Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2010 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 2010 was estimated to be:

Age	Run Size Number	Run Size Proportion
2	16,652	0.15
3	46,182	0.43
4	44,411	0.41
5	379	0.00
Total	107,624	1.00

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

Sector	Adults Preseason Forecast	Adults Postseason Estimate	Pre / Post
Run Size	110,700	91,000	1.22
Fishery Mortality			
Tribal Harvest	34,600	30,000	1.15
Recreational Harvest	12,000	3,000	4.00
Drop-off Mortality	3,300	2,700	1.22
	49,900	35,700	1.40
Escapement			
Hatchery Spawners	20,200	18,100	1.12
Natural Area Spawners	40,700	37,200	1.09
	60,900	55,300	1.10

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 2010. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFG 2011) and with the 2011 forecast of ocean stock abundance (KRTT 2011).

Age-specific escapement estimates for 2010 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 2011). 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 2011). These forecasts are necessary inputs to the Klamath Ocean Harvest Model (Mohr 2006b); the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on Klamath River fall Chinook salmon.

Methods

The KRTT obtained estimates of abundance and age composition separately for each sector of harvest and escapement. Random and nonrandom sampling methods of various types were used throughout the Basin (Table 1) to 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.

An alternative method was used to estimate the age structure of escapement to the Shasta River in 2010. The method is described in Appendix B.

Stream surveys in the Salmon River were effectively stopped early in the 2010 spawning season due to high flow events. Methods describing the alternative method used for estimation of adult escapement to the Salmon River for the 2010 run are described in Appendix C.

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 D for the Klamath River and Appendix E for the Trinity River.

Results

A total of 10,813 scales from 17 different sectors were aged for this analysis (Table 2). Of these, 1,257 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 F and G). Overall,

the scale-based ages were generally accurate. Accuracy within the Trinity Basin was 99% for age-2 fish, 95% for age-3 fish, 97% for age-4 fish, and 100% for age-5 fish. Accuracy within the Klamath River Basin was 99% for age-2 fish, 97% for age-3 fish, 88% 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 H.

The final estimates of the 2009 Klamath Basin age composition were slightly modified from the preliminary age composition. Final estimates are presented in Appendix I.

List of Acronyms and Abbreviations

ad-clipped	adipose fin removed
CDFG	California Department of Fish and Game
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
M&U	Klamath River below Weitchpec: "middle" section (Hwy 101–Surpur Ck) and "upper" section (Surpur Ck—Trinity River)
SCS	Siskiyou County Schools
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 2010 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, marks. Systematic random sample ~10% bio-sampled[a] . All ad-clipped fish bio-sampled.	CDFG
Trinity River Hatchery (TRH)	Direct count. All fish bio-sampled. Scales collected from ~20% of all fish by systematic random sampling of aggregated ad- and non-ad-clipped fish.	CDFG, HVT
Natural Spawners		
Salmon River Basin	Only two carcass/redd surveys were completed due to high flows. Redd data from the first two weeks were used to estimate total redd deposition for the entire season using an alternative method detailed in Appendix C.	CDFG,USFS,YT, KT, SRRC, SCS
Scott River Basin	Video count above weir at river mile 21, and twice weekly redd/carcass count above and below weir. Bio-data collected from all carcasses observed. Adult estimate below weir based on redds * 2 and video count above weir.	CDFG, SCS
Shasta River Basin	Video count above weir. Bio-data collected from carcasses upstream of video weir /trap site one day per week and from mortalities stranded on weir.	CDFG, SCS
Bogus Creek Basin	Video count above weir and twice weekly direct carcass count below weir. Bio-data taken from a systematic random sample (1:3) of all carcasses observed during surveys above and below weir. All ad-clipped fish were bio-sampled.	CDFG, YT
Klamath River mainstem (IGH to Shasta R)	Petersen mark-recapture carcass estimate. River sections are surveyed weekly. Bio-data collected from fresh carcasses.	USFWS, YT
Klamath River mainstem (Shasta R to Indian Cr)	Redd count based on weekly surveys. Adults = 2 * redd counts; total run = adults/(1-proportion jacks estimated in IGH to Shasta reach). No bio-data collected.	USFWS, KT
Klamath Tributaries (above Trinity River)	Periodic redd surveys, the majority of which were performed weekly. Adults=2 * redd counts+live fish observed on last day surveyed. Total run = adults/(1-proportion jacks). Bio-data collected from all carcasses recovered.	USFS,CDFG
Blue Creek	Weekly surveys. Jacks and adults estimated as the peak count of successive weekly snorkel surveys. Bio-data collected from all fresh carcasses.	YT
Trinity River (mainstem above WCW)	Petersen mark-recapture run-size estimate; marks applied at WCW, recovered at TRH. All fish bio-sampled . Scales taken at WCW in systematic random sample (1:2). Total natural escapement calculated from WCW run size minus TRH return minus recreational harvest.	CDFG, HVT
Trinity River (mainstem below WCW)	Bi-weekly redd surveys attempted, however flows limited number of surveys to 4 for the season. Adults = 2 * redd counts. Total run = adults/(1-proportion jacks estimated for upper Trinity natural escapement). Bio-samples from all recovered carcasses.	HVT
Trinity Tributaries (above Reservation; below WCW)	Redd surveys. Adults = 2 * redd counts. Total run = adults/(1-proportion jacks estimated for upper Trinity natural escapement). Bio-data collected from all observed carcasses.	CDFG
Hoopa Reservation Tributaries	Redd surveys. Adults = 2 * redd counts. Total run = adults/(1-proportion jacks estimated for upper Trinity natural escapement). Bio-data collected from all observed 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.	CDFG
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.	CDFG
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. Upper river adult harvest=total adult harvest minus lower river adult harvest. Upper river total harvest=upper river adult harvest /(1-proportion jacks estimated by IGH and Bogus weighted average).	CDFG
Trinity River Basin (above WCW)	Jack and adult harvest estimates based on estimated harvest rates from angler return of tags (applied at WCW) multiplied by WCW jack and adult run sizes.	CDFG
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 4 random 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] Biological samples("bio-samples" or "bio-data") of live fish or carcasses generally include: sex, fork length, scales, tags or marks, and CWT recovery from ad-clipped fish.

