Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2012 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 2012 was estimated to be:

	Run Size	
Age	Number	Proportion
2	21,473	0.07
3	248,532	0.77
4	51,352	0.16
5	2,225	0.01
Total	323,582	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	381,000	302,100	1.26
Fishery Mortality			
Tribal Harvest	160,000	101,500	1.58
Recreational Harvest	67,600	13,600	4.97
Drop-off Mortality	15,300	9,100	1.68
	242,900	124,200	1.96
Escapement			
Hatchery Spawners	51,800	55,900	0.93
Natural Area Spawners	86,300	122,000	0.71
	138,100	177,900	0.78

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 2012. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFG 2013) and with the 2013 forecast of ocean stock abundance (KRTT 2013).

Age-specific escapement estimates for 2012 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 2013). Cohort reconstruction results enable 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 2013). 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 in the 2012 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 where the sample of scales was insufficient for estimation of age composition, or was 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 (CWT fish) and unknown read ages for estimation of the escapement or harvest age-composition is described in Appendix A.

In cases where scales were believed to be non-representative of the age-two 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-two, 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, known-age (CWT) length-frequencies. 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 17,374 scales from 17 different sectors were aged for this analysis (Table 2). Of these, 2,390 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, 99% for age-3 fish, 96% for age-4 fish, and 100% for age-5 fish. Accuracy within the Klamath River Basin was 96% for age-2 fish, 99% for age-3 fish, 85% age-4 fish, and 100% 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 2011 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 Ck) and "upper" section (Surpur Ck—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 2012 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. Age composition based on scale-age data from this area.	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. Age composition based on scale-age data from this area.	CDFW, HVT
Natural Spawners		
Salmon River Basin	Carcass mark-recapture (Cormack-Jolly-Seber) within the mainstem combined with redd surveys of the lower mainstem and tributaries. Total run based on mark-recapture estimate and (2*total redd count)/(1-proportion of jacks estimated from scale-age data in this area). Bio-data collected from all recovered carcasses though scales were obtained only from Path 1 carcasses (both eyes clear). Age composition based on scale-age data from this area.	CDFW,USFS,YT, KT, SRRC, SCS
Scott River Basin	Video count above weir at river mile 17 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. Bio-data collected from all carcasses recovered. Age composition based on scale-age data from this area.	CDFW, SCS, QVIR, USFS, KT, NCRC, SRCD
Shasta River Basin	Video count above weir. Bio-data collected from carcasses upstream of video weir site and mortalities stranded on weir. Age composition based on scale-age data from the carcass survey.	CDFW
Bogus Creek Basin	Video count above weir and twice weekly direct carcass count below weir. Bio-data collected from a systematic random sample (1:5) of all carcasses observed during surveys above and below weir. Additionally, all ad-clipped fish were bio-sampled. Age composition based on scale-age data from this area.	CDFW, SCS
Klamath River mainstem (IGH to Shasta R)	Area under the curve estimate from weekly surveys. Bio-data collected from fresh carcasses. Age composition based on scale-age data from this area.	USFWS, YT
Klamath River mainstem (Ash Cr to Indian Cr)	Weekly redd survey. Total run = (2*total redd count)/(1-proportion jacks from the Klamath River mainstem area based scale-age data). Age composition based on scale-age data from the Klamath River mainstem IGH to Shasta R. area.	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. Bio-data collected from all carcasses recovered. Age composition based on scale-age data from this area.	USFS,CDFW, KT, YT, SRRC, MKWC, SCS
Blue Creek	Weekly snorkel surveys. Jacks and adults estimated as the peak count during surveys. Bio-data collected from all fresh carcasses. Age composition based number of jacks observed in surveys and adult age composition based on scale-age data from this area.	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 attempted, however flows limited number of surveys to 2 for the season. Total run = (2*total redd count)/(1-proportion jacks estimated for the natural area above WCW). Bio-samples from all recovered carcasses. Age composition based on natural spawning escapement above WCW.	HVT
Trinity Tributaries (above Reservation; below WCW)	Perodic redd survey. Total run = (2*total redd count)/(1-proportion jacks estimated for the upper Trinity River natural spawners). Bio-data collected from all recovered carcasses. Age composition based on natural spawning escapement above WCW.	USFWS
Hoopa Reservation Tributaries	Perodic redd survey. Total run = (2*total redd count)/(1-proportion jacks estimated for the upper Trinity River natural spawners). Bio-data collected from all recovered carcasses. Age composition based on natural spawning escapement above WCW.	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. Age composition based on scale-age data from this area.	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. Age composition based on scale-age data from this area.	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 estimated from the weighted IGH, Klamath mainstem, Bogus Creek and Shasta age composition data). Age composition based on weighted IGH, Klamath mainstem, Bogus Creek and Shasta 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. Adult age composition based on scale-age data from the lower Trininy recreational fishery.	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 Age composition based on scale-age data from this area.	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. Age composition based on scale-age data from this area.	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. Age composition based on scale-age data from this area.	YT
Trinity River (Hoopa Reservation)	Effort and catch-per-effort surveys 4 random days per statistical week. Bio-data collected during net harvest interviews. Age composition based on scale-age data from this area.	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 2012 Klamath Basin fall Chinook age-composition assessment.

