

Klamath River Fall Chinook Age-Specific Escapement, River Harvest, and Run Size Estimates, 2005 Run

Klamath River Technical Advisory Team
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Executive Summary

The number of Klamath River fall chinook returning to the Klamath River Basin (Basin) in 2005 was estimated to be:

<i>Age</i>	<i>Run Size</i>	
	<i>Number</i>	<i>Proportion</i>
2	2,300	0.03
3	43,900	0.65
4	17,500	0.26
5	3,900	0.06
Total	67,600	1.00

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

<i>Sector</i>	<i>Adults</i>	
	<i>Preseason Forecast</i>	<i>Postseason Estimate</i>
<i>Run Size</i>	74,200	65,300
<i>Fishery Mortality</i>		
Tribal Harvest	8,300	8,000
Recreational Harvest	1,200	1,600
Drop-off Mortality	<u>700</u>	<u>700</u>
	10,200	10,300
<i>Escapement</i>		
Hatchery Spawners	28,900	27,700
Natural Area Spawners	<u>35,000</u>	<u>27,300</u>
	<u>63,900</u>	<u>55,000</u>

Table 1 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.

Introduction

This report describes the data and methods used by the Klamath River Technical Advisory Team (KRTAT) to estimate age-specific numbers of fall chinook returning to the Basin in 2005. The estimates provided in this report are consistent with the Klamath River Megatable (CDFG 2006) and with the 2006 forecast of ocean stock abundance (KRTAT 2006).

Age-specific escapement estimates for 2005 and previous years, coupled with the coded-wire tag (CWT) recovery data on the Basin's hatchery stocks, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall chinook (KRTAT 2006, Goldwasser et al. 2001). Cohort reconstruction results enable forecasts to be developed of the current year's ocean

stock abundance, ocean fishery contact rates, and percent of spawners expected in natural areas (KRTAT 2006). These forecasts are necessary inputs to the Klamath Ocean Harvest Model (Mohr et al. 2001); the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on the Klamath River fall chinook stock.

Methods

The KRTAT 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 2) to obtain the data from which the Klamath River Megatable totals and estimates of age composition were derived.

Estimates of age composition were based on random samples of scales (Table 3) whenever possible. Generally, each scale is aged independently by two trained readers. In cases of disagreement, a third person arbitrates. Statistical methods (Kimura and Chikuni 1987, Cook and Lord 1978, Cook 1983) were used to correct the reader-assigned age composition estimates for potential bias based on the known-age vs. read-age validation matrices. No significant difference was observed among the sector-specific validation matrices, for the Trinity River scale readers. Thus a single (pooled) validation matrix was used for the Trinity River assessment. Significant differences were observed in the validation matrices for the harvested versus spawned (carcass) fish aged by Klamath River scale readers. In this case separate matrices were used for these two respective sectors in the Klamath River assessment.

The KRTAT relied on length-frequency analysis where the sample of scales was non-representative of the age-two component. 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.

The KRTAT relied on surrogate data where the sample of scales was insufficient for estimation of age composition, or was altogether lacking within a particular sector.

An indirect method of subtraction 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 that immigrated above the 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 the returns to Trinity River Hatchery and of 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.

Results

The specific protocols used to develop estimates of age composition for each sector are provided in Table 4. A summary of the KRTAT minutes specific to each sector is given in Appendix A for the Klamath River and Appendix B for the Trinity River.

A total of 10,401 scales from 17 different sectors were used for this analysis (Table 3). Of these, 1,501 were from known-age (CWT) fish. Known-age scales provide a direct check, or "validation," of accuracy of the scale-based age estimates (Tables 5a, 5b). Overall, the scale-based ages were accurate and precise. For the Trinity River, accuracy was $\geq 95\%$ for age-2, age-3, and age-4 fish, and was 75% for age-5 fish. For Klamath River harvest recovery sectors, the accuracy was $\geq 83\%$ for age-2, age-3, and age-4 fish, and 75% for age-5 fish; in the hatchery and natural spawning

sectors, accuracy was $\geq 88\%$ for age-2, age-3, and age-4 fish, but only 28% for age-5 fish (due to resorption of the last annulus). The statistical bias-adjustment methods employed are intended to correct for scale-reading bias, but the methods assume that the known-age vs. read-age validation matrices are themselves well estimated (Kimura and Chikuni 1987).

