composition calculation worksheet.

2/8/2019

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)	435	11425	11860	435	10666	759	0	11860	scales	0.03797	0.90105	0.06098	0.00000	1.0	869				
									IGH cwts	68	1950	169	0	2187					
Trinity River Hatchery (TRH)	171	7139	7310	171	7054	85	0	7310	scales	0.02346	0.96444	0.01210	0.00000	1.0	1087				
Hatchery spawner subtotal:	606	18564	19170	606	17720	844	0	19170	TRH cwts	36	1502	15	0	1553					
	prop. hatchery grilse		0.032			proportion hatchery		0											
Natural Spawners																			
Trinity River mainstem above WCW	4352	15773	20125	4352	15617	156	0	20125	scales	0.21624	0.77601	0.00775	0.00000	1.0	750				
Trinity River mainstem below WCW	57	208	265	57	206	2	0	265	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	104			
Salmon River Basin (includes Wooley Cr)	285	1228	1513	285	1169	59	0	1513	scales	0.18852	0.77284	0.03864	0.00000	1.0	122	601	26		307
Scott River	71	1208	1279	71	1085	115	8	1279	scales	0.05517	0.84831	0.08962	0.00690	1.0	145	413		405	
									Scott CWT	0	0	0	0	0					
Shasta River	2016	18673	20689	2016	17713	960	0	20689	scales	0.09744	0.85614	0.04642	0.00000	1.0	195			20689	
									Shasta CWT	2	12	0	0	14					
Bogus Creek	196	3482	3678	196	3379	103	0	3678	scales	0.05423	0.91992	0.02585	0.00000	1.0	627			2734	944
									Bogus CWT	11	242	15	0	268					
Mainstem Klamath (IGH to Shasta R)	453	7709	8162	453	6973	736	0	8162	scales	0.05556	0.85420	0.09025	0.00000	1.0	432				
									KR main CWT	2	38	3	0	43					
Mainstem Klamath (Ash Cr to Wingate Bar)	220	3738	3958	220	3381	357	0	3958	Up K main	0.05556	0.85420	0.09025	0.00000	1.0	IGH to Shasta	1869			
Mainstem Klamath (Persido Bar to Big Bar)	21	198	219	21	188	10	0	219	Klam tribs	0.09459	0.85800	0.04741	0.00000	1.0	Klam tribs	99			
Main basin subtotals:	7,650	52,019	59,669	7,650	49,523	2,488	8	59,669											
Klamath Tributaries																			
Aiken Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	0	0		
Beaver Cr	25	242	267	25	229	13	0	267	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	121	0		
Bluff Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74				
Boise Cr	0	4	4	0	4	0	0	4	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	2	0		
Camp Cr	13	120	133	13	114	6	0	133	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	56	8		
Clear Cr	28	265	293	28	251	14	0	293	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	107	51		
Dillon Cr	12	116	128	12	110	6	0	128	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	57	2		
Elk Cr	12	112	124	12	106	6	0	124	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	53	6		
Ft. Goff Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	0	0		
Grider Cr	11	109	120	11	103	6	0	120	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	54	1		
Horse Cr	1	14	15	1	13	1	0	15	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	7	0		
Independence Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	0	0		
Indian Cr	9	89	98	9	84	5	0	98	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	41	7		
Irving Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	0	0		
Pearch Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74				
Red Cap Cr	7	63	70	7	60	3	0	70	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	31	1		
Rock Cr	2	22	24	2	21	1	0	24	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	11	0		
Slate Cr	1	13	14	1	12	1	0	14	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	4	5		
Swillup Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74				
Thompson Cr	6	62	68	6	59	3	0	68	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	31	0		