Table 2. Scale sampling locations and numbers of scales collected for the 2010 Klamath Basin fall Chinook age-composition assessment.

Sampling Location	Scales collected				
	Read				
	Unknown-age [a]	Known-age [b]	Not read [c]	Total	Agency
Hatchery Spawners					
Iron Gate Hatchery (IGH)	1,015	396	561	1,972	CDFG
Trinity River Hatchery (TRH)	1,367	389	47	1,803	HVT
Natural Spawners					
Salmon River Carcass Survey	137	0	2	139	CDFG
Scott River Carcass Survey	496	0	6	502	CDFG
Shasta River Carcass	24	1	126 [d]	151	CDFG
Bogus Creek Weir	808	48	19	875	CDFG
Klamath River mainstem	444	0	33	477	USFWS
Upper Klamath River tributaries	35	0	0	35	USFS
Blue Creek Snorkle	5	0	0	5	YT
Willow Creek Weir	600	29	17	646	CDFG, HVT
Lower Trinity River Carcass	9	0	0	9	HVT
Lower Trinity River tributaries	21	0	0	21	HVT
Recreational Harvest					
Lower Klamath River Creel	935	12	20	967	CDFG
Lower Trinity River Creel	83	3	2	88	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	1,206	205	638	2,049	YT
Klamath River (Hwy 101 to Trinity R)	1,229	25	109	1,363	YT
Trinity River (Hoopa Reservation)	1,142	149	15	1,306	HVT
TOTAL	9,556	1,257	1,595	12,408	

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 (n=122) but not used in scale analysis.

Table 3. Age-composition methods used for the 2010 Klamath Basin fall Chinook run assessment.

Sampling Location	Age Composition Method
Hatchery Spawners	
Iron Gate Hatchery (IGH)	Jack/adult structure from scale-age analysis.
Trinity River Hatchery (TRH)	Jack/adult structure from scale-age analysis.
Natural Spawners	
Salmon River Basin	Jack/adult structure from scale-age analysis.
Scott River Basin	Jack/adult structure from scale-age analysis.
Shasta River Basin	Jacks estimated from wash back sample; Adult surrogate: Scott River Basin scale adult age-structure.
Bogus Creek Basin	Jack/adult structure from scale-age analysis.
Klamath River mainstem (IGH to Shasta R)	Jack/adult structure from scale-age analysis.
Klamath River mainstem (Shasta R to Indian Cr)	Surrogate: Klamath mainstem (IGH to Shasta R) age-structure.
Klamath tributaries (above Trinity River)	Surrogate:Un-weighted average of Salmon and Scott rivers scale age-structure.
Blue Creek	Jacks estimated by direct observation. Adult surrogate structure from un-weighted average of Scott and Salmon rivers age-structures.
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: Mainstem natural spawners above WCW age-structure.
Trinity Tributaries (above Reservation to WCW)	Surrogate: Mainstem natural spawners above WCW age-structure.
Hoopa Reservation Tributaries	Surrogate: Mainstem natural spawners above WCW age-structure.
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 and Bogus Creek weighted age composition.
Trinity River Basin (above WCW)	Jack component based on estimated jack harvest rate. Adult Surrogate: 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)	Jacks component based on estimated jack harvest. 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. 2010 Klamath River Basin scale validation matrices.

Number		Known Age				
		2	3	4	5	
	2	166	0	0	0	
Read	3	2	264	39	0	
Age	4	0	8	273	0	
	5	0	0	0	1	Total
	Total	168	272	312	1	753

Percentage		Known Age			
		2	3	4	5
	2	0.99	0.00	0.00	0.00
Read	3	0.01	0.97	0.13	0.00
Age	4	0.00	0.03	0.88	0.00
	5	0.00	0.00	0.00	1.00
	Total	1.00	1.00	1.00	1.00

Table 4b. 2010 Trinity River Basin scale validation matrices.

Number		Known Age				
		2	3	4	5	
	2	73	1	0	0	
Read	3	1	252	8	0	
Age	4	0	12	222	0	
	5	0	0	0	1	Total
	Total	74	265	230	1	570

Percentage		Known Age			
		2	3	4	5
	2	0.99	0.00	0.00	0.00
Read	3	0.01	0.95	0.03	0.00
Age	4	0.00	0.05	0.97	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 2010 Klamath Basin fall Chinook run.