	Scales collected				
	Read				
Sampling Location	Unknown-age [a]	Known-age [b]	Not read [c]	Total	Agency
Hatchery Spawners					
Iron Gate Hatchery (IGH)	969	579	9,980	11,528	CDFW
Trinity River Hatchery (TRH)	2,629	782	93	3,504	HVT
Natural Spawners					
Salmon River Carcass Survey	398	0	32	430	CDFW
Scott River Carcass Survey	1,475	0	2,423	3,898	CDFW
Shasta River Carcass	608	2	103 [d]	713	CDFW
Bogus Creek Weir	735	351	610	1,696	CDFW
Klamath River mainstem	843	0	16	859	USFWS
Upper Klamath River tributaries	95	0	5	100	USFS
Blue Creek Snorkle	19	0	1	20	YT
Willow Creek Weir	1,143	70	26	1,239	CDFW, HVT
Lower Trinity River Carcass	19	0	1	20	HVT
Lower Trinity River tributaries	5	0	0	5	HVT
Recreational Harvest					
Lower Klamath River Creel	1,999	243	396	2,638	CDFW
Lower Trinity River Creel	111	2	23	136	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	1,140	198	3,362	4,700	YT
Klamath River (Hwy 101 to Trinity R)	1,342	35	29	1,406	YT
Trinity River (Hoopa Reservation)	1,454	128	11	1,593	HVT
TOTAL	14,984	2,390	17,111	34,485	

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

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

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

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

Table 3. Age-composition methods used for the 2012 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 (Ashe 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	Jacks estimated by direct observation. Adult age structure derrived from scale-age analysis.
Trinity River (above WCW)	Jack/adult structure from subtracting age specific TRH counts and recreational harvest estimate above WCW from the age specific total run estimate above WCW.
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: IGH, Bogus Creek, Shasta and Klamath River mainstem 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. 2012 Klamath River Basin scale validation matrices.

Number		Known Age				
		2	3	4	5	
	2	104	3	0	0	
Read	3	4	1162	18	0	
Age	4	0	12	111	0	
	5	0	0	1	0	Total
	Total	108	1177	130	0	1415

Percentage		Known Age				
		2	3	4	5	
	2	0.96	0.00	0.00	0.00	
Read	3	0.04	0.99	0.14	0.00	
Age	4	0.00	0.01	0.85	0.00	
	5	0.00	0.00	0.01	1.00	
	Total	1.00	1.00	1.00	1.00	

Table 4b. 2012 Trinity River Basin scale validation matrices.

Number		Known Age				
		2	3	4	5	
	2	8	2	0	0	
Read	3	0	825	5	0	
Age	4	0	5	137	0	
	5	0	0	0	1	Total
	Total	8	832	142	1	983

Percentage		Known Age				
		2	3	4	5	
	2	1.00	0.00	0.00	0.00	
Read	3	0.00	0.99	0.04	0.00	
Age	4	0.00	0.01	0.96	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 2012 Klamath Basin fall Chinook run.

Escapement & Harvest	2	3	AGE 4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,537	36,485	1,992	0	38,478	40,015
Trinity River Hatchery (TRH)	92	14,965	2,494	2	17,461	17,553
Hatchery Spawner subtotal	**1,629**	**51,450**	**4,486**	**2**	**55,939**	**57,568**
Natural Spawners						
Salmon River Basin	829	2,633	925	4	3,561	4,390
Scott River Basin	1,783	5,608	1,938	23	7,569	9,352
Shasta River Basin	1,944	27,591	2	0	27,593	29,537
Bogus Creek Basin	839	11,390	403	0	11,792	12,631
Klamath River mainstem (IGH to Shasta R)	817	7413	788	0	8,202	9,019
Klamath River mainstem (Shasta R to Indian Cr)	684	5990	610	0	6,600	7,284
Klamath Tributaries (above Trinity River)	629	2,813	441	0	3,253	3,883
Blue Creek	406	329	393	39	761	1,167
Klamath Basin subtotal	7,931	63,767	5,500	66	69,333	77,263
Trinity River (mainstem above WCW)	7,562	38,697	12,422	134	51,253	58,815
Trinity River (mainstem below WCW)	88	452	145	2	598	686
Trinity Tributaries (above Reservation; below WCW)	77	393	126	1	520	597
Hoopa Reservation tributaries	47	239	77	1	316	363
Trinity Basin subtotal	7,774	39,781	12,770	138	52,689	60,461
Natural Spawners subtotal	**15,705**	**103,548**	**18,270**	**204**	**122,022**	**137,724**
Total Spawner Escapement	**17,334**	**154,998**	**22,756**	**206**	**177,961**	**195,292**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	382	2,132	539	25	2,696	3,078
Klamath River (Hwy 101 to Weitchpec)	3,183	4,512	633	30	5,174	8,357
Klamath River (Weitchpec to IGH)	237	3,820	147	0	3,967	4,204
Trinity River Basin (above WCW)	32	1,051	242	0	1,293	1,325
Trinity River Basin (below WCW)	24	359	85	0	444	468
Subtotals	**3,858**	**11,874**	**1,646**	**55**	**13,574**	**17,432**
Tribal Harvest						
Klamath River (below Hwy 101)	72	69,688	22,139	1,689	93,516	93,588
Klamath River (Hwy 101 to Trinity mouth)	59	2,433	1,274	108	3,815	3,874
Trinity River (Hoopa Reservation)	55	2,784	1,350	11	4,145	4,200
Subtotals	**186**	**74,905**	**24,763**	**1,808**	**101,476**	**101,662**
Total Harvest	**4,044**	**86,779**	**26,409**	**1,863**	**115,050**	**119,094**
Totals						
Harvest and Escapement	21,378	241,777	49,165	2,069	293,011	314,386
Recreational Angling Dropoff Mortality 2.04%	79	242	34	1	277	356
Tribal Net Dropoff Mortality 8.7%	16	6,513	2,153	158	8,824	8,840
Total River Run	**21,473**	**248,532**	**51,352**	**2,225**	**302,109**	**323,582**