The resulting sector-specific age composition is given in Table 6 and further summarized in Table 1. Calculations underlying the results for the Klamath and Trinity Rivers are presented in Appendices C and D, respectively.

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Table 1. Age composition of the 2005 Klamath River fall chinook run.

Escapement & Harvest	AGE				Total Adults	Total Run
	2	3	4	5		
Hatchery Spawners						
Iron Gate Hatchery (IGH)	42	8,145	4,969	840	13,955	13,997
Trinity River Hatchery (TRH)	59	10,438	3,218	89	13,744	13,803
Hatchery Spawner subtotal	101	18,583	8,187	929	27,699	27,800
Natural Spawners						
Salmon River basin	105	287	114	0	401	506
Scott River basin	58	646	0	52	698	756
Shasta River Basin	37	1,361	579	79	2,018	2,055
Bogus Creek Basin	58	3,703	1,319	319	5,341	5,399
Klamath River mainstem (IGH to Shasta R)	28	1866	1492	728	4,086	4,114
Klamath River mainstem (Shasta R to Indian Cr)	4	245	196	96	536	540
Klamath Tributaries (above Reservation)	40	279	68	14	361	401
Yurok Reservation Tributaries	<u>68</u>	<u>81</u>	<u>32</u>	<u>0</u>	<u>113</u>	<u>181</u>
Klamath Basin subtotal	398	8,468	3,800	1,286	13,554	13,952
Trinity River (mainstem above WCW)	665	10,424	1,917	992	13,333	13,998
Trinity River (mainstem below WCW)	8	133	24	13	170	178
Trinity Tributaries (above Reservation)	8	128	24	12	164	172
Hoopa Reservation Tributaries	<u>4</u>	<u>66</u>	<u>12</u>	<u>6</u>	<u>84</u>	<u>88</u>
Trinity Basin subtotal	685	10,751	1,977	1,023	13,751	14,436
Natural Spawners subtotal	1,083	19,219	5,777	2,309	27,305	28,388
Total Spawner Escapement	1,184	37,802	13,964	3,238	55,004	56,188
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	311	190	43	10	243	554
Klamath River (Hwy 101 to Weitchpec)	595	366	82	20	468	1,063
Klamath River (Weitchpec to IGH)	6	259	51	8	318	324
Trinity River basin (above WCW)	88	400	67	1	468	556
Trinity River basin (below WCW)	18	86	13	0	100	118
Subtotals	1,018	1,301	256	40	1,597	2,615
Tribal Harvest						
Klamath River (below Hwy 101)	21	1,223	818	193	2,233	2,254
Klamath River (Hwy 101 to Trinity mouth)	38	1,755	1,335	223	3,313	3,351
Trinity River (Hoopa Reservation)	11	1,384	872	153	2,409	2,420
Subtotals	70	4,361	3,025	569	7,955	8,025
Total Harvest	1,088	5,662	3,281	609	9,552	10,640
Totals						
Harvest and Escapement	2,272	43,464	17,245	3,847	64,556	66,828
Recreational Angling Dropoff Mortality 2.04%	21	27	5	0	32	53
Tribal Net Dropoff Mortality 8.7%	6	379	263	50	692	698
Total River Run	2,299	43,870	17,513	3,897	65,280	67,579