Escapement & Harvest	2	3	AGE 4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,071	6,899	3,376	1	10,276	11,347
Trinity River Hatchery (TRH)	1,432	3,958	3,810	6	7,774	9,206
Hatchery Spawner subtotal	**2,503**	**10,857**	**7,186**	**7**	**18,050**	**20,553**
Natural Spawners						
Salmon River Basin	356	1,610	868	0	2,478	2,834
Scott River Basin	394	399	1,714	0	2,113	2,507
Shasta River Basin	87	239	1,020	0	1,259	1,346
Bogus Creek Basin	291	2,243	932	4	3,179	3,470
Klamath River mainstem (IGH to Shasta R)	180	1088	1293	12	2,392	2,572
Klamath River mainstem (Shasta R to Indian Cr)	95	588	698	6	1,292	1,387
Klamath Tributaries (above Trinity River)	274	704	959	0	1,663	1,937
Blue Creek	134	335	455	0	790	924
Klamath Basin subtotal	1,811	7,206	7,939	22	15,166	16,977
Trinity River (mainstem above WCW)	9,764	11,587	9,765	195	21,547	31,311
Trinity River (mainstem below WCW)	15	17	15	0	32	47
Trinity Tributaries (above Reservation; below WCW)	69	82	69	1	152	221
Hoopa Reservation tributaries	147	174	147	3	324	471
Trinity Basin subtotal	9,995	11,860	9,996	199	22,055	32,050
Natural Spawners subtotal	**11,806**	**19,066**	**17,935**	**221**	**37,221**	**49,027**
Total Spawner Escapement	**14,309**	**29,923**	**25,121**	**228**	**55,271**	**69,580**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	162	198	306	6	510	672
Klamath River (Hwy 101 to Weitchpec)	1,320	838	384	3	1,225	2,545
Klamath River (Weitchpec to IGH)	89	595	280	0	875	964
Trinity River Basin (above WCW)	127	112	74	3	190	317
Trinity River Basin (below WCW)	134	141	90	4	235	369
Subtotals	**1,832**	**1,884**	**1,134**	**16**	**3,035**	**4,867**
Tribal Harvest						
Klamath River (below Hwy 101)	20	8,584	13,052	89	21,725	21,745
Klamath River (Hwy 101 to Trinity mouth)	156	2,616	1,823	22	4,461	4,617
Trinity River (Hoopa Reservation)	260	1,990	1,807	14	3,810	4,070
Subtotals	**436**	**13,190**	**16,682**	**125**	**29,996**	**30,432**
Total Harvest	**2,268**	**15,074**	**17,816**	**141**	**33,031**	**35,299**
Totals						
Harvest and Escapement	16,577	44,997	42,937	369	88,302	104,879
Recreational Angling Dropoff Mortality 2.04%	37	38	23	0	62	99
Tribal Net Dropoff Mortality 8.7%	38	1,147	1,451	10	2,608	2,646
Total River Run	**16,652**	**46,182**	**44,411**	**379**	**90,972**	**107,624**

Table 6. Age proportion of the 2010 Klamath Basin fall Chinook run.

Escapement & Harvest	AGE			
	2	3	4	5
Hatchery Spawners				
Iron Gate Hatchery (IGH)	0.09	0.61	0.30	0.00
Trinity River Hatchery (TRH)	0.16	0.43	0.41	0.00
Hatchery Spawner subtotal	0.12	0.53	0.35	0.00
Natural Spawners				
Salmon River Basin	0.13	0.57	0.31	0.00
Scott River Basin	0.16	0.16	0.68	0.00
Shasta River Basin	0.06	0.18	0.76	0.00
Bogus Creek Basin	0.08	0.65	0.27	0.00
Klamath River mainstem (IGH to Shasta R)	0.07	0.42	0.50	0.00
Klamath River mainstem (Shasta R to Indian Cr)	0.07	0.42	0.50	0.00
Klamath tributaries (above Reservation)	0.14	0.36	0.49	0.00
Yurok Reservation tributaries	0.15	0.36	0.49	0.00
Klamath Basin subtotal	0.11	0.42	0.47	0.00
Trinity River (mainstem above WCW)	0.31	0.37	0.31	0.01
Trinity River (mainstem below WCW)	0.31	0.37	0.31	0.01
Trinity tributaries (above Reservation)	0.31	0.37	0.31	0.01
Hoopa Reservation tributaries	0.31	0.37	0.31	0.01
Trinity Basin subtotal	0.31	0.37	0.31	0.01
Natural Spawners subtotal	0.24	0.39	0.37	0.00
Total Spawner Escapement	0.21	0.43	0.36	0.00
Recreational Harvest				
Klamath River (below Hwy 101 bridge)	0.24	0.29	0.46	0.01
Klamath River (Hwy 101 to Weitchpec)	0.52	0.33	0.15	0.00
Klamath River (Weitchpec to IGH)	0.09	0.62	0.29	0.00
Trinity River Basin (above WCW)	0.40	0.35	0.23	0.01
Trinity River Basin (below WCW)	0.36	0.38	0.25	0.01
Subtotals	0.38	0.39	0.23	0.00
Tribal Harvest				
Klamath River (below Hwy 101)	0.00	0.39	0.60	0.00
Klamath River (Hwy 101 to Trinity mouth)	0.03	0.57	0.39	0.00
Trinity River (Hoopa Reservation)	0.06	0.49	0.44	0.00
Subtotals	0.01	0.43	0.55	0.00
Total Harvest	0.06	0.43	0.50	0.00
Totals				
Harvest and Escapement	0.16	0.43	0.41	0.00
Recreational Angling Dropoff Mortality 2.04%	0.37	0.38	0.23	0.00
Tribal Net Dropoff Mortality 8.7%	0.01	0.43	0.55	0.00
Total River Run	0.15	0.43	0.41	0.00

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

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

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

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

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

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: Shasta River escapement age composition 2010

Age structure of the Shasta River fall Chinook salmon run was determined using:
1. estimated total number of fish passing the video weir (jacks and adults combined),
2. proportion of males among adults in the carcass survey and weir trap samples,
3. proportion of jacks among males in the carcasses at the weir site (wash-back samples),
4. adult age composition based on the pooled adult scales collected in the carcass survey trap, and the weir wash-back samples.