Table 6. Age proportion of the 2012 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE			
	2	3	4	5
Hatchery Spawners				
Iron Gate Hatchery (IGH)	0.04	0.91	0.05	0.00
Trinity River Hatchery (TRH)	0.01	0.85	0.14	0.00
Hatchery Spawner subtotal	0.03	0.89	0.08	0.00
Natural Spawners				
Salmon River Basin	0.19	0.60	0.21	0.00
Scott River Basin	0.19	0.60	0.21	0.00
Shasta River Basin	0.07	0.93	0.00	0.00
Bogus Creek Basin	0.07	0.90	0.03	0.00
Klamath River mainstem (IGH to Shasta R)	0.09	0.82	0.09	0.00
Klamath River mainstem (Shasta R to Indian Cr)	0.09	0.82	0.08	0.00
Klamath tributaries (above Reservation)	0.16	0.72	0.11	0.00
Yurok Reservation tributaries	0.35	0.28	0.34	0.03
Klamath Basin subtotal	0.10	0.83	0.07	0.00
Trinity River (mainstem above WCW)	0.13	0.66	0.21	0.00
Trinity River (mainstem below WCW)	0.13	0.66	0.21	0.00
Trinity tributaries (above Reservation)	0.13	0.66	0.21	0.00
Hoopa Reservation tributaries	0.13	0.66	0.21	0.00
Trinity Basin subtotal	0.13	0.66	0.21	0.00
Natural Spawners subtotal	0.11	0.75	0.13	0.00
Total Spawner Escapement	0.09	0.79	0.12	0.00
Recreational Harvest				
Klamath River (below Hwy 101 bridge)	0.12	0.69	0.18	0.01
Klamath River (Hwy 101 to Weitchpec)	0.38	0.54	0.08	0.00
Klamath River (Weitchpec to IGH)	0.06	0.91	0.03	0.00
Trinity River Basin (above WCW)	0.02	0.79	0.18	0.00
Trinity River Basin (below WCW)	0.05	0.77	0.18	0.00
Subtotals	0.22	0.68	0.09	0.00
Tribal Harvest				
Klamath River (below Hwy 101)	0.00	0.74	0.24	0.02
Klamath River (Hwy 101 to Trinity mouth)	0.02	0.63	0.33	0.03
Trinity River (Hoopa Reservation)	0.01	0.66	0.32	0.00
Subtotals	0.00	0.74	0.24	0.02
Total Harvest	0.03	0.73	0.22	0.02
Totals				
Harvest and Escapement	0.07	0.77	0.16	0.01
Recreational Angling Dropoff Mortality 2.04%	0.22	0.68	0.10	0.00
Tribal Net Dropoff Mortality 8.7%	0.00	0.74	0.24	0.02
Total River Run	0.07	0.77	0.16	0.01

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 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–2012 Details.