Ti Cr	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	0	0		
Ukonom Cr	3	33	36	3	31	2	0	36	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	14	5		
Other	1	5	6	1	5	0	0	6	scales	0.09459	0.85800	0.04741	0.00000	1.0	74	2	1		
Pine Cr (formerly in Hoopa tribs)	0	0	0	0	0	0	0	0	scales	0.09459	0.85800	0.04741	0.00000	1.0	74				
Klamath trib subtotal:	131	1269	1400	131	1202	67	0	1400								591	87		
Trinity Tributaries																			
Horse Linto Cr	14	50	64	14	50	0	0	64	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	24	2		
Cedar Cr (trib to Horse Linto)	7	26	33	7	26	0	0	33	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	12	2		
Other (Willow & Madden creeks in Up TR nat estim)	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0				
Trinity trib subtotal:	21	76	97	21	76	0	0	97								36			
Non-reservation trib subtotal:	152	1345	1497	152	1278	67	0	1497											
Reservation Tributaries-Hoopa Valley																			
Campbell Cr	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	0			
Hostler Cr	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	0			
Mill Cr	10	38	48	10	37	1	0	48	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	19			
~~Pine Cr.~~ (moved in 2007 to Klam tribs)																			
Soctish Cr	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	0			
Supply Cr	7	26	33	7	26	0	0	33	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	13			
Tish Tang Cr	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0	0			
Other (Hospital Cr.)	0	0	0	0	0	0	0	0	Up T main	0.21624	0.77601	0.00775	0.00000	1.0	0				
HVT reservation trib subtotal:	17	64	81	17	63	1	0	81								32			
							0												
Reservation Tributaries-Yurok									SURROGATE - Salmon and Scott rivers unweighted average for adults										
Blue Cr	118	196	314	118	181	14	1	314	SS	count	0.92512	0.07123	0.00365	1.0	4				
										0.376									
Reservation tributaries subtotal:	135	260	395	135	244	15	1	395											
Natural spawner subtotal:	7937	53624	61561	7937	51045	2570	9	61561											
Total spawners:	**8543**	**72188**	**80731**	**8543**	**68765**	**3414**	**9**	**80731**											
Angler Harvest																			
Klamath River (below Hwy 101)	121	435	556	121	380	55	0	556	scales	0.21907	0.68417	0.09658	0.00019	1.0	356				
									est-LRC CWT	1	7	2	0	10					
Klamath River (Hwy 101 to Weitchpec)	1780	1603	3383	1780	1543	60	0	3383	scales	0.52682	0.45573	0.01745	0.00000	1.0	570				
									mid-LRC CWT	13	15	1	0	29					
		Upper Klam							SURROGATE - IGH+Bogus+Klamath Mainstem+Shasta Weighted Totals							IGH+BOG+Kmain+Shasta			
		ratio estimator							IGH+Bog+Klam+Shasta	3100	38731	2558	0	44389		44389			
Klamath River (Weitchpec to IGH)	77	1027	1104	77	963	64	0	1104		0.0698	0.8725	0.0576	0.0000	1.0		1104	0.02487		
									SURROGATE - Trinity Rec. Harvest below WCW - adults only										
Trinity River (above Willow Cr. Weir)	169	726	895	169	726	0	0	895	TR LRC	count	1.00000	0.00000	0.00000	1.0					
									don't use paper TR CWTs in age calculations										
Trinity River (below Willow Cr. Weir)	59	284	343	59	284	0	0	343	scales	0.17972	0.82028	0.00000	0.00000	1.0	61				
									TR-low CWT	1	19	0	0	20					
Angler harvest subtotal:	2,206	4075	6,281	2,206	3,896	179	0	6281											
Tribal Harvest																			
Klamath River (Estuary)	86	8665	8751	86	7637	1028	0	8751	scales	0.0099	0.8730	0.1171	0.0000	1.0	851				
									YTFP EST CWT	1	105	17	0	123		Yurok harvest			
Klamath River (101 to Trinity R)	42	3779	3821	42	3084	695	0	3821	scales	0.0112	0.8052	0.1836	0.0000	1.0	1,137	1535	MidKlm		