A total of 1,346 fall Chinook salmon were estimated to have passed the weir in 2010. During the spawning ground surveys only 29 carcasses were sampled (9 male, 19 female, 3 unidentified). The KRTT concluded that the number of scales collected during the spawning ground surveys were insufficient in themselves to apportion the run into age classes. A second set of 121 carcasses from which sex could be identified were collected at the weir site (wash-back samples). Of these 121 carcasses, 102 (84%) were male. Due to the apparent bias toward the male component of the run, these data were also considered insufficient for apportioning the run into age classes.

The KRTT elected to utilize a method, developed in 2006 (KRTAT 2007), that partitions the run using data collected from the carcass survey, weir trap, and wash-back sample as follows. The proportion of males among adults, *P(M|A)*, was estimated using the carcass survey and trap data. After removing two jacks based on length (< 62 cm FL) from the trap and carcass sample, 0.26923 of the adults for which sex could be determined were males (7 of 26). The proportion of jacks among males, *P(J|M)*, was estimated from the wash-back sample to be 0.20408 (20 of 98). The equations below were then used to partition the total run (*N*) into jacks (*J*) and adults (*A*), and following that, the age composition of the adults was estimated using the age proportions derived from the Scott River.

1. Estimate the proportion of males in the run:

$$P(M) = \frac{P(M \mid A)}{1 - P(J \mid M)[1 - P(M \mid A)]} = \frac{0.26923}{1 - 0.20408[1 - 0.26923]} = 0.31642$$

based on the following relationship:

$$P(M \mid A) = \frac{P(M, A)}{P(A)} = \frac{P(M) - P(J)}{1 - P(J)} = \frac{P(M) - P(J \mid M)P(M)}{1 - P(J \mid M)P(M)}$$

2. Estimate the proportion of jacks in the run:

$$P(J) = P(M) \times P(J \mid M) = 0.31642 \times 0.20408 = 0.06458$$

3. Estimate the jack run:

$$J = N \times P(J) = 1346 \times 0.06458 = 87$$

4. Estimate the adult run:

$$A = N - K = 1346 - 87 = 1259.$$

Reference

KRTAT (Klamath River Technical Advisory Team). 2007. Klamath River fall Chinook age-specific escapement , river harvest, and run size estimates, 2006 run. Available from the Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, OR97220-1384.

Appendix C: Estimation of Salmon River escapement, accounting for a shortened survey.

In 2010, the Salmon River mark-recapture and redd surveys were conducted in a typical manner through Julian week 42 (the week ending on 21 October 2010). However, a large rain event on 24 October 2010 resulted in very sparse survey effort thereafter. In the Salmon River system, substantial spawning occurs after Julian week 42, and this spawning activity was insufficiently sampled.

To estimate total adult escapement in the Salmon River in 2010, accounting for the lack of sampling after Julian week 42, we utilized redd deposition data up to and including Julian week 42 and the temporal distributions of redd deposition from past years. Redd deposition data for years 1998-2009 indicated that the average proportion of new redds counted up to, and including, Julian week 42 was $\bar{p} = 0.3124$ (individual values of p ranged from 0.13 to 0.50). In 2010, 387 redds were enumerated up to, and including, Julian week 42 ($R_{inc} = 387$). Using these data, the total number of redds (R_{tot}) was estimated

$$R_{tot} = \frac{R_{inc}}{\bar{p}} = \frac{387}{0.3124} = 1239 \,,$$

which enabled the estimation of adult escapement (E) to the Salmon River

$$E = R_{tot} \times 2 = 1239 \times 2 = 2478.$$

Appendix D. Klamath River – 2010 Details.

Iron Gate Hatchery
A systematic random bio-sample[a] was obtained from every tenth Chinook returning to IGH in 2010. Additionally every ad-clip fish not occurring in the random sample was bio-sampled as nonrandom. Scale-based age compositions were used to apportion all age classes in the IGH fish (Table 3).

Bogus Creek
Total run was estimated by summing carcasses encountered below the video weir and videography (since 2002) counts above the weir. Bio-samples were obtained from all areas using a systematic random sample of 1:3. Additionally, biological data were obtained from a non-random collection of every ad-clipped fish encountered. All age classes were apportioned by scale-based analysis.

Shasta River
Total run was estimated by videography (as since 1998). Bio-samples were collected from all recovered carcasses from surveys in the lower 7 miles on public and private lands where access was granted. An additional 6 miles of valley area were surveyed on Nature Conservancy and adjoining Busk Ranch properties. Bio-samples were also obtained from all fish that washed back onto the counting weir. Twenty-eight carcasses were recovered in spawning ground surveys above the weir. Proportions of jacks among males in the 122 wash back fish were used to estimate jacks within the total run (Appendix B). Adult age proportions were based on proportions of adults estimated for Scott River.

Scott River
Total escapement was obtained using expansion of redd counts (2 X redds counted) for reaches below a resistance board weir installed near Jones Beach. Videography was used to estimate the population above the weir. Bio-samples were obtained from all non-deteriorated carcasses encountered above and below the weir. Scale-age proportions were used to assign all ages.

Salmon River
In past years, carcass mark-recapture was use to estimate total fall Chinook spawners in Salmon River. However, surveys were suspended due to high flows which started on 24 October and remained above the safe threshold for walking carcass-recapture surveys (above 450 cfs) for the balance of the season. Therefore, the total run estimate was generated by redd surveys conducted prior to these high flows and data on the temporal accumulation of redds from past years. (Appendix C).

Klamath River Tributaries
The adult run estimate was obtained by multiplying total redd counts by two and adding the total of live fish observed during the final survey in each tributary. Due to insufficient collection of scales, Chinook from these tributaries were apportioned by age using a surrogate of un-weighted average proportions estimated for the Salmon and Scott Rivers combined.