Iron Gate Hatchery (IGH)
A systematic random bio-sample[a] was obtained from every tenth Chinook salmon returning to IGH in 2012. Additionally, every ad-clipped fish not occurring in the random sample was bio-sampled as nonrandom. Nonrandom sampled ad-clipped fish are used for age validation, but not used in scale-based age proportions. A total of 1,548 scale samples were collected and read, of which 579 were from known-age coded wire tagged (CWT) fish. 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 1:5 systematic random sample. Additionally, biological data were obtained from a non-random collection of every ad-clipped fish encountered. A total of 1,086 scale samples were collected and read, of which 351 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 for surveys in the lower seven river miles on public and private lands where access is granted. An additional six river miles within the valley area (Big Springs Complex) were surveyed where access was granted. Bio-samples were also obtained from a systematic random sample of 1:10 fish that washed back onto the counting weir as well as all observed ad-clipped carcasses not occurring in the 1:10 sample. A total of 610 scale samples were collected from carcasses (excluding 'wash backs') and read, two of which were from known-age CWT fish. Scale-based age compositions from the carcass survey samples 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. Bio-samples were obtained from all non-deteriorated carcasses recovered above and below the weir. A total of 1,475 scale samples were collected and read, of which zero were from known-age CWT fish. Scale-based age compositions were used to apportion all age classes.

Salmon River
Total escapement was estimated by combining the Cormack Jolley Seber estimator for 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 "Path 1" carcasses (both eyes clear). A total of 398 scale samples were collected and read, 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 in the number of live fish observed during the final survey in each tributary. A total of 95 scale samples were collected and read, none of which were of known-age CWT fish. Scale-based age compositions were used to apportion all age classes.

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

Klamath River Mainstem
Weekly counts without removal were used to calculate an area under the curve estimate of escapement. Each bank was calculated independently. Observation efficiency was derived from mark-recapture results using a subset of sampled carcasses. Carcass "life" was derived from retention experiments conducted on the Klamath and Trinity Rivers. A total of 843 scale samples from carcasses were collected and read, of which zero 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). The total was estimated by expansion of the adult estimate using scale-based age proportions from the upper reach [adult/(1-proportion jacks)]. 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 Highway 101 Bridge to Weitchpec and below Highway 101 Bridge to mouth). A total of 2,242 scale samples were collected and read, of which 243 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 2012. 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 for these years to the average harvest in the lower Klamath River Creel area was applied to the Lower Klamath River Creel harvest estimate to estimate the total 2012 adult harvest in the Klamath River main stem. Adult harvest for the upper Klamath River recreational fishery was 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 Klamath River main stem, Bogus Creek, Shasta River 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 closed on Wednesdays and Thursdays and between the hours of 12 AM and 10 AM on fishing days. A total of 1,338 scale samples were collected and read, of which 198 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. The fishery was closed on Wednesdays and Thursdays and the Mid-Klamath fishery was closed between the hours of 12 AM and 10 AM on fishing days. Yurok harvest in the mid- and upper-Klamath area was segregated into jacks and adults based on scale ages. A total of 1,377 scale samples were collected and read, of which 35 came from known-age CWT fish. Scale-based age compositions were used to apportion all age classes.

Blue Creek
Escapement was estimated from the peak dive count of live fish. Jacks were estimated by direct diver count. A total of 19 scale samples from carcasses and netted live fish were read. Scale-based age compositions were used to apportion adult age classes and jack proportion was determined through direct observation.

Appendix C. Trinity River–2012 Details.

Trinity River Hatchery (TRH)
Sampling for scales was conducted in a systematic (1:5) random manner. Ad-clipped and non-ad-clipped fish were selected with equal probability. A total of 3,411 scales were aged of which 782 scales came from CWT fish. Scale samples were used to apportion the hatchery return into age classes.

Upper Trinity River Recreational Harvest
The general method for estimating the upper Trinity recreational harvest depends on the application of reward/non-reward program tags at the Willow Creek Weir (WCW) and subsequent returns by anglers. CDFW estimated a 1.8455% harvest rate on adult Chinook based on return of 27 program reward-tags of the 1,496 applied at WCW. The jack harvest rate of 0.422% was based on return of a single non-reward program tag of the combined 237 reward and non-reward tags applied, yielding an estimated harvest of 32 age-2 Chinook. There were no scales recovered from this fishery as no creel census was implemented in 2012. The adult age-proportions estimated for the Lower Trinity River Creel were used to apportion the Upper Trinity River Recreational Harvest adult component.

Lower Trinity River Creel
A roving creel census was implemented in Trinity River below the location of the WCW. A total of 113 scales were aged of which 2 were from known-age fish. Total harvest was apportioned by age using the scale-age proportions.

Upper Trinity River Natural Escapement
Total run was estimated using a Petersen mark-recapture estimator. The methods used for ageing the Trinity River run above WCW are similar to those used in the estimation of the population, 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 later recovered at either TRH or natural spawning areas which are also referenced to WCW by a unique "program tag" (spaghetti tag applied at WCW with unique identifying number). A total of 1,213 scales were used in estimation of the WCW run of which 70 CWT records were subsequently recovered at TRH.