									YTFP MU CWT	0	57	5	0	62		2286	UpKlm		
Trinity River (net and hook-and-line)	7	1101	1108	7	1035	66	0	1108	net scales	0.00631	0.93525	0.05844	0.00000	1.0	443				
									HVT net CWT	0	49	5	0	54					
Trinity River (harvest weir)	173	1224	1397	173	1198	26	0	1397	weir scales	0.13381	0.84511	0.02108	0.00000	1.0	1,117				
									HVT weir CWT	21	238	2	0	261					
Tribal harvest subtotal:	308	14769	15077	308	12954	1815	0	15077											
Total harvest:	**2514**	**18844**	**21358**	**2514**	**16850**	**1994**	**0**	**21358**											
Totals																			
Harvest and Escapement	11057	91032	102089	11057	85615	5408	9	102089											
Angling drop-off mortality (2.04%)	45	83	128	45	79	4	0	128	0.0204 angling drop-off mortality rate on harvest										
Net drop-off mortality (8.7%)*	12	1178	1190	12	1023	155	0	1190	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	0.0112	0.8052	0.1836	0.0000	1.0000					
Total disease testing:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	HVT scales	0.0063	0.9353	0.0584	0.0000	1.0000					
									Trin CWTs	0	0	0	0	0					
Total in-river run	**11114**	**92293**	**103407**	**11114**	**86717**	**5567**	**9**	**103407**											

Appendix G. Final age composition of the 2017 Klamath Basin fall Chinook run. 1/17/2019

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	3,193	5,800	1,620	23	7,443	10,636
Trinity River Hatchery (TRH)	1,863	3,487	244	39	3,770	5,633
Hatchery Spawner subtotal	**5,056**	**9,287**	**1,864**	**62**	**11,213**	**16,269**
Natural Spawners						
Salmon River Basin	327	724	495	119	1,338	1,665
Scott River Basin	307	1,933	79	257	2,269	2,576
Shasta River Basin	6,618	782	2,022	483	3,287	9,905
Bogus Creek Basin	848	1,565	274	35	1,874	2,722
Klamath River mainstem (IGH to Shasta R)	1,735	2,379	560	66	3,005	4,740
Klamath River mainstem (Ash Cr to Wingate Bar)	587	728	169	20	917	1,504
Klamath Tributaries (above Trinity River)	154	527	299	176	1,002	1,156
Blue Creek	45	23	117	0	140	185
Klamath Basin subtotal	10,621	8,661	4,015	1,156	13,832	24,453
Trinity River (mainstem above WCW)	3,999	4,850	767	205	5,822	9,821
Trinity River (mainstem below WCW)	129	84	14	4	102	231
Trinity Tributaries (above Reservation; below WCW)	96	63	10	3	76	172
Hoopa Reservation tributaries	92	59	11	2	72	164
Trinity Basin subtotal	4,316	5,056	802	214	6,072	10,388
Natural Spawners subtotal	**14,937**	**13,717**	**4,817**	**1,370**	**19,904**	**34,841**
Total Spawner Escapement	**19,993**	**23,004**	**6,681**	**1,432**	**31,117**	**51,110**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	26	16	27	4	47	73
Klamath River (Hwy 101 to Weitchpec)	10	6	10	1	17	27
Klamath River (Weitchpec to IGH)	0	0	0	0	0	0
Trinity River Basin (above WCW)	0	0	0	0	0	0
Trinity River Basin (below WCW)	6	1	6	0	7	13
Subtotals	**42**	**23**	**43**	**5**	**71**	**113**
Tribal Harvest						
Klamath River (below Hwy 101)	66	154	51	3	208	274
Klamath River (Hwy 101 to Trinity mouth)	6	4	7	1	12	18
Trinity River (net and hook-and-line)	112	1,096	445	112	1,653	1,765
Trinity River (harvest weir)	82	7	0	0	7	89
Subtotals	**266**	**1,261**	**503**	**116**	**1,880**	**2,146**
Total Harvest	**308**	**1,284**	**546**	**121**	**1,951**	**2,259**
Totals						
Harvest and Escapement	20,301	24,288	7,227	1,553	33,068	53,369
Recreational Angling Dropoff Mortality 2.04%	1	0	1	0	1	2
Tribal Net Dropoff Mortality 8.7%	16	109	44	10	163	179
Klamath-Trinity Basin Ich disease testing	0	0	0	0	0	0
Total River Run	**20,318**	**24,397**	**7,272**	**1,563**	**33,232**	**53,550**