Klamath River Mainstem
For the upper reach (IGH to Shasta River section), the total population was estimated by tag recovery using an unstratified Peterson estimator. Scale-age proportions were used to assign all ages.

For the lower reach (Shasta River to Indian Creek) redds were multiplied by two to estimate the adult run. The scale-age proportions from the upper reach were used as surrogate to assign all ages.

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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.

Lower Klamath River Creel
Harvest was estimated by creel survey in each of the sub-areas (mouth to Highway 101 bridge and Highway 101 bridge to Weitchpec). Scale-age proportions were used to assign all ages in both sub-areas.

Upper Klamath River Recreational Fishery
There was no creel survey in this sub-area in 2010. Harvest data were available from creel surveys conducted on lower and upper river fisheries from 1999 through 2002. The ratio of mean total (all sub-areas) adult recreational harvest to mean adult harvest in the lower sub-area for these years was used to estimate adult harvest in the upper area in 2010, given the estimated lower-river harvest. The number of jacks and adult age assignments were estimated by applying the scale-based age proportions obtained from the weighted average age composition of Bogus Creek and Irongate Hatchery.

Yurok Tribal Estuary Fishery (Klamath mouth to Hwy 101)
Yurok harvest in the estuary area was estimated by bi-hourly counts to determine effort and fisher interviews to determine catch-per-effort. The fishery was closed on Wednesdays and Thursdays and between the hours of midnight and 10 a.m. on fishing days. Scale-age proportions were used to assign all ages.

Yurok Tribal Above 101
Yurok harvest in this sub-area was estimated by daily effort and catch-per-effort estimation. The fishery was closed on Wednesdays and Thursdays. Scale-age proportions were used to assign all ages.

Blue Creek
Escapement was estimated from the peak dive count of live fish. Jacks were estimated by direct diver count. Adult ages were apportioned using an un-weighted average surrogate from the Salmon and Scott rivers.

Appendix E. Trinity River – 2010 Details.

Trinity River Hatchery (TRH)
Scales were collected by a systematic random sample (1:5). Ad-clipped and non-ad-clipped fish were selected with equal probability. 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 tags returned by anglers. No scales are recovered from this fishery. In 2010, CDFG reported a 0.67% harvest rate on adult Chinook based on return of program reward-tags. The jack harvest rate of 1.02% was based on return of 4 program tags of the 394 tags applied at WCW yielding an estimated harvest of 127 age-2 Chinook. 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
Roving creel census implemented in Trinity River below the location of the WCW. Total harvest was apportioned by age using the scale-age proportions.

Upper Trinity River Natural Escapement
Total run estimated using a Petersen mark-recapture estimator. Age structured estimate of natural escapement is determined by subtracting the hatchery population and the harvest estimate by age from the total age-specific run estimate. At WCW a systematic random sampling (1:2) of all fish 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).

Lower Trinity River Natural Escapement:
The Lower Trinity natural escapement estimate includes total spawners estimated in both main-stem and tributary sub-areas (redds X 2). Ages were apportioned using the "Upper Trinity Natural Escapement" proportions as a surrogate.

Hoopa Valley Tribal Harvest
Hoopa Valley Tribal harvest is a composite of the gillnet and hook-and-line fisheries prosecuted by Tribal members. The total harvest was apportioned by age using these scale-age proportions.

Appendix F. 2010 Klamath age analysis

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	63	531	205	1	800
IGH	81	627	270	0	978
SALMON	17	81	39	0	137
SCOTT	77	120	299	0	496
SHASTA	0	4	20	0	24
MAINSTEM	30	211	201	2	444
UR TRIBS	1	19	15	0	35
LRC EST	25	36	43	1	105
LRC UP	428	281	118	1	828
YTFP EST	1	553	647	5	1,206
YTFP M&U	41	736	445	6	1,228
BLUE CRK	0	3	2	0	5
	764	3202	2304	16	6286

Unknown scales corrected age proportions (Kimura method)

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0.0797	0.6480	0.2711	0.0013	1.0
IGH	0.0838	0.6216	0.2946	0.0000	1.0
SALMON	0.1256	0.5682	0.3062	0.0000	1.0
SCOTT	0.1571	0.1593	0.6836	0.0000	1.0
SHASTA	0.0000	0.0493	0.9507	0.0000	1.0
MAINSTEM	0.0684	0.4240	0.5031	0.0045	1.0
UR TRIBS	0.0289	0.4980	0.4731	0.0000	1.0
LRC EST	0.2410	0.2913	0.4582	0.0095	1.0
LRC UP	0.5231	0.3237	0.1520	0.0012	1.0
YTFP EST	0.0008	0.3952	0.5998	0.0041	1.0
YTFP M&U	0.0338	0.5662	0.3951	0.0049	1.0
BLUE CRK	0.0000	0.5617	0.4383	0.0000	1.0

Known CWT ages [a]

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	19	30	6	0	55
IGH	193	392	292	1	878
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	0	1	0	0	1
MAINSTEM	4	0	1	0	5
UR TRIBS	0	0	0	0	0
LRC	23	39	9	0	71
YTFP EST	2	131	221	0	354
YTFP M&U	1	24	15	0	40
BLUE CRK	0	0	0	0	0
	242	617	544	1	1404
Breakout within strata					
Bogus1	1	2	2	0	5
Bogus2	18	28	4	0	50
LRC - lo	2	5	2	0	9
LRC - mid	21	34	7	0	62
YTFP MID	0	9	9	0	18
YTFP UP	1	15	6	0	22

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

Appendix G. 2010 Trinity age analysis

WCW = Willow Ck. Weir

		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	15	0	1	1	0	17
	2	165	6	0	0	0	171
Scale	3	228	0	7	0	0	235
Ages	4	204	0	2	14	0	220
31	5	3	0	0	0	0	3
600		615	6	10	15	0	646