The age-structure for fish passing above WCW was estimated using these scales and known-age fish recovered at Trinity River Hatchery which are linked to the scale samples. Next, specific age structures are estimated for fish returning to TRH and the recreational fishery. These proportions are applied to the total hatchery escapement and estimated fishery harvest, respectively, providing totals by age within area. These totals are next 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 estimation area included total spawners estimated in both main stem and tributary sub-areas (redds X 2). In the tributaries, a total of five scales were aged, none of which were from known-age fish. In the main stem, a total of 19 scales were aged, none of which were from known-age fish. Inadequate scale samples were recovered to generate independent age proportions for both the main stem and tributary sub-areas. Therefore, the upper Trinity River natural age structure was used to apportion all age classes in both tributaries and main stem sub-areas 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 1,582 scales were aged of which 128 were from known-age fish. The total harvest was apportioned by age using these scale-age proportions.

Appendix D. 2012 Klamath age analysis

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	52	657	26	0	735
IGH	41	879	49	0	969
SALMON	73	250	74	1	398
SCOTT	273	926	270	6	1,475
SHASTA	40	563	5	0	608
MAINSTEM	78	697	68	0	843
UR TRIBS	15	70	10	0	95
LRC EST	102	580	130	8	820
LRC UP	443	648	83	5	1,179
YTFP EST	3	874	240	23	1,140
YTFP M&U	22	895	384	41	1,342
BLUE CRK	1	9	8	1	19
	1143	7048	1347	85	9623

Unknown scales corrected age proportions (Kimura method)

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0.0711	0.8986	0.0303	0.0000	1.0
IGH	0.0415	0.9107	0.0478	0.0000	1.0
SALMON	0.1889	0.5996	0.2106	0.0009	1.0
SCOTT	0.1906	0.5997	0.2072	0.0025	1.0
SHASTA	0.0659	0.9341	0.0000	0.0000	1.0
MAINSTEM	0.0939	0.8223	0.0838	0.0000	1.0
UR TRIBS	0.1620	0.7244	0.1135	0.0000	1.0
LRC EST	0.1274	0.6868	0.1775	0.0084	1.0
LRC UP	0.3888	0.5315	0.0761	0.0037	1.0
YTFP EST	0.0008	0.7432	0.2377	0.0183	1.0
YTFP M&U	0.0154	0.6290	0.3276	0.0280	1.0
BLUE CRK	0.0536	0.4093	0.4882	0.0489	1.0

Known CWT ages [a]

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	24	1090	55	0	1169
IGH	211	7402	465	0	8078
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	1	28	2	0	31
MAINSTEM	11	355	69	0	435
UR TRIBS	0	0	0	0	0
LRC	20	274	24	0	318
YTFP EST	2	1282	262	0	1546
YTFP M&U	0	21	18	0	39
BLUE CRK	0	0	0	0	0
	269	10452	895	0	11616
Breakout within strata					
Bogus1	7	219	21	0	247
Bogus2	17	871	34	0	922
LRC - lo	3	90	11	0	104
LRC - mid	17	184	13	0	214
YTFP MID	0	16	15	0	31
YTFP UP	0	5	3	0	8

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

Appendix E. 2012 Trinity age analysis.

WCW = Willow Ck. Weir — Cwt Age

		no cwt age	2	3	4	5	Total
Scale unreadable		26	0	0	0	0	26
	2	115	2	0	0	0	117
Scale	3	806	0	59	0	0	865
Ages	4	220	0	1	8	0	229
70	5	2	0	0	0	0	2
1143		1169	2	60	8	0	1239

LOWTRINREC = Lower Trinity Recreational — Cwt Age

		no cwt age	2	3	4	5	Total
Scale unreadable		4	0	0	0	0	4
	2	6	0	0	0	0	6
Scale	3	85	0	2	0	0	87
Ages	4	20	0	0	0	0	20
	5	0	0	0	0	0	0
111		115	0	2	0	0	117

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

		no cwt age	2	3	4	5	Total
Scale unreadable		6	0	3	2	0	11
	2	22	0	0	0	0	22
Scale	3	970	0	89	1	0	1060
Ages	4	458	0	2	36	0	496
133	5	4	0	0	0	0	4
1454		1460	0	94	39	0	1593

TRH = Trinity River Hatchery — Cwt Age

		no cwt age	2	3	4	5	Total
Scale unreadable		77	0	16	0	0	93
	2	17	6	2	0	0	25
Scale	3	2242	0	675	4	0	2921
Ages	4	370	0	2	93	0	465
798	5	0	0	0	0	0	0
2629		2706	6	695	97	0	3504

LOWTRINTRIBS = Lower Trinity Tribs - Includes samples taken by ... — Cwt Age

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

UPKLAMREC Upper Klamath Recreational — NO DATA — Cwt Age

		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

		no cwt age	2	3	4	5	Total
Scale unreadable		1	0	0	0	0	1
	2	0	0	0	0	0	0
Scale	3	9	0	0	0	0	9
Ages	4	10	0	0	0	0	10
0	5	0	0	0	0	0	0
19		20	0	0	0	0	20

0 — NO DATA — Cwt Age

		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	8	2	0	0
3	0	825	5	0
4	0	5	137	0
5	0	0	0	1