Table 2. Estimation and sampling methods used for the 2005 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 for fork-length (FL), scales, sex, and all ad-clipped fish bio-sampled.	CDFG
Trinity River Hatchery (TRH)	Direct count. All fish bio-sampled for FL, fin-clips, marks, sex. Scales collected from ~20% of all fish by systematic random sampling of ad- and non-ad-clipped fish.	CDFG
Natural Spawners		
Salmon River Basin	Peak redd counts prior to 1 November flood event plus the peak redd count after this event, all multiplied by two, plus observed fish from Wooley Creek, plus the last day survey live fish count, minus spring chinook counted within overlapping reach.	CDFG,USFS
Scott River Basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio-data (scales, FLs, marks) collected from all fresh carcasses.	CDFG
Shasta River Basin	Video count. Bio-data (scales, FLs, sex, marks) collected from carcasses upstream of video weir site and mortalities stranded on weir.	CDFG
Bogus Creek Basin	Video count above weir, direct carcass count below weir. Bio-data (scales, FLs, sex, fin-clips) in both areas by 1:4 systematic sampling.	CDFG
Klamath River mainstem (IGH to Shasta R)	Petersen mark-recapture carcass estimate. Total Run=[Adult Estimate*(Jacks examined/Adults examined)]+Adult Estimate. River sections are surveyed once weekly. Bio-data (scales, FLs' marks) collected from fresh carcasses.	USFWS
Klamath River mainstem (Shasta R to Indian Cr)	Redd count based on weekly surveys. Adults = 2*redd counts; total run = adults/(1-%jacks estimated in IGH to Shasta reach).	USFWS
Klamath Tributaries (above Reservation)	Periodic redd surveys. Total Run = 2 * redd counts+live fish observed on last day surveyed.	USFS,CDFG
Yurok Reservation Tributaries	Only surveyed stream is Blue Creek. Jacks and adults estimated as the peak count of successive weekly snorkle surveys Oct - Dec.	YT
Trinity River (mainstem above WCW)	Petersen mark-recapture run-size estimate; marks applied at WCW, recaptured at TRH. All fish bio-sampled (FL, marks, fin-clips). Scales taken 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)	Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement estimated above WCW). Surveys were suspended prior to completion of spawning due to low river clarity in November.	HVT
Trinity Tributaries (above Reservation)	Only stream surveyed in 2005 was Horse Linto Cr. Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement above WCW).	USFS, CDFG
Hoopaa Reservation Tributaries	Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement estimated above WCW). No surveys completed in Pine Creek, surveys incomplete in other tributaries due to storms.	HVT
Recreational Harvest		
Klamath River (below Hwy 101 bridge)	Total harvest estimate based on weekly stratified, access point creel survey, on three randomly selected days per statistical week. 2005 regulations limited adult (>55cm) retention to five days per week. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Hwy 101 to Weitchpec)	Total harvest estimate based on weekly stratified, access point creel survey, on three randomly selected days per statistical week. 2005 regulations limited adult (>55cm) retention to five days per week. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Weitchpec to IGH)	Total harvest estimate based on roving creel census. 2005 regulations limited adult (>55cm) retention to five days per week. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	HVT
Trinity River Basin (above WCW)	Adult harvest: Estimated adult harvest rate from recovery of reward/non-reward tags (applied at WCW) multiplied by WCW adult run size. Jack harvest: Estimated adult harvest rate above WCW multiplied by the jack to adult ratio in the recreational harvest below the weir, divided by the jack to adult ratio in the run above WCW.	CDFG
Trinity River Basin (below WCW)	Estimate based on a stratified (weekday/weekend day), roving creel survey. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	HVT
Tribal Harvest		
Klamath River (below Hwy 101)	Stratified (night/day), effort and catch-per-effort surveys. Bio-data (FLs, scales, fin-clips, marks) collected during net harvest interviews.	YT
Klamath River (Hwy 101 to Trinity mouth)	Effort and catch-per-effort surveys. Bio-data (FLs, scales, fin-clips, marks) collected during net harvest interviews.	YT
Trinity River (Hoopa Reservation)	Two-stage effort and catch-per-effort surveys. Bio-data (FLs, scales, fin-clips) 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

Table 3. Scale sampling locations and numbers of scales used for the 2005 Klamath River Basin fall chinook age-composition assessment.

