Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2014 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 2014 was estimated to be:

	Run Size	
Age	*Number*	*Proportion*
2	22,348	0.12
3	57,837	0.32
4	98,710	0.54
5	3,897	0.02
Total	182,792	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	92,800	160,400	0.58
Fishery Mortality			
Tribal Harvest	27,300	25,900	1.05
Recreational Harvest	4,100	5,300	0.77
Drop-off Mortality	2,500	2,400	1.04
	33,900	33,600	1.01
Escapement			
Hatchery Spawners	18,200	31,300	0.58
Natural Area Spawners	40,700	95,300	0.43
	58,900	126,600	0.47

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 2014. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFG 2015) and with the 2014 forecast of ocean stock abundance (KRTT 2015).

Age-specific escapement estimates for 2014 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 2015). 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 2015). 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 (Appendix B and C). Random and nonrandom sampling methods of various types were used throughout the Basin (Table 1) to estimate the numbers of fall Chinook salmon in the 2014 run 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 was aged independently by two trained readers. In cases of disagreement, a third read was 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.

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

Results

A total of 11,796 scales from 15 different sectors were aged for this analysis (Table 2). Of these, 941 were from known-age CWT fish. Known-age scales provide a direct check, or "validation", of accuracy of the scale-based age estimates (Tables 4a and 4b, Appendices D and E). Overall, the scale-based ages were generally accurate. Accuracy within the Trinity Basin was 100% for age-2 fish, 98% for age-3 fish, 99% for age-4 fish, and 100% for age-5 fish. Accuracy within the Klamath River Basin was 97% for age-2 fish, 96% for age-3 fish, 92% for age-4 fish, and 71% for age-5 fish. 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 2013 Klamath Basin age composition were slightly modified from the preliminary age composition. Final estimates 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
YT	Yurok Tribe
YTFP	Yurok Tribal Fisheries Program

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Table 1. Estimation and sampling methods used for the 2014 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
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.	CDFW, HVT
Natural Spawners		
Salmon River Basin	Carcass mark-recapture survey (Cormack-Jolly-Seber) within the mainstem combined with redd surveys of the lower mainstem and tributaries. Total run based on mark-recapture estimate and expanded redd count (2*total redd count)/(1-proportion of jacks) + live fish observed on last day surveyed. Jacks estimated from scale-age data for this area. Bio-data collected from all carcasses recovered.	CDFW,USFS,YT, KT, SRRC, SCS
Scott River Basin	Video count above weir at river mile 18 and carcass mark-recapture (Cormack-Jolly-Seber) below weir. Total run based on video count through the weir and mark-recapture estimate below the weir. Access was limited in a 0.5 mile section of the mark-recapture area which was surveyed once for a peak redd count. In this 0.5 mile section total was estimated using the following formula: Total run = (2*total redd count)/(1-proportion jacks). Bio-data collected from all carcasses recovered.	CDFW, SCS, QVIR, USFS, KT, NCRC, SRCD
Shasta River Basin	Video count above weir. Bio-data collected from carcasses upstream of video weir site, a temporary trap, and mortalities stranded on weir.	CDFW
Bogus Creek Basin	Video count above weir and twice weekly direct carcass count below weir. Bio-data collected from a systematic random sample (1:4) of all carcasses observed during surveys above and below weir. Additionally, all ad-clipped fish were bio-sampled.	CDFW, SCS
Klamath River mainstem (IGH to Shasta R)	Area under the curve estimate from weekly carcass surveys. Bio-data collected from fresh carcasses.	USFWS, YT
Klamath River mainstem (Ash Cr to Indian Cr)	Weekly redd survey. Total run = (2*total redd count)/(1-proportion jacks). Jacks estimated from the Klamath River mainstem area scale-age data.	USFWS, KT
Klamath Tributaries above Trinity	Periodic redd surveys, the majority of which were performed weekly. Total run = (2*total redd count)/(1-proportion jacks) + live fish observed on last day surveyed. Jacks estimated from Klamath tributary scale-age data. Bio-data collected from all carcasses recovered.	USFS,CDFW, KT, YT, SRRC, MKWC, SCS
Blue Creek	Weekly snorkel surveys. Total estimated as the peak count during surveys. Bio-data collected from all fresh carcasses.	YT
Trinity River (mainstem above WCW)	Mark-recapture (Peterson); marks applied at WCW and recovered at TRH. All fish bio-sampled and scales collected in systematic random sample (1:2). Age composition of total run past WCW based on scale-age data from the weir. Natural spawning escapement estimated by subtracting age specific estimates of hatchery returns and recreational harvest above WCW from the total run.	CDFW, HVT
Trinity River (mainstem below WCW)	Bi-weekly redd survey. Total run = (2*total redd count)/(1-proportion jacks). Jacks estimated from the natural area above WCW. Bio-samples from all recovered carcasses.	HVT, USFWS
Trinity Tributaries (above Reservation; below WCW)	Periodic redd survey. Total run = (2*total redd count)/(1-proportion jacks) + live fish observed on last day surveyed. Jacks estimated from the Trinity tributaries and Hoopa Reservation tributaries combined. Bio-data collected from all recovered carcasses.	USFS
Hoopa Reservation Tributaries	Periodic redd survey. Total run = (2*total redd count)/(1-proportion jacks). Jacks estimated from the Trinity tributaries and Hoopa Reservation tributaries combined. Bio-data collected from all recovered carcasses.	HVT
Recreational Harvest		
Klamath River (below Hwy 101 bridge)	Jack and adult estimates based on access point creel survey during three randomly selected days per statistical week. Bio-data collected during angler interviews.	CDFW
Klamath River (Hwy 101 to Weitchpec)	Jack and adult estimates based on access point creel survey during three randomly selected days per statistical week. 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). Upper river adult harvest = total adult harvest minus lower river adult harvest. Total harvest = adults/(1-proportion jacks). Jacks estimated from the weighted IGH, Klamath mainstem, Bogus Creek age composition data.	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
Trinity River Basin (below WCW)	Roving access creel survey during three randomly selected days per statistical week stratified by weekdays and weekend 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. Bio-data collected during net harvest and buying station interviews.	YT
Klamath River (Hwy 101 to Trinity mouth)	Daily harvest estimates based on effort and catch-per-effort surveys. Bio-data collected during net harvest interviews.	YT
Trinity River (Hoopa Reservation)	Effort and catch-per-effort surveys during four randomly selected days per statistical week. Bio-data collected during net harvest interviews.	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 2014 Klamath Basin fall Chinook age-composition assessment.