4x4   0.99

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

	2	3	4	5
2	1.0000	0.0024	0.0000	0.0000
3	0.0000	0.9916	0.0352	0.0000
4	0.0000	0.0060	0.9648	0.0000
5	0.0000	0.0000	0.0000	1.0000

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

	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		
# known scales	70	133	2	798				0	1003	
# unknown scales	1143	1454	111	2629				5	5361	
Age										
2	0.0989	0.0135	0.0522	0.0044	0.1286	-	0.1286	0.0000		
3	0.7042	0.6613	0.7658	0.8550	0.6579	0.8080	0.6579	1.0000		
4	0.1951	0.3224	0.1820	0.1405	0.2112	0.1920	0.2112	0.0000		
5	0.0017	0.0028	0.0000	0.0000	0.0023	0.0000	0.0023	0.0000		
	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

UNKNOWN CWTS   0   0   0

CWTS Age	Willow Creek Weir WCW	Hoopa Tribal NET HARV	Lower Trinity REC HARV	TRH HATCHERY	Lower Trinity CARCASS	Upper Trinity REC HARV (Estimated)	Upper Trinity NATURAL (Estimated)	Hoopa Hook&Line
2	2	0	0	32	0	1	273	0
3	60	94	2	3458	0	119	3358	0
4	8	39	0	603	0	21	585	0
5	0	0	0	2	0	0	2	0
	70	133	2	4095	0	141	4219	0

WCW scales

Age	WCW no cwts	known age cwts scales	Total age all scales	WCW age proportions
2	113	2	115	0.0949
3	805	60	865	0.7130
4	223	8	231	0.1904
5	2	0	2	0.0016
	1143	70	1213	1.0000

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

	Total Run	Age	WCW proportions	TRH + Rec above WCW+Natural Escapement	Apportioned Natural Escapement minus TRH #s minus above WCW creel #s Escapement	Proportions
Rec above WCW	1325	2	0.0989	7685	7562	0.1286
TRH	17553	3	0.7042	54713	38697	0.6579
Naturals	58815	4	0.1951	15159	12422	0.2112
Total	77693	5	0.0017	136	134	0.0023
				77693		

Appendix F. 2012 Klamath Basin fall Chinook age-composition calculation worksheet.