LOWTRINREC = Lower Trinity Recreational

		no cwt age	Cwt Age 2	3	4	5	Total
	Scale unreadable	2	0	0	0	0	2
	2	30	0	0	0	0	30
Scale	3	31	0	2	0	0	33
Ages	4	21	0	0	1	0	22
	5	1	0	0	0	0	1
	83	85	0	2	1	0	88

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

		no cwt age	2	3	4	5	Total
	Scale unreadable	11	0	1	3	0	15
	2	76	3	0	0	0	79
Scale	3	551	0	65	5	0	621
Ages	4	511	0	3	73	0	587
153	5	4	0	0	0	0	4
1142		1153	3	69	81	0	1306

TRH = Trinity River Hatchery Cwt Age

		no cwt age	2	3	4	5	Total
	Scale unreadable	34	0	8	5	0	47
	2	216	64	1	0	0	281
Scale	3	572	1	178	3	0	754
Ages	4	578	0	7	134	0	719
402	5	1	0	0	0	1	2
1367		1401	65	194	142	1	1803

LOWTRINTRIBS = Lower Trinity Tribs Cwt Age

		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	7	0	0	0	0	7
Ages	4	13	0	0	0	0	13
0	5	0	0	0	0	0	0
21		21	0	0	0	0	21

UPKLAMREC Upper Klamath Recreational Cwt Age — NO DATA

		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	0	0	0	0	0	0
	2	2	0	0	0	0	2
Scale	3	4	0	0	0	0	4
Ages	4	3	0	0	0	0	3
0	5	0	0	0	0	0	0
9		9	0	0	0	0	9

0 Cwt Age — NO DATA

		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	73	1	0	0
3	1	252	8	0
4x4 4	0	12	222	0
5	0	0	0	1

0.961403509

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

	2	3	4	5
2	0.9865	0.0038	0.0000	0.0000
3	0.0135	0.9509	0.0348	0.0000
4	0.0000	0.0453	0.9652	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	31	153	153	402			0	589
# unknown scales	600	1142	83	1367			21	3222
Age 2	0.2773	0.0656	0.3649	0.1586	0.2235	-	0.3118	0.0470
3	0.3834	0.4903	0.3786	0.4225	0.4523	0.5962	0.3701	0.3270
4	0.3343	0.4406	0.2444	0.4182	0.3241	0.3848	0.3119	0.6260
5	0.0050	0.0035	0.0120	0.0007	0.0000	0.0190	0.0062	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 14 3 100

CWTS Age	Willow Creek Weir WCW	Hoopa Tribal NET HARV	Lower Trinity REC HARV	TRH HATCHERY	Lower Trinity CARCASS	Upper Trinity REC HARV	Upper Trinity NATURAL (Estimated)	Hoopa Hook&Line
2	0	3	0	296	0	6	269	0
3	0	69	2	931	0	8	239	0
4	0	81	1	813	0	7	209	0
5	0	0	0	1.01	0	0	0	0
	0	153	3	2041.01	0	21	716	0

WCW scales

Age	WCW no cwts	known age cwts scales	Total age all scales	WCW age proportions
2	166	0	166	0.2773
3	230	0	230	0.3834
4	201	0	201	0.3343
5	3	0	3	0.0050
	600	0	600	1.0000

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

	Total Run
Rec above WCW	317
TRH	9206
Naturals	31311
Total	40834

Apportioned Natural Escapement

Age	WCW proportions	TRH + Rec above WCW+Natural Escapement	minus TRH #s Escapement	minus above WCW creel #s Proportions
2	0.2773	11323	9764	0.3118
3	0.3834	15657	11587	0.3701
4	0.3343	13649	9765	0.3119
5	0.0050	204	195	0.0062
		40834		

Appendix H. 2010 Klamath Basin fall Chinook age-composition calculation worksheet.