Sampling Location	Scales collected: Aged: Unknown-age [a/]	Aged: Known-age [b/]	Not aged [c/]	Total	Agency
Hatchery Spawners					
Iron Gate Hatchery (IGH)	1,014	95	1,573	2,682	CDFW
Trinity River Hatchery (TRH)	993	301	24	1,318	HVT
Natural Spawners					
Salmon River Carcass Survey	449	0	15	464	CDFW
Scott River Carcass Survey	1,094	1	1,809	2,904	CDFW
Shasta River Carcass	272	12	123	407 [d/]	CDFW
Bogus Creek Weir	943	230	1,010	2,183	CDFW
Klamath River mainstem	677	61	20	758	USFWS
Upper Klamath River tributaries	504	0	12	516	USFS
Blue Creek Snorkle	63	0	4	67	YT
Willow Creek Weir	518	21	6	545	CDFW, HVT
Lower Trinity River Carcass	21	0	1	22	HVT
Lower Trinity River tributaries	36	0	0	36	HVT, USFS
Recreational Harvest					
Lower Klamath River Creel	1,448	15	73	1,536	CDFW
Lower Trinity River Creel	18	0	0	18	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	1,490	141	336	1,967	YT
Klamath River (Hwy 101 to Trinity R)	535	16	29	580	YT
Trinity River (Hoopa Reservation)	684	51	15	750	HVT
TOTAL	10,759	944	5,050	16,753	

a/ Scales from non-ad-clipped fish and ad-clipped fish without CWTs, mounted and aged.

b/ Scales from all mounted and aged ad-clipped CWT fish; non-random CWT fish used for validation but not age composition.

c/ Scales mounted and not aged or scales not mounted.

d/ Includes 12 scales collected from washbacks at Shasta weir that were aged but not used in scale analysis.

Table 3. Age-composition methods used for the 2014 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 Indian Cr)	Surrogate: Klamath mainstem (IGH to Shasta R) age-structure.
Klamath tributaries (above Trinity River)	Jack/adult structure from scale-age analysis.
Blue Creek	Jack/adult structure from scale-age analysis.
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)	Jack/adult structure from scale-age analysis.
Hoopa Reservation Tributaries	Jack/adult structure from scale-age analysis.
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: IGH, Bogus Creek, and Klamath River mainstem (IGH to Shasta River) weighted age composition.
Trinity River Basin (above WCW)	Jack component based on estimated jack harvest rate and total jack run estimate. Adult Surrogate: adult age composition from Trinity River Basin 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 (Hoopa Reservation)	Jack/adult structure from scale-age analysis.

Table 4a. 2014 Klamath River Basin scale validation matrices.

Number

		Known Age				
		2	3	4	5	
Read Age	2	103	5	0	0	
	3	3	198	34	0	
	4	0	4	381	12	
	5	0	0	1	29	Total
	Total	106	207	416	41	770

Percentage

		Known Age			
		2	3	4	5
Read Age	2	0.97	0.02	0.00	0.00
	3	0.03	0.96	0.08	0.00
	4	0.00	0.02	0.92	0.29
	5	0.00	0.00	0.00	0.71
	Total	1.00	1.00	1.00	1.00

Table 4b. 2014 Trinity River Basin scale validation matrices.

Number

		Known Age				
		2	3	4	5	
Read Age	2	12	0	0	0	
	3	0	183	2	0	
	4	0	3	172	0	
	5	0	0	0	1	Total
	Total	12	186	174	1	373

Percentage

		Known Age			
		2	3	4	5
Read Age	2	1.00	0.00	0.00	0.00
	3	0.00	0.98	0.01	0.00
	4	0.00	0.02	0.99	0.00
	5	0.00	0.00	0.00	1.00
	Total	1.00	1.00	1.00	0.00