Hatchery spawners	# Grilse	# Adults	Total Run	CALC 2	CALC 3	CALC 4	CALC 5	CALC Total	scale label	SCALE 2	SCALE 3	SCALE 4	SCALE 5	Total	Unk. Age Scales Read	Redds	Live
Iron Gate Hatchery (IGH)	1537	38478	40015	1537	36485	1992	0	40015	scales	0.0415	0.9107	0.0478	0.0000	1.0	969		
									IGH cwts	211	7402	465	0	8078			
Trinity River Hatchery (TRH)	92	17461	17553	92	14965	2494	2	17553	scales	0.00441	0.8550	0.1405	0.0000	1.0	2629		
Hatchery spawner subtotal:	1629	55939	57568	1629	51450	4486	2	57568	TRH cwts	32	3458	603	2	4095			
	prop. hatchery grilse		0.028			proportion hatchery		0.178									
Natural Spawners																	
Trinity River mainstem above WCW	7562	51253	58815	7562	38697	12422	134	58815	scales	0.12857	0.65795	0.21121	0.00228	1.0	1143		
Trinity River mainstem below WCW	88	598	686	88	452	145	2	686	Up T main	0.12857	0.65795	0.21121	0.00228	1.0	19	299	
Salmon River Basin (includes Wooley Cr)	829	3561	4390	829	2633	925	4	4390	scales	0.18888	0.59963	0.21060	0.00089	1.0	398	469	3234
Scott River	1783	7569	9352	1783	5608	1938	23	9352	scales	0.19062	0.59969	0.20722	0.00247	1.0	1,475	redds	
									Scott CWT	0	0	0	0	0			
Shasta River	1944	27593	29537	1944	27591	2	0	29537	scales	0.06585	0.93415	0.00000	0.00000	1.0	608		
									Shasta CWT	1	28	2	0	31			
Bogus Creek	839	11792	12631	839	11390	403	0	12631	scales	0.07109	0.89858	0.03033	0.00000	1.0	735		
									Bogus CWT	24	1090	55	0	1169			
Mainstem Klamath (IGH to Shasta R)	817	8202	9019	817	7413	788	0	9019	scales	0.09391	0.82228	0.08381	0.00000	1.0	843	<59cm	
									KR main CWT	11	355	69	0	435			
Mainstem Klamath (Ash Cr to Indian Cr)	684	6600	7284	684	5990	610	0	7284	Up K main	0.09391	0.82228	0.08381	0.00000	1.0	IGH to Shasta	3300	
Main basin subtotals:	14,546	117,168	131,714	14,546	99,774	17,233	163	131,714									
Klamath Tributaries																	
Aiken Cr	2	8	10	2	7	1	0	10	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	4	
Beaver Cr	87	451	538	87	390	61	0	538	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	225	1
Bluff Cr	0	1	1	0	1	0	0	1	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		1
Boise Cr	0	1	1	0	1	0	0	1	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		1
Camp Cr	149	772	921	149	667	105	0	921	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	373	31
Clear Cr	51	266	318	51	230	36	0	318	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	126	17
Dillon Cr	29	151	181	29	131	21	0	181	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	69	16
Elk Cr	47	243	290	47	210	33	0	290	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	121	1
Grider Cr	19	100	119	19	86	13	0	119	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	23	64
Horse Cr	26	135	162	26	117	18	0	162	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	66	4
Independence Cr	0	0	0	0	0	0	0	0	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		
Indian Cr	58	301	359	58	260	41	0	359	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	148	6
Irving Cr	1	3	3	1	2	0	0	3	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	1	1
Perch Cr	0	0	0	0	0	0	0	0	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		
Red Cap Cr	96	498	595	96	431	68	0	595	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	245	10
Rock Cr	10	50	60	10	43	7	0	60	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	25	0
Slate Cr	5	26	31	5	22	4	0	31	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	13	0
Seiad Cr	0	0	0	0	0	0	0	0	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		
Thompson Cr	47	245	293	47	212	33	0	293	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	92	73
Ti Cr	0	2	2	0	2	0	0	2	scales	0.16205	0.72442	0.11353	0.00000	1.0	95	1	
Pine Cr (formally in Klam tribs)	0	0	0	0	0	0	0	0	scales	0.16205	0.72442	0.11353	0.00000	1.0	95		
Klamath trib subtotal:	629	3253	3883	629	2813	441	0	3883								1532	226
Trinity Tributaries																	
Horse Linto Cr	39	266	305	39	201	64	1	305	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		133	0
Cedar Cr (trib to Horse Linto)	37	254	291	37	192	62	1	291	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		127	0
Trinity trib subtotal:	77	520	597	77	393	126	1	597								260	
Non-reservation trib subtotal:	706	3773	4480	706	3206	567	1	4480									
Reservation Tributaries-Hoopa Valley																	
Campbell Cr	2	12	14	2	9	3	0	14	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		6	
Hostler Cr	0	0	0	0	0	0	0	0	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		0	
Mill Cr	18	122	140	18	92	30	0	140	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		61	
Pine Cr. (moved in 2007 to Klam tribs)																	
Soctish Cr	1	8	9	1	6	2	0	9	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		4	
Supply Cr	13	88	101	13	66	21	0	101	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		44	
Tish Tang Cr	13	86	99	13	65	21	0	99	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		43	
Other (Hospital Cr.)	0	0	0	0	0	0	0	0	Up T main	0.12857	0.65795	0.21121	0.00228	1.0		0	
HVT reservation trib subtotal:	47	316	363	47	239	77	1	363								158	
Reservation Tributaries-Yurok																	
Blue Cr	406	761	1167	406	329	393	39	1167	scales	count	0.43248	0.51587	0.05164	1.0	19		
Reservation tributaries subtotal:	453	1077	1530	453	568	470	40	1530									
Natural spawner subtotal:	15705	122018	137724	15705	103548	18270	204	137724	122022								
Total spawners:	17334	177957	195292	17334	154998	22756	206	195292									
Angler Harvest																	
Klamath River (below Hwy 101)	382	2696	3078	382	2132	539	25	3078	scales	0.12736	0.68678	0.17747	0.00839	1.0	820		
									est-LRC CWT	3	90	11	0	104			
Klamath River (Hwy 101 to Weitchpec)	3183	5174	8357	3183	4512	633	30	8357	scales	0.38879	0.53145	0.07610	0.00366	1.0	1,179		
									mid-LRC CWT	17	184	13	0	214			

SURROGATE - Iron Gate+Bogus+Klamath Mainstem+Shasta Weighted Totals   IGH+BOG+Kmain 61665

| | | Feb 6 ratio estimator | | | | | | | IGH+Bog+Klam | 5137 | 82879 | 3185 | 0 | 91202 | | | |
| Klamath River (Weitchpec to IGH) | 237 | 3967 | 4204 | 237 | 3820 | 147 | 0 | 4204 | +Shast | 0.0563 | 0.9087 | 0.0349 | 0.0000 | 1.0 | | 4204 | 0.0682 |