Hatchery spawners	# Grilse	# Adults	Total Run	2	3	4	5	Total	(type)	2	3	4	5	Total	Unk. Age Scales Read	Redds	Live
Iron Gate Hatchery (IGH)	1071	10276	11347	1071	6899	3376	1	11347	scales	0.0838	0.6216	0.2946	0.0000	1.0	978		
									IGH cwts	193	392	292	1	878			
Trinity River Hatchery (TRH)	1432	7774	9206	1432	3958	3810	6	9206	scales	0.15856	0.4225	0.4182	0.0007	1.0	1367		
Hatchery spawner subtotal:	2503	18050	20553	2503	10857	7186	7	20553	TRH cwts	296	931	813	1	2041			
	prop. hatchery grilse		0.122			proportion hatchery		0.191									
Natural Spawners																	
Trinity River mainstem above WCW	9764	21547	31311	9764	11587	9765	195	31311	scales	0.31185	0.37006	0.31188	0.00621	1.0	600		
Trinity River mainstem below WCW	15	32	47	15	17	15	0	47	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		16	
Salmon River Basin (includes Wooley Cr)	356	2478	2834	356	1610	868	0	2834	scales	0.12558	0.56818	0.30624	0.00000	1.0	137	1239	0.3123
Scott River	394	2113	2507	394	399	1714	0	2507	scales	0.15711	0.15930	0.68359	0.00000	1.0	496		
Shasta River	87	1259	1346	87	239	1020	0	1346	scales count		0.18900	0.81100	0.00000	1.0	scott surrogate	<62cm	
									Shasta CWT		1	0	0	1			
Bogus Creek	291	3179	3470	291	2243	932	4	3470	scales	0.07970	0.64797	0.27108	0.00125	1.0	800		
									Bogus CWT	19	30	6	0	55			
Mainstem Klamath (IGH to Shasta R)	180	2392	2572	180	1088	1293	12	2572	scales	0.06838	0.42399	0.50312	0.00450	1.0	444		
									KR main CWT	4	0	1	0	5			
Mainstem Klamath (Shasta R to Indian Cr)	95	1292	1387	95	588	698	6	1387	Upper Main	0.06838	0.42399	0.50312	0.00450	1.0	IGH to Shasta	646	
Main basin subtotals:	11,182	34,292	45,474	11,182	17,771	16,305	217	45,474									
Klamath Tributaries									Salmon Scott unweighted average	0.14135	0.36374	0.49491	0.00000	1.0			
Aiken Cr	0	0	0	0	0	0	0	0	scales	0.14135	0.36374	0.49491	0.00000	1.0			
Beaver Cr	14	87	101	14	37	50	0	101	scales	0.14135	0.36374	0.49491	0.00000	1.0		42	3
Bluff Cr	3	21	24	3	9	12	0	24	scales	0.14135	0.36374	0.49491	0.00000	1.0		10	1
Boise Cr	1	6	7	1	3	3	0	7	scales	0.14135	0.36374	0.49491	0.00000	1.0		3	0
Camp Cr	94	568	662	94	241	327	0	662	scales	0.14135	0.36374	0.49491	0.00000	1.0		251	66
Clear Cr	20	120	140	20	51	69	0	140	scales	0.14135	0.36374	0.49491	0.00000	1.0		53	14
Dillon Cr	9	57	66	9	24	33	0	66	scales	0.14135	0.36374	0.49491	0.00000	1.0		9	39
Elk Cr	27	164	191	27	69	95	0	191	scales	0.14135	0.36374	0.49491	0.00000	1.0		56	52
Grider Cr	10	59	69	10	25	34	0	69	scales	0.14135	0.36374	0.49491	0.00000	1.0		26	7
Horse Cr	7	42	49	7	18	24	0	49	scales	0.14135	0.36374	0.49491	0.00000	1.0		21	0
Independence Cr	4	22	26	4	9	13	0	26	scales	0.14135	0.36374	0.49491	0.00000	1.0		11	0
Indian Cr	27	162	189	27	69	93	0	189	scales	0.14135	0.36374	0.49491	0.00000	1.0		73	16
Irving Cr	2	15	17	2	6	9	0	17	scales	0.14135	0.36374	0.49491	0.00000	1.0		5	5
Perch Cr	0	0	0	0	0	0	0	0	scales	0.14135	0.36374	0.49491	0.00000	1.0			
Red Cap Cr	36	217	253	36	92	125	0	253	scales	0.14135	0.36374	0.49491	0.00000	1.0		104	9
Rock Cr	3	20	23	3	8	12	0	23	scales	0.14135	0.36374	0.49491	0.00000	1.0		7	6
Slate Cr	10	60	70	10	25	35	0	70	scales	0.14135	0.36374	0.49491	0.00000	1.0		24	12
Seiad Cr	3	18	21	3	8	10	0	21	scales	0.14135	0.36374	0.49491	0.00000	1.0		5	8
Thompson Cr	2	13	15	2	6	7	0	15	scales	0.14135	0.36374	0.49491	0.00000	1.0		6	1
Ti Cr	2	12	14	2	5	7	0	14	scales	0.14135	0.36374	0.49491	0.00000	1.0		5	2
Pine Cr (previously in Trin Tribs)	0	0	0	0	0	0	0	0	scales	0.14135	0.36374	0.49491	0.00000	1.0	0.85865		
Klamath trib subtotal:	274	1663	1937	274	704	959	0	1937								711	241
Trinity Tributaries									SURROGATE - Trinity River Mainstem above WCW								
Horse Linto Cr	45	100	145	45	54	45	1	145	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		50	
Cedar Cr (trib to Horse Linto)	24	52	76	24	28	24	0	76	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		26	
Trinity trib subtotal:	69	152	221	69	82	69	1	221								76	
Non-reservation trib subtotal:	343	1815	2158	343	786	1028	1	2158									
Reservation Tributaries-Hoopa Valley																	
Campbell Cr	0	0	0	0	0	0	0	0	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		0	
Hostler Cr	24	52	76	24	28	24	0	76	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		26	
Mill Cr	76	168	244	76	90	76	2	244	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		84	
Pine Cr. (moved in 2007 to Klam tribs)																	
Soctish Cr	5	10	15	5	5	5	0	15	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		5	
Supply Cr	9	20	29	9	11	9	0	29	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		10	
Tish Tang Cr	29	64	93	29	34	29	1	93	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		32	
Other (Hospital Cr.)	5	10	15	5	5	5	0	15	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		5	
HVT reservation trib subtotal:	147	324	471	147	174	147	3	471	Above WCW	0.31185	0.37006	0.31188	0.00621	1.0		162	
Reservation Tributaries-Yurok																	
Blue Cr	134	790	924	134	335	455	0	924	count	0.42362	0.57638	0.00000	1.0		Surrogate		
									SS unweighted adults only	0.42362	0.57638	0.00000					
Reservation tributaries subtotal:	281	1114	1395	281	509	602	3	1395									
Natural spawner subtotal:	11806	37221	49027	11806	19066	17935	221	49027									
Total spawners:	14309	55271	69580	14309	29923	25121	228	69580									
Angler Harvest																	
Klamath River (below Hwy 101)	162	510	672	162	198	306	6	672	scales	0.24096	0.29128	0.45824	0.00952	1.0	105		
									est-LRC CWT	2	5	2	0	9			
Klamath River (Hwy 101 to Weitchpec)	1320	1225	2545	1320	838	384	3	2545	scales	0.52314	0.32366	0.15199	0.00121	1.0	828		
									mid-LRC CWT	21	34	7	0	62			
									SURROGATE - Iron Gate+Bogus Weighted Totals								
										1362	9142	4308	5	14817			
Klamath River (Weitchpec to IGH)	89	875	964	89	595	280	0	964	IGH+Bogus	0.09190	0.61699	0.29075	0.00036	1.0			
									SURROGATE - Trinity Rec. Harvest below WCW								
Trinity River (above Willow Cr. Weir)	127	190	317	127	112	74	3	317	TR LRC count		0.59623	0.38480	0.01897	1.0		<62cm	
									TR-up CWT		8	7	0	15	Paper CWTs		
Trinity River (below Willow Cr. Weir)	134	235	369	134	141	90	4	369	scales	0.36495	0.37864	0.24437	0.01205	1.0	83		
									TR-low CWT	0	2	1	0	3			
Angler harvest subtotal:	1,832	3,035	4,867	1,832	1,884	1,134	16	4,867									
Tribal Harvest																	
Klamath River (Estuary)	20	21725	21745	20	8584	13052	89	21745	scales	0.0008	0.3952	0.5998	0.0041	1.0	1,206		27686 q
									YTFP EST CWT	2	131	221	0	354			
Klamath River (101 to Trinity R)	156	4461	4617	156	2616	1823	22	4617	scales	0.0338	0.5662	0.3951	0.0049	1.0	1,228		
									YTFP MU CWT	1	24	15	0	40			
Trinity River	260	3810	4070	260	1990	1807	14	4070	scales	0.06559	0.49033	0.44058	0.00350	1.0	1142		
									HVT CWT	3	69	81	0	153			
Tribal harvest subtotal:	436	29996	30432	436	13190	16682	125	30432									
Total harvest:	2268	33031	35299	2268	15074	17816	141	35299									
Totals																	
In-river run and escapement	16577	88302	104879	16577	44997	42937	369	104879									
Angling drop-off mortality (2.04%)	37	62	99	37	38	23	0	99	0.02041 angling drop-off mortality rate on harvest								
Net drop-off mortality (8.7%)	38	2608	2646	38	1147	1451	10	2646	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	16652	90972	107624	16652	46182	44411	379	107624									
				15.5%	42.9%	41.3%	0.4%				42.9%	41.3%	0.4%	84.5%			