Table 5. Age composition of the 2014 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,039	12,864	11,276	160	24,300	25,339
Trinity River Hatchery (TRH)	221	3,653	3,271	51	6,975	7,196
Hatchery Spawner subtotal	**1,260**	**16,517**	**14,547**	**211**	**31,275**	**32,535**
Natural Spawners						
Salmon River Basin	527	865	1,674	167	2,706	3,233
Scott River Basin	2,051	2,977	7,159	283	10,419	12,470
Shasta River Basin	3,945	4,064	10,265	83	14,412	18,357
Bogus Creek Basin	323	6,119	6,448	40	12,607	12,930
Klamath River mainstem (IGH to Shasta R)	1269	6491	8847	114	15,451	16,720
Klamath River mainstem (Shasta R to Indian Cr)	575	2932	4010	50	6,992	7,567
Klamath Tributaries (above Trinity River)	1,498	1,649	4,987	241	6,877	8,375
Blue Creek	332	105	1,108	32	1,245	1,577
Klamath Basin subtotal	10,520	25,202	44,498	1,010	70,709	81,229
Trinity River (mainstem above WCW)	6,576	10,261	12,011	1,004	23,276	29,852
Trinity River (mainstem below WCW)	74	115	135	11	262	336
Trinity Tributaries (above Reservation; below WCW)	47	123	361	31	515	562
Hoopa Reservation tributaries	52	135	398	34	568	620
Trinity Basin subtotal	6,749	10,634	12,905	1,080	24,621	31,370
Natural Spawners subtotal	**17,269**	**35,836**	**57,403**	**2,091**	**95,330**	**112,599**
Total Spawner Escapement	**18,529**	**52,353**	**71,950**	**2,302**	**126,605**	**145,134**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	268	249	775	69	1,093	1,361
Klamath River (Hwy 101 to Weitchpec)	2,847	365	1,438	71	1,875	4,722
Klamath River (Weitchpec to IGH)	75	728	759	9	1,496	1,571
Trinity River Basin (above WCW)	168	358	355	45	758	926
Trinity River Basin (below WCW)	3	26	26	3	55	58
Subtotals	**3,361**	**1,726**	**3,353**	**198**	**5,277**	**8,638**
Tribal Harvest						
Klamath River (below Hwy 101)	153	2,262	16,668	1,108	20,039	20,192
Klamath River (Hwy 101 to Trinity mouth)	130	593	2,785	56	3,434	3,564
Trinity River (Hoopa Reservation)	65	524	1,804	111	2,439	2,504
Subtotals	**348**	**3,379**	**21,257**	**1,277**	**25,913**	**26,260**
Total Harvest	**3,709**	**5,105**	**24,610**	**1,475**	**31,190**	**34,898**
Totals						
Harvest and Escapement	22238	57458	96560	3777	157,794	180032
Recreational Angling Dropoff Mortality 2.04%	69	35	68	5	108	177
Tribal Net Dropoff Mortality 8.7%	30	294	1,848	111	2,253	2,283
Klamath River disease testing	11	50	234	4	288	299
Total River Run	**22,348**	**57,837**	**98,710**	**3,897**	**160,444**	**182,792**

Table 6. Age proportion of the 2014 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5
Hatchery Spawners				
Iron Gate Hatchery (IGH)	0.04	0.51	0.45	0.01
Trinity River Hatchery (TRH)	0.03	0.51	0.45	0.01
Hatchery Spawner subtotal	0.04	0.51	0.45	0.01
Natural Spawners				
Salmon River Basin	0.16	0.27	0.52	0.05
Scott River Basin	0.16	0.24	0.57	0.02
Shasta River Basin	0.21	0.22	0.56	0.00
Bogus Creek Basin	0.02	0.47	0.50	0.00
Klamath River mainstem (IGH to Shasta R)	0.08	0.39	0.53	0.01
Klamath River mainstem (Shasta R to Indian Cr)	0.08	0.39	0.53	0.01
Klamath tributaries (above Reservation)	0.18	0.20	0.60	0.03
Yurok Reservation tributaries	0.21	0.07	0.70	0.02
Klamath Basin subtotal	0.13	0.31	0.55	0.01
Trinity River (mainstem above WCW)	0.22	0.34	0.40	0.03
Trinity River (mainstem below WCW)	0.22	0.34	0.40	0.03
Trinity tributaries (above Reservation)	0.08	0.22	0.64	0.06
Hoopa Reservation tributaries	0.08	0.22	0.64	0.06
Trinity Basin subtotal	0.22	0.34	0.41	0.03
Natural Spawners subtotal	0.15	0.32	0.51	0.02
Total Spawner Escapement	0.13	0.36	0.50	0.02
Recreational Harvest				
Klamath River (below Hwy 101 bridge)	0.20	0.18	0.57	0.05
Klamath River (Hwy 101 to Weitchpec)	0.60	0.08	0.30	0.02
Klamath River (Weitchpec to IGH)	0.05	0.46	0.48	0.01
Trinity River Basin (above WCW)	0.18	0.39	0.38	0.05
Trinity River Basin (below WCW)	0.06	0.45	0.44	0.06
Subtotals	0.39	0.20	0.39	0.02
Tribal Harvest				
Klamath River (below Hwy 101)	0.01	0.11	0.83	0.05
Klamath River (Hwy 101 to Trinity mouth)	0.04	0.17	0.78	0.02
Trinity River (Hoopa Reservation)	0.03	0.21	0.72	0.04
Subtotals	0.01	0.13	0.81	0.05
Total Harvest	0.11	0.15	0.71	0.04
Totals				
Harvest and Escapement	0.12	0.32	0.54	0.02
Recreational Angling Dropoff Mortality 2.04%	0.39	0.20	0.38	0.03
Tribal Net Dropoff Mortality 8.7%	0.01	0.13	0.81	0.05
Total River Run	0.12	0.32	0.54	0.02

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 – 2014 details.