Sampling Location	Scales			Total	Agency
	Unknown-age read ^{a/}	Known-age read ^{b/}	Not used ^{c/}		
Hatchery Spawners					
Iron Gate Hatchery (IGH)	1,274	475	417	2,166	CDFG
Trinity River Hatchery (TRH)	1,920	602	47	2,569	HVT
Natural Spawners					
Salmon River Carcass Survey	54	0	2	56	CDFG, USFS
Scott River Carcass Survey	151	0	2	153	CDFG, USFS
Shasta River Weir & Carcass	395	9	11	415	CDFG
Bogus Creek Weir	897	89	23	1,009	CDFG
Klamath River mainstem	214	0	3	217	USFWS
Upper Klamath River Tribs	5	0	0	5	CDFG, USFS
Willow Creek Weir	639	60	18	717	CDFG, HVT
Lower Trinity River Carcass	25	0	1	26	HVT
Lower Trinity River Tribs	1	0	0	1	HVT
Recreational Harvest					
Upper Klamath River Creel	45	7	5	57	HVT
Lower Klamath River Creel	565	25	6	596	CDFG
Lower Trinity River Creel	19	1	1	21	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	1,080	90	18	1,188	YT
Klamath River (Hwy 101 to Trinity R)	1,179	85	591	1,855	YT
Trinity River (Hoopa Reservation)	437	58	5	500	HVT
TOTAL	8,900	1,501	1,150	11,551	

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

b/ Scales from ad-clipped, CWT fish, mounted and read; not all Klamath scales used in scale validation matrix.

c/ Scales from non-ad-clipped fish, mounted and not read, or un-readable; scales from non-ad-clipped fish, not mounted; scales from ad-clipped fish with no cwt, not mounted or mounted and not read; scales from ad-clipped, CWT fish not mounted.

Table 4. Age-composition methods used for the 2005 Klamath River fall chinook run assessment.

Sampling Location	Age Composition Method
<u>Hatchery Spawners</u>	
Iron Gate Hatchery (IGH)	Jacks ≤ 50 cm. Adults apportioned by scale-age analysis.
Trinity River Hatchery (TRH)	Jack/adult structure from scale-age analysis.
<u>Natural Spawners</u>	
Salmon River Basin	Jack/adult structure from scale-age analysis.
Scott River Basin	Jack/adult structure from scale-age analysis.
Shasta River Basin	Jacks ≤ 52 cm. Adults apportioned by scale-age analysis.
Bogus Creek Basin	Jacks ≤ 52 cm. Adults apportioned by scale-age analysis.
Klamath River mainstem (IGH to Shasta R)	Jacks ≤ 52 cm. 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 Reservation)	Surrogate: Unweighted average age structure from the Scott, Shasta, and Salmon Rivers.
Yurok Reservation Tributaries	Jacks estimated by direct observation. Adult Surrogate: Salmon River age structure.
Trinity River (mainstem above WCW)	Indirect estimation: WCW run (age structure from scales) minus age-structured TRH return minus recreational harvest above WCW by age.
Trinity River (mainstem below WCW)	Jack surrogate: jacks = adults * (%jacks / %adults) in natural escapement above WCW. Adult surrogate: Mainstem natural spawners above WCW age-structure.
Trinity Tributaries (above Reservation)	Jack surrogate: jacks = adults * (%jacks / %adults) in natural escapement above WCW. Adult surrogate: Mainstem natural spawners above WCW age-structure.
Hoopa Reservation Tributaries	Jack surrogate: jacks = adults * (%jacks / %adults) in natural escapement above WCW. Adult surrogate: Mainstem natural spawners above WCW age-structure.
<u>Recreational Harvest</u>	
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)	Jack/adult structure from scale-age analysis.
Trinity River Basin (above WCW)	Adult surrogate: Recreational harvest below WCW age-structure.
Trinity River Basin (below WCW)	Jack/adult structure from scale-age analysis.
<u>Tribal Harvest</u>	
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 5a. 2005 Klamath River scale validation matrices.