SURROGATE - Trinity Rec. Harvest below WCW - adults only

Trinity River (above Willow Cr. Weir)	32	1293	1325	32	1051	242	0	1325	TR LRC	count	0.80799	0.19201	0.00000	1.0		<58cm	
									TR-up CWT		119	21	0	139	Paper CWTs		
Trinity River (below Willow Cr. Weir)	24	444	468	24	359	85	0	468	scales	0.05221	0.76580	0.18199	0.00000	1.0	111		
									TR-low CWT	0	2	0	0	2			
Angler harvest subtotal:	3,858	13,574	17,432	3,858	11,874	1,646	55	17,432									
Tribal Harvest																	
Klamath River (Estuary)	72	93516	93588	72.47	69688	22139	1689	93588	scales	0.0008	0.7432	0.2377	0.0183	1.0	1,140		
									YTFP EST CWT	2	1282	262	0	1546			
Klamath River (101 to Trinity R)	59	3815	3874	59	2433	1274	108	3874	scales	0.0154	0.6290	0.3276	0.0280	1.0	1,342		
									YTFP MU CWT	0	21	18	0	39			
Trinity River	55	4145	4200	55	2784	1350	11	4200	scales	0.01354	0.66134	0.32237	0.00275	1.0	1,454		
									HVT CWT	0	94	39	0	133			
Tribal harvest subtotal:	186	101476	101662	186	74905	24763	1808	101662									
Total harvest:	4044	115050	119094	4044	86779	26409	1863	119094									
Totals																	
In-river run and escapement	21378	293007	314386	21378	241777	49165	2069	314386									
Angling drop-off mortality (2.04%)	79	277	356	79	242	34	1	356	0.02041 angling drop-off mortality rate on harvest								
Net drop-off mortality (8.7%)	16	8824	8840	16	6513	2153	158	8840	0.08696 net drop-off mortality rate on harvest								
									Age comp of adults in total run		3	4	5 Total adults				
Total in-river run	21473	302109	323582	21473	248532	51352	2225	323582									
					6.6%	76.8%	15.9%	0.7%				76.8%	15.9%	0.7% 93.4%			

Appendix G. Final age composition of the 2011 Klamath Basin fall Chinook run (02/07/13).

Escapement & Harvest	2	3	AGE 4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	9,549	6,212	2,276	1	8,490	18,039
Trinity River Hatchery (TRH)	1,875	12,169	1,598	81	13,847	15,722
Hatchery Spawner subtotal	**11,424**	**18,381**	**3,874**	**82**	**22,337**	**33,761**
Natural Spawners						
Salmon River Basin	1,819	1,885	1,789	0	3,674	5,493
Scott River Basin	2,502	979	2,040	0	3,019	5,521
Shasta River Basin	11,175	23	190	0	213	11,388
Bogus Creek Basin	2,303	2,046	869	5	2,919	5,222
Klamath River mainstem (IGH to Shasta R)	2209	1205	1460	6	2,671	4,880
Klamath River mainstem (Shasta R to Indian Cr)	1061	539	719	3	1,262	2,323
Klamath Tributaries (above Trinity River)	3,259	458	2,583	32	3,072	6,331
Blue Creek	418	11	1,067	65	1,143	1,561
Klamath Basin subtotal	24,746	7,146	10,717	111	17,973	42,719
Trinity River (mainstem above WCW)	36,783	16,239	9,478	1,078	26,794	63,577
Trinity River (mainstem below WCW)	130	132	732	60	924	1,054
Trinity Tributaries (above Reservation; below WCW)	96	0	515	27	542	638
Hoopa Reservation tributaries	94	0	503	27	530	624
Trinity Basin subtotal	37,103	16,371	11,228	1,192	28,790	65,893
Natural Spawners subtotal	**61,849**	**23,517**	**21,945**	**1,303**	**46,763**	**108,612**
Total Spawner Escapement	**73,273**	**41,898**	**25,819**	**1,385**	**69,100**	**142,373**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	700	477	144	4	624	1,324
Klamath River (Hwy 101 to Weitchpec)	6,557	556	332	24	912	7,469
Klamath River (Weitchpec to IGH)	1,481	997	485	1	1,483	2,964
Trinity River Basin (above WCW)	809	393	303	14	710	1,519
Trinity River Basin (below WCW)	434	207	202	9	418	852
Subtotals	**9,981**	**2,630**	**1,466**	**52**	**4,147**	**14,128**
Tribal Harvest						
Klamath River (below Hwy 101)	429	7,629	9,251	338	17,218	17,647
Klamath River (Hwy 101 to Trinity mouth)	467	2,376	1,841	56	4,272	4,739
Trinity River (Hoopa Reservation)	426	3,281	1,495	87	4,863	5,289
Subtotals	**1,322**	**13,286**	**12,587**	**481**	**26,353**	**27,675**
Total Harvest	**11,303**	**15,916**	**14,053**	**533**	**30,500**	**41,803**
Totals						
Harvest and Escapement	84,576	57,814	39,872	1,918	99,600	184,176
Recreational Angling Dropoff Mortality 2.04%	204	54	30	1	85	289
Tribal Net Dropoff Mortality 8.7%	115	1,155	1,095	42	2,292	2,407
Total River Run	**84,895**	**59,023**	**40,997**	**1,957**	**101,977**	**186,872**