Iron Gate Hatchery (IGH)
A systematic random bio-sample[a] was obtained from every tenth Chinook salmon returning to IGH in 2014. A total of 1,109 scale samples were aged, of which 95 were from known-age, CWT fish. 143 non-random scales were collected from known-age CWT fish <50 cm to assist in validation. Scale-based age compositions were used to apportion all age classes.

Bogus Creek
Escapement was estimated by summing carcasses encountered below the video weir and videography counts (since 2002) above the weir. Bio-samples were obtained using a 1:4 systematic random sample. Additionally, biological data, but no scale samples, were obtained from every (i.e., non-random) ad-clipped fish encountered. A total of 1,173 scale samples were aged, of which 230 were from known-age, CWT fish. Scale-based age compositions were used to apportion all age classes.

Shasta River
Escapement was estimated by videography (since 1998) while bio-samples were collected from all recovered carcasses during surveys in the lower seven river miles on public and private lands where access is granted. Bio-samples were also obtained from systematically sampled (1:10) carcasses that washed back onto the counting weir. Additionally, all ad-clipped fish not falling within the systematic sample were bio-sampled. A total of 284 scale samples were aged (258 from spawning ground surveys, 14 from a live trap and 12 from weir "wash-backs'). The 12 'wash-back' samples were from known-age, CWT fish. Scale-based age compositions were used to apportion all age classes.

Scott River
Independent estimates from above and below the weir were combined to produce total escapement. Escapement above the weir was estimated using videography (since 2008). Escapement below the weir was calculated using the Cormack-Jolly-Seber estimator with data from twice weekly mark-recapture carcass surveys, with one exception. In a 0.5 mile reach, where access was granted for a single pass survey, a redd survey was conducted. Bio-samples were obtained from all non-deteriorated carcasses recovered above and below the weir. A total of 1,095 scale samples were aged of which one was of known-age. Scale-based age compositions were used to apportion all age classes.

Salmon River
Total escapement was estimated by combining the Cormack-Jolly-Seber estimate from the carcass survey within the main stem, upstream of Nordheimer campground, and a redd count expansion (redds X 2) from tributaries and the lowest three reaches of the main stem. Biological samples and scales were obtained from all recovered carcasses. A total of 449 scale samples were aged, none of which were from known-age CWT fish. Scale-based age compositions were used to apportion all age classes.

Klamath River Tributaries
Adult escapement was estimated by expanding the total redd count (redds X 2) and adding the number of live fish observed during the final survey in each tributary. A total of 504 scale samples were aged, none of which were from known-age CWT fish. Total escapement (including jacks) was estimated by expanding the adult estimate by the scale-based age-2 proportion. Scale-based age compositions were used to apportion all age classes.

Klamath River Mainstem
For the upper reach (IGH to Shasta River), weekly counts without removal were used to calculate an area-under-the-curve escapement estimate. Observation efficiency was derived from recapture histories of marked carcasses. Carcass 'life' (residence time) was derived from recapture histories and a 5-point

[a] 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.

scale for appraisal of carcass condition. A total of 738 scales were aged, of which 61 were from known-age CWT fish. Scale-based age proportions were used to assign all age classes.

For the lower reach (Ash Creek to Indian Creek), adult escapement was estimated by expanding the total redd count (redds X 2). Total escapement was estimated by expanding the adult estimate by the scale-based age-2 proportion from the upper reach. Scale-based age proportions from the upper reach were used as surrogate to assign all age classes from total estimate.

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). A total of 1,463 scale samples were aged, of which 15 were taken from known-age CWT fish. Scale-based age proportions for each sub-area were used to apportion all age classes in their respective sub-area.

Upper Klamath River Recreational Fishery
A creel census in this sub-area was not conducted in 2014. 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 main stem to the average harvest in the lower Klamath River Creel area from these years was applied to the 2014 lower Klamath River Creel harvest estimate to estimate the total adult harvest in the Klamath River main stem. 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 main stem (IGH to Shasta River), Bogus Creek, and Iron Gate Hatchery. These weighted scale-based age compositions were used to apportion all age classes in this fishery.

Yurok Tribal Estuary Fishery (Klamath mouth to Hwy 101)
Yurok harvest in the estuary was estimated by hourly stratified effort and catch-per-effort methods. The fishery was largely subsistence and ceremonial with a four-day commercial fishery. A total of 1,631 scales were aged, of which 141 were from known-age CWT fish. Scale-based age compositions were used to apportion all age classes.

Yurok Tribal Fishery Above 101
Yurok harvest in this sub-area was estimated by daily effort and catch-per-effort analyses. A total of 551 scale samples were aged, of which 16 came from known-age, CWT fish. Scale-based age compositions were used to apportion all age classes.

Blue Creek
The peak dive count of live fish was used as the estimate of escapement. A total of 63 scale samples were aged. Bio-samples were obtained from all carcasses recovered. Scale-based age compositions were used to apportion all age classes.

Appendix C. Trinity River – 2014 details.

Trinity River Hatchery (TRH)
Sampling for scales was conducted in a systematic (1:5) random manner including ad-clipped and non-ad-clipped fish (no non-random ad-clipped fish scales were collected). A total of 1,294 scales were aged, of which 301 scales came from known-age CWT 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 recreational harvest depends on the application of reward and non-reward program tags at the Willow Creek Weir (WCW) and subsequent returns by anglers. In 2014, only reward tags were used to estimate harvest. CDFW estimated a 2.44% harvest rate on adult Chinook salmon based on the return of program reward tags (14 of 573) applied at WCW. The jack harvest rate of 2.42% was based on return of program reward tags (3 of 124 applied), yielding an estimated harvest of 168 age-2 Chinook. There were no scales recovered from this fishery as no creel survey was implemented in 2014. The age-2 recreational harvest was determined by multiplying the jack harvest rate by the age-2 run size estimated from scales aged at WCW. The adult age proportions estimated for the Lower Trinity River Creel were used to apportion the adult component.