Appendix I. Age composition of the 2009 Klamath Basin fall Chinook run. (finalized Feb 3, 2011)

Escapement & Harvest	2	3	AGE 4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,229	8,982	3,184	97	12,263	13,492
Trinity River Hatchery (TRH)	143	6,867	444	39	7,351	7,494
Hatchery Spawner subtotal	**1,372**	**15,849**	**3,628**	**136**	**19,614**	**20,986**
Natural Spawners						
Salmon River Basin	516	1,291	511	403	2,204	2,720
Scott River Basin	44	1,794	106	267	2,167	2,211
Shasta River Basin	151	5,587	315	243	6,145	6,296
Bogus Creek Basin	471	4,836	552	66	5,455	5,926
Klamath River mainstem (IGH to Shasta R)	160	3150	1010	107	4,267	4,427
Klamath River mainstem (Shasta R to Indian Cr)	135	2724	863	92	3,678	3,813
Klamath Tributaries (above Trinity, including Pine Creek	175	2,793	168	134	3,094	3,269
Blue Creek	296	667	33	33	733	1,029
Klamath Basin subtotal	1,948	22,842	3,558	1,345	27,743	29,691
Trinity River (mainstem above WCW)	5,761	12,734	2,002	898	15,634	21,395
Trinity River (mainstem below WCW)	197	435	68	31	534	731
Trinity Tributaries (above Reservation; below WCW)	70	155	24	11	190	260
Hoopa Reservation tributaries	114	251	39	18	308	422
Trinity Basin subtotal	6,142	13,575	2,133	958	16,666	22,808
Natural Spawners subtotal	**8,090**	**36,417**	**5,691**	**2,303**	**44,409**	**52,499**
Total Spawner Escapement	**9,462**	**52,266**	**9,319**	**2,439**	**64,023**	**73,485**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	319	966	154	71	1,191	1,510
Klamath River (Hwy 101 to Weitchpec)	1,559	1,825	111	80	2,015	3,574
Klamath River (Weitchpec to IGH)	155	1,259	340	15	1,614	1,769
Trinity River Basin (above WCW)	145	449	67	44	559	704
Trinity River Basin (below WCW)	36	216	34	22	272	308
Subtotals	**2,214**	**4,715**	**706**	**232**	**5,651**	**7,865**
Tribal Harvest						
Klamath River (below Hwy 101)	43	13,055	4,216	2,194	19,465	19,508
Klamath River (Hwy 101 to Trinity mouth)	39	3,548	926	295	4,769	4,808
Trinity River (Hoopa Reservation)	96	3,217	689	247	4,153	4,249
Subtotals	**178**	**19,820**	**5,831**	**2,736**	**28,387**	**28,565**
Total Harvest	**2,392**	**24,535**	**6,537**	**2,968**	**34,038**	**36,430**
Totals						
Harvest and Escapement	11,854	76,801	15,856	5,407	98,061	109,915
Recreational Angling Dropoff Mortality 2.04%	45	96	14	5	115	160
Tribal Net Dropoff Mortality 8.7%	15	1,723	507	238	2,468	2,483
Total River Run	**11,914**	**78,620**	**16,377**	**5,647**	**100,644**	**112,558**