Klamath Carcass Validation						Klamath Harvest Validation								
<u>Number</u>		Known Age					<u>Number</u>		Known Age					
		2	3	4	5				2	3	4	5		
Read Age	2	9	9	1	0	Total	681	2	10	1	0	0	Total	252
	3	0	318	36	0			3	2	121	3	1		
	4	0	15	260	23			4	0	13	92	1		
	5	0	1	0	9			5	0	0	2	6		
Total		9	343	297	32			12	135	97	8			
<u>Percentage</u>		Known Age				<u>Percentage</u>		Known Age						
		2	3	4	5			2	3	4	5			
Read Age	2	1.000	0.026	0.003	0.000	Total	1.00	1.00	1.00	1.00				
	3	0.000	0.927	0.121	0.000		2	0.833	0.007	0.000	0.000			
	4	0.000	0.044	0.875	0.719		3	0.167	0.896	0.031	0.125			
	5	0.000	0.003	0.000	0.281		4	0.000	0.096	0.948	0.125			
Total		1.00	1.00	1.00	1.00			5	0.000	0.000	0.021	0.750		
Total		1.00	1.00	1.00	1.00			1.00	1.00	1.00	1.00			

Table 5b. 2005 Trinity River scale validation matrix.

<u>Number</u>		Known Age												
		2	3	4	5									
Read Age	2	1	0	0	0	Total	721							
	3	0	557	7	0									
	4	0	4	148	1									
	5	0	0	0	3									
Total		1	561	155	4									
<u>Percentage</u>		Known Age												
		2	3	4	5									
Read Age	2	1.0000	0.0000	0.0000	0.0000	Total	1.00	1.00	1.00	0.00				
	3	0.0000	0.9929	0.0452	0.0000		2	1.0000	0.0000	0.0000	0.0000			
	4	0.0000	0.0071	0.9548	0.2500		3	0.0000	0.9929	0.0452	0.0000			
	5	0.0000	0.0000	0.0000	0.7500		4	0.0000	0.0071	0.9548	0.2500			
Total		1.00	1.00	1.00	0.00			5	0.0000	0.0000	0.0000	0.7500		
Total		1.00	1.00	1.00	0.00			1.00	1.00	1.00	0.00			

Table 6. 2005 Klamath age-composition calculation worksheet.