Lower Trinity River Creel
A roving creel survey was implemented in Trinity River below the location of the WCW. A total of 18 scales were aged, of which none were from known-age, CWT fish. Total harvest was apportioned by age using the scale age proportions.

Upper Trinity River Natural Escapement
Total run was estimated using a non-stratified 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 to three general recovery areas: Trinity River Hatchery, Trinity upper basin natural spawning escapement, and recreational harvest. At WCW a systematic random sample (1:2) of all Chinook examined produces a collection of scales for program-marked fish, some of which are ad-clipped (Trinity River Hatchery origin). Validation of WCW scales is accomplished with known-age fish recovered throughout all sectors of the Trinity River. A total of 539 scales were aged of which 21 were from known-age, CWT fish subsequently recovered at TRH.

The age structure for fish passing above WCW was estimated using scales collected at WCW minus those from known-age fish later recovered at TRH. Next, specific age structures were estimated for fish returning to TRH and the recreational fishery. These proportions were applied to the total hatchery escapement and estimated fishery harvest, respectively, providing totals by age within area. These totals were then deducted from the WCW run apportioned by age resulting in an age structure for the natural escapement in the upper Trinity River.

Lower Trinity River Natural Escapement:
The lower Trinity River natural escapement estimate included total spawners estimated in both main stem and tributary sub-areas (redds X 2). In the tributaries, a total of 36 scales were aged, none of which were from known-age fish. In the main stem, a total of 21 scales were aged, none of which were from known-age fish. Scale based age proportions were used to apportion all age classes in tributaries while the upper Trinity River natural age structure was used to apportion all age classes in the main stem below WCW.

Hoopa Valley Tribal Harvest
Hoopa Valley Tribal harvest is a composite of the gillnet and hook-and-line fisheries prosecuted by Tribal members. A total of 735 scales were aged, of which 51 were from known-age fish. The total harvest was apportioned by age using these scale age proportions.

Appendix D. 2014 Klamath age analysis.

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	32	463	437	3	935
IGH	50	516	441	5	1,012
SALMON	74	136	222	17	449
SCOTT	181	306	587	19	1,093
SHASTA	48	59	116	1	224
MAINSTEM	56	280	333	4	673
UR TRIBS	90	122	281	11	504
LRC EST	74	85	203	14	376
LRC UP	633	123	304	12	1,072
YTFP EST	15	259	1,155	61	1,490
YTFP M&U	21	120	387	7	535
BLUE CRK	13	8	41	1	63
	1287	2477	4507	155	8426

Unknown scales corrected age proportions (Kimura method)

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0.0234	0.4743	0.4994	0.0028	1.0
IGH	0.0386	0.4923	0.4637	0.0054	1.0
SALMON	0.1630	0.2676	0.5177	0.0518	1.0
SCOTT	0.1645	0.2388	0.5741	0.0226	1.0
SHASTA	0.2150	0.2212	0.5594	0.0044	1.0
MAINSTEM	0.0760	0.3874	0.5300	0.0066	1.0
UR TRIBS	0.1789	0.1969	0.5954	0.0288	1.0
LRC EST	0.1980	0.1818	0.5694	0.0507	1.0
LRC UP	0.6058	0.0761	0.3033	0.0148	1.0
YTFP EST	0.0076	0.1109	0.8264	0.0551	1.0
YTFP M&U	0.0363	0.1667	0.7812	0.0158	1.0
BLUE CRK	0.2107	0.0665	0.7028	0.0201	1.0

Known CWT ages [/a]

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	34	263	283	5	585
IGH	224	2478	1493	46	4241
SALMON	0	0	0	0	0
SCOTT	0	0	0	1	1
SHASTA	0	6	4	2	12
MAINSTEM	7	60	50	4	121
UR TRIBS	0	0	0	0	0
LRC	15	14	29	3	61
YTFP EST	1	41	113	5	160
YTFP M&U	1	2	13	0	16
BLUE CRK	0	0	0	0	0
	282	2864	1985	66	5197
Breakout within strata					
Bogus1	14	92	114	1	221
Bogus2	20	171	169	4	364
LRC - lo	2	5	10	1	18
LRC - mid	13	9	19	2	43
YTFP MID-UP	1	2	13	0	16

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

Appendix E. 2014 Trinity age analysis.

WCW = Willow Ck. Weir — *Cwt Age*

Scale Ages		no cwt age	2	3	4	5	Total
	Scale unreadable	4	0	1	1	0	6
	2	95	2	0	0	0	97
Scale	3	194	0	12	0	0	206
Ages	4	214	0	1	6	0	221
23	5	15	0	0	0	0	15
518		522	2	14	7	0	545

LOWTRINREC = Lower Trinity Recreational — *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
Scale	3	8	0	0	0	0	8
Ages	4	8	0	0	0	0	8
0	5	1	0	0	0	0	1
18		18	0	0	0	0	18

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

Scale Ages		no cwt age	2	3	4	5	Total
	Scale unreadable	13	0	0	2	0	15
	2	18	0	0	0	0	18
Scale	3	145	0	16	0	0	161
Ages	4	490	0	1	34	0	525
53	5	31	0	0	0	0	31
684		697	0	17	36	0	750

TRH = Trinity River Hatchery — *Cwt Age*

Scale Ages		no cwt age	2	3	4	5	Total
	Scale unreadable	20	0	1	3	0	24
	2	30	10	0	0	0	40
Scale	3	496	0	155	2	0	653
Ages	4	459	0	1	132	0	592
305	5	8	0	0	0	1	9
993		1013	10	157	137	1	1318

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	3	0	0	0	0	3
Scale	3	8	0	0	0	0	8
Ages	4	23	0	0	0	0	23
0	5	2	0	0	0	0	2
36		36	0	0	0	0	36

UPKLAMREC Upper Klamath Recreational — *Cwt Age*

NO DATA

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

LOWTRINMAINSTEM = Lower Trinity Mainstem — *Cwt Age*

Scale Ages		no cwt age	2	3	4	5	Total
	Scale unreadable	1	0	0	0	0	1
	2	1	0	0	0	0	1
Scale	3	2	0	0	0	0	2
Ages	4	14	0	0	0	0	14
0	5	4	0	0	0	0	4
21		22	0	0	0	0	22

0 — *Cwt Age*

NO DATA

Scale Ages		no 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	12	0	0	0	
	3	0	183	2	0	
4x4	4	0	3	172	0	
	5	0	0	0	1	0.99

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

	2	3	4	5
2	1.0000	0.0000	0.0000	0.0000
3	0.0000	0.9839	0.0115	0.0000
4	0.0000	0.0161	0.9885	0.0000
5	0.0000	0.0000	0.0000	1.0000

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

# known scales	23	53	0	305			0	381
# unknown scales	518	684	18	993			36	2270

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	0.1834	0.0263	0.0556	0.0302	0.0476	-	0.2203	0.0833
3	0.3758	0.2070	0.4466	0.5023	0.0889	0.4728	0.3437	0.2184
4	0.4118	0.7213	0.4423	0.4594	0.6730	0.4683	0.4024	0.6428
5	0.0290	0.0453	0.0556	0.0081	0.1905	0.0588	0.0336	0.0556
	1.00000	1.00000	1.00000	1.00000	1.00000	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	1.0138	-0.0040	0.0001	0.0000
3	-0.0144	1.0535	-0.0380	0.0000
4	0.0007	-0.0494	1.0378	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	2	0	0	53	0	8	252	0
3	14	17	0	866	0	60	1491	0
4	7	36	0	722	0	50	1243	0
5	0	0	0	6	0	0	10	0
	23	53	0	1647	0	117	2996	0
# unknown ads	0	5	2	54	0	0	0	0
# total ads	0	58	2	1701	0	paper CWTs		0

WCW scales

Age	WCW no cwts	known age cwts scales	Total age all scales	WCW age proportions
2	95	2	97	0.1793
3	195	14	209	0.3857
4	213	7	220	0.4072
5	15	0	15	0.0277
	518	23	541	1.0000

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

	Total Run
Rec above WCW	926
TRH	7196
Naturals	29852
Total	37974

Age	WCW proportions	TRH + Rec above WCW+Natural Escapement	Apportioned Natural Escapement minus TRH #s minus above WCW creel #s	Proportions
2	0.1834	6964	6576	0.2203
3	0.3758	14272	10261	0.3437
4	0.4118	15638	12011	0.4024
5	0.0290	1100	1004	0.0336
		37974		

Appendix F. 2014 Klamath Basin fall Chinook age-composition calculation worksheet.

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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	Length Freq or Redds	Live
Iron Gate Hatchery (IGH)	1039	24300	25339	1039	12864	11276	160	25339	scales	0.03861	0.49230	0.46369	0.00541	1.0	1,012	<60	
									IGH cwts	224	2478	1493	46	4241			
Trinity River Hatchery (TRH)	221	6975	7196	221	3653	3271	51	7196	scales	0.03021	0.50232	0.45941	0.00806	1.0	993	<55	
Hatchery spawner subtotal:	1260	31275	32535	1260	16517	14547	211	32535	TRH cwts	53	866	722	6	1647			
	prop. hatchery grilse		0.039			proportion hatchery		0.178									
Natural Spawners																	
Trinity River mainstem above WCW	6576	23276	29852	6576	10261	12011	1004	29852	scales	0.22028	0.34372	0.40236	0.03364	1.0	518	<55	
Trinity River mainstem below WCW	74	262	336	74	115	135	11	336	Up T main	0.22028	0.34372	0.40236	0.03364	1.0	21	131	
Salmon River Basin (includes Wooley Cr)	527	2706	3233	527	865	1674	167	3233	scales	0.16296	0.26761	0.51766	0.05177	1.0	449	642	262
Scott River	2051	10419	12470	2051	2977	7159	283	12470	scales	0.16449	0.23877	0.57412	0.02263	1.0	1,093	36	<62
									Scott CWT	0	0	0	1	1			
Shasta River	3945	14412	18357	3945	4064	10265	83	18357	scales	0.2150	0.2212	0.5594	0.0044	1.0	224	<64	
									Shasta CWT	0	6	4	2	12			
Bogus Creek	323	12607	12930	323	6119	6448	40	12930	scales	0.02343	0.47433	0.49940	0.00284	1.0	935	<62	
									Bogus CWT	34	263	283	5	585			
Mainstem Klamath (IGH to Shasta R)	1269	15451	16720	1269	6491	8847	114	16720	scales	0.07600	0.38743	0.52997	0.00660	1.0	673	≤61	
									KR main CWT	7	60	50	4	121			
Mainstem Klamath (Ash Cr to Indian Cr)	575	6992	7567	575	2932	4010	50	7567	Up K main	0.07600	0.38743	0.52997	0.00660	1.0	IGH to Shasta	3496	≤61
Main basin subtotals:	15,340	86,125	101,465	15,340	33,824	50,549	1,752	101,465									
Klamath Tributaries																	
Aiken Cr	4	18	22	4	4	13	1	22	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	8	3
Beaver Cr	220	1009	1229	220	242	732	35	1229	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	500	11
Bluff Cr	0	0	0	0	0	0	0	0	scales	0.17888	0.19690	0.59539	0.02883	1.0	504		
Boise Cr	7	31	38	7	7	22	1	38	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	15	1
Camp Cr	189	867	1056	189	208	629	30	1056	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	423	26
Clear Cr	105	484	589	105	116	351	17	589	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	232	24
Dillon Cr	119	545	663	119	131	395	19	663	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	242	74
Elk Cr	154	707	861	154	170	513	25	861	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	326	67
Ft. Goff Cr	32	146	178	32	35	106	5	178	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	72	3
Grider Cr	116	531	646	116	127	385	19	646	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	260	13
Horse Cr	46	211	257	46	51	153	7	257	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	105	1
Independence Cr	1	6	7	1	1	4	0	7	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	2	2
Indian Cr	153	701	854	153	168	509	25	854	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	345	14
Irving Cr	0	0	0	0	0	0	0	0	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	0	0
Perch Cr	0	0	0	0	0	0	0	0	scales	0.17888	0.19690	0.59539	0.02883	1.0	504		
Red Cap Cr	152	697	849	152	167	506	24	849	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	315	82
Rock Cr	12	56	68	12	13	41	2	68	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	28	0
Slate Cr	5	24	29	5	6	17	1	29	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	11	2
Swillup Cr	4	19	23	4	5	14	1	23	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	9	1
Seiad Cr	0	0	0	0	0	0	0	0	scales	0.17888	0.19690	0.59539	0.02883	1.0	504		
Thompson Cr	103	474	577	103	114	344	17	577	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	237	0
Ti Cr	0	0	0	0	0	0	0	0	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	0	0
Unkonom Cr	39	181	221	39	43	131	6	221	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	36	133
Other (China Cr)	1	6	7	1	1	4	0	7	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	3	0
Pine Cr (formerly in Hoopa tribs)	36	164	200	36	39	119	6	200	scales	0.17888	0.19690	0.59539	0.02883	1.0	504	82	0
Klamath trib subtotal:	1498	6877	8375	1498	1649	4987	241	8375								3251	457
							241										
Trinity Tributaries																	
Horse Linto Cr	27	296	323	27	71	208	18	323	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	148	0
Cedar Cr (trib to Horse Linto)	20	219	239	20	52	154	13	239	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	109	1
Other (Willow & Madden creeks in Up TR nat estim)				0	0	0	0	0	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	276	3
Trinity trib subtotal:	47	515	562	47	123	361	31	562								533	
Non-reservation trib subtotal:	1545	7392	8937	1545	1772	5348	272	8937									
							272										
Reservation Tributaries-Hoopa Valley																	
Campbell Cr	1	6	7	1	1	4	0	7	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	3	
Hostler Cr	1	8	9	1	2	6	0	9	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	4	
Mill Cr	25	278	303	25	66	195	17	303	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	139	
~~Pine Cr.~~ (moved in 2007 to Klam tribs)																	
Soctish Cr	1	10	11	1	2	7	1	11	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	5	
Supply Cr	3	34	37	3	8	24	2	37	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	17	
Tish Tang Cr	21	232	253	21	55	163	14	253	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36	116	
Other (Hospital Cr.)	0	0	0	0	0	0	0	0	L. Trin tribs	0.08333	0.21836	0.64276	0.05556	1.0	36		
HVT reservation trib subtotal:	52	568	620	52	135	398	34	620								284	
							34										
Reservation Tributaries-Yurok																	
Blue Cr	332	1245	1577	332	105	1108	32	1577	scales	0.21071	0.06647	0.70277	0.02005	1.0	50	<55	
Reservation tributaries subtotal:	384	1813	2197	384	240	1506	67	2197									
Natural spawner subtotal:	17269	95330	112599	17269	35836	57403	2091	112599									
Total spawners:	**18529**	**126605**	**145134**	**18529**	**52353**	**71950**	**2302**	**145134**									
Angler Harvest																	
Klamath River (below Hwy 101)	268	1093	1361	268	249	775	69	1361	scales	0.19802	0.18182	0.56945	0.05071	1.0	376	<60	
									est-LRC CWT	2	5	10	1	18			
Klamath River (Hwy 101 to Weitchpec)	2847	1875	4722	2847	365	1438	71	4722	scales	0.60579	0.07611	0.30330	0.01480	1.0	1,072	<60	
			6083						mid-LRC CWT	13	9	19	2	43			
		Feb 4							**SURROGATE** - Iron Gate+Bogus+Klamath Mainstem Weighted Totals							IGH+BOG+Kmain	
		ratio estimator							IGH+Bog+Klam	2630	25474	26571	314	54989		54989	
Klamath River (Weitchpec to IGH)	75	1496	1571	75	728	759	9	1571		0.0478	0.4633	0.4832	0.0057	1.0		1571	0.0286
									SURROGATE - Trinity Rec. Harvest below WCW - adults only								
Trinity River (above Willow Cr. Weir)	168	758	926	168	358	355	45	926	TR LRC count		0.47283	0.46835	0.05882	1.0		<55	
									TR-up CWT		60	50	0	110	Paper CWTs		
Trinity River (below Willow Cr. Weir)	3	55	58	3	26	26	3	58	scales	0.05556	0.44656	0.44233	0.05556	1.0	18	<56	
									TR-low CWT	0	0	0	0	0			
Angler harvest subtotal:	3,361	5,277	8,638	3,361	1,726	3,353	198	8,638									
Tribal Harvest																	
Klamath River (Estuary)	153	20039	20192	153	2262	16668	1108	20192	scales	0.0076	0.1109	0.8264	0.0551	1.0	1,490		
									YTFP EST CWT	1	41	113	5	160	0.0079		
Klamath River (101 to Trinity R)	130	3434	3564	130	593	2785	56	3564	scales	0.0363	0.1667	0.7812	0.0158	1.0	535		
									YTFP MU CWT	1	2	13	0	16	0.0045		
Trinity River	65	2440	2504	65	524	1804	111	2504	scales	0.02632	0.20704	0.72133	0.04532	1.0	684	<56	
									HVT CWT	0	17	36	0	53			
Tribal harvest subtotal:	348	25913	26260	348	3379	21257	1277	26260									
Total harvest:	**3709**	**31190**	**34898**	**3709**	**5105**	**24610**	**1475**	**34898**									
Totals																	
In-river run and escapement	22238	157795	180032	22238	57458	96560	3777	180032									
Angling drop-off mortality (2.04%)	69	108	177	69	35	68	5	177	0.02041 angling drop-off mortality rate on harvest								
Net drop-off mortality (8.7%)	30	2253	2283	30	294	1848	111	2283	0.08696 net drop-off mortality rate on harvest								
Klamath River disease testing	11	288	299	11	50	234	4	299	YTFP MU sc	0.0363	0.1667	0.7812	0.0158	1.0000			
Total in-river run	**22348**	**160444**	**182792**	**22348**	**57837**	**98710**	**3897**	**182792**									
				12.2%	31.6%	54.0%	2.1%										

Appendix G. Age composition of the 2013 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,323	6,743	6,670	18	13,431	14,754
Trinity River Hatchery (TRH)	135	1,032	2,682	3	3,717	3,852
Hatchery Spawner subtotal	**1,458**	**7,775**	**9,352**	**21**	**17,148**	**18,606**
Natural Spawners						
Salmon River Basin	240	721	1,519	0	2,240	2,480
Scott River Basin	588	1,517	2,483	36	4,036	4,624
Shasta River Basin	1,096	3,896	3,029	0	6,925	8,021
Bogus Creek Basin	338	2,206	1,471	5	3,682	4,020
Klamath River mainstem (IGH to Shasta R)	388	2933	4037	0	6,970	7,358
Klamath River mainstem (Shasta R to Indian Cr)	295	2212	3010	0	5,222	5,517
Klamath Tributaries (above Trinity River)	200	718	1,591	0	2,310	2,510
Blue Creek	129	13	282	31	326	455
Klamath Basin subtotal	3,274	14,216	17,422	72	31,711	34,985
Trinity River (mainstem above WCW)	6,582	4,379	20,838	459	25,675	32,257
Trinity River (mainstem below WCW)	372	248	1,178	26	1,452	1,824
Trinity Tributaries (above Reservation; below WCW)	20	13	63	1	78	98
Hoopa Reservation tributaries	62	41	195	4	240	302
Trinity Basin subtotal	7,036	4,681	22,274	490	27,445	34,481
Natural Spawners subtotal	**10,310**	**18,897**	**39,696**	**562**	**59,156**	**69,466**
Total Spawner Escapement	**11,768**	**26,672**	**49,048**	**583**	**76,304**	**88,072**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	546	3,532	7,681	59	11,272	11,818
Klamath River (Hwy 101 to Weitchpec)	1,135	545	566	3	1,113	2,248
Klamath River (Weitchpec to IGH)	531	3,080	3,157	6	6,243	6,774
Trinity River Basin (above WCW)	0	390	479	11	880	880
Trinity River Basin (below WCW)	48	128	160	3	292	340
Subtotals	**2,260**	**7,675**	**12,043**	**82**	**19,800**	**22,060**
Tribal Harvest						
Klamath River (below Hwy 101)	205	17,503	39,650	350	57,504	57,709
Klamath River (Hwy 101 to Trinity mouth)	38	923	1,581	8	2,513	2,551
Trinity River (Hoopa Reservation)	16	570	2,440	10	3,019	3,035
Subtotals	**259**	**18,996**	**43,671**	**368**	**63,036**	**63,295**
Total Harvest	**2,519**	**26,671**	**55,714**	**450**	**82,836**	**85,355**
Totals						
Harvest and Escapement	14,287	53,343	104,762	1,033	159,140	173,427
Recreational Angling Dropoff Mortality 2.04%	46	157	246	2	404	450
Tribal Net Dropoff Mortality 8.7%	23	1,652	3,797	32	5,481	5,504
Total River Run	**14,356**	**55,152**	**108,805**	**1,068**	**165,025**	**179,381**