2005

	# Grilse	# Adults	Total Run	CALCULATED AGE					SCALE AGE PROPORTIONS					Scales read or unknown CWTs	Redd counts	
				2	3	4	5	Total	2	3	4	5	Total			
Hatchery spawners																
Iron Gate Hatchery (IGH)	42	13955	13997	42	8145	4969	840	13997	scales 0.00299	0.59197	0.34440	0.06063	1.0	1,274	<=50cm	
Trinity River Hatchery (TRH)	59	13744	13803	59	10438	3218	89	13803	IGH cwt	3	334	425	40	802	0	
<i>Hatchery spawner subtotal:</i>	<i>101</i>	<i>27699</i>	<i>27800</i>	<i>101</i>	<i>18583</i>	<i>8187</i>	<i>929</i>	<i>27800</i>	scales 0.00521	0.75472	0.23382	0.00625	1.0	1920		
									TRH cwt	3	2382	722	22	3129	0	
									proportion hatchery 0.411							
Natural Spawners																
Trinity River mainstem above WCW	665	13333	13998	665	10424	1917	992	13998	scales 0.04749	0.74465	0.13698	0.07087	1.0			
Trinity River mainstem below WCW	8	170	178	8	133	24	13	178	scales 0.04749	0.74465	0.13698	0.07087	1.0	surrogate above	85	
Salmon River Basin (includes Wooley Cr)	105	401	506	105	287	114	0	506	scales 0.20656	0.56785	0.22559	0.00000	1.0	54		
Scott River	58	698	756	58	646	0	52	756	scales 0.07692	0.85437	0.00000	0.06871	1.0	151		
Shasta River	37	2018	2055	37	1361	579	79	2055	scales 0.01800	0.66371	0.27972	0.03856	1.0	395	<=52cm	
									Shasta CWT	0	4	7	0	11	0	
Bogus Creek	58	5341	5399	58	3703	1319	319	5399	scales 0.01080	0.68789	0.24180	0.05952	1.0	897	<=52cm	
									Bogus CWT	1	55	37	3	96	0	
Main stem Klamath (IGH to Shasta R)	28	4086	4114	28	1866	1492	728	4114	scales 0.00678	0.45360	0.36264	0.17697	1.0	214	<=52cm	
Main stem Klamath (Shasta R to Indian Cr)	4	536	540	4	245	196	96	540	Upper main	0.00678	0.45360	0.36264	0.17697	1.0	Surrogate used	268
<i>subtotal:</i>	<i>963</i>	<i>26,583</i>	<i>27,546</i>	<i>963</i>	<i>18,665</i>	<i>5,641</i>	<i>2,279</i>	<i>27,546</i>								
									0.0054	0.0054	0.0054	0.0054				
									Unweighted Shasta Salmon Scott(SSS) - SURROGATE							
									SSS	0.10049	0.69531	0.16844	0.03576	1.0		
Klamath Tributaries																
Aiken Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Beaver Cr.	1	9	10	1	7	2	0	10	SSS	0.10049	0.69531	0.16844	0.03576		3	
Bluff Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Boise Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Camp Cr.	7	66	73	7	51	12	3	73	SSS	0.10049	0.69531	0.16844	0.03576		32	
Clear Cr.	11	101	112	11	78	19	4	112	SSS	0.10049	0.69531	0.16844	0.03576		49	
Dillon Cr.	4	32	36	4	25	6	1	36	SSS	0.10049	0.69531	0.16844	0.03576		15	
Elk Cr.	7	66	73	7	51	12	3	73	SSS	0.10049	0.69531	0.16844	0.03576		33	
Grider Cr.	2	21	23	2	16	4	1	23	SSS	0.10049	0.69531	0.16844	0.03576		10	
Horse Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Independence Cr.	0	2	2	0	2	0	0	2	SSS	0.10049	0.69531	0.16844	0.03576		1	
Indian Cr.	4	33	37	4	26	6	1	37	SSS	0.10049	0.69531	0.16844	0.03576		9	
Irving Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Perch Cr.	0	0	0	0	0	0	0	0	SSS	0.10049	0.69531	0.16844	0.03576		0	
Red Cap Cr.	3	27	30	3	21	5	1	30	SSS	0.10049	0.69531	0.16844	0.03576		13	
Thompson Cr.	0	1	1	0	1	0	0	1	SSS	0.10049	0.69531	0.16844	0.03576		0	
Slate Cr	0	3	3	0	2	1	0	3	SSS	0.10049	0.69531	0.16844	0.03576	0.90	1	
<i>Klamath Tribs subtotal</i>	<i>40</i>	<i>361</i>	<i>401</i>	<i>40</i>	<i>279</i>	<i>68</i>	<i>14</i>	<i>401</i>							166	
															29	
Trinity Tributaries																
Horse Linto Cr.	4	80	84	4	63	12	6	84	scales 0.04749	0.74465	0.13698	0.07087	1.0		40	
Cedar Cr (trib to Horse Linto)	4	84	88	4	66	12	6	88	scales 0.04749	0.74465	0.13698	0.07087	1.0		42	
<i>subtotal</i>	<i>8</i>	<i>164</i>	<i>172</i>	<i>8</i>	<i>128</i>	<i>24</i>	<i>12</i>	<i>172</i>	surrogate Trinity River Mainstem							
<i>Non-Reservation Misc. tribs sub total</i>	<i>48</i>	<i>525</i>	<i>573</i>	<i>48</i>	<i>407</i>	<i>92</i>	<i>26</i>	<i>573</i>								
Reservation Tributaries-Hoopa Valley																
Campbell Cr.	0	0	0	0	0	0	0	0	scales 0.04749	0.74465	0.13698	0.07087			0	
Hostler	0	0	0	0	0	0	0	0	scales 0.04749	0.74465	0.13698	0.07087			0	
Mill	2	32	34	2	25	5	2	34	scales 0.04749	0.74465	0.13698	0.07087			16	
Pine Cr.	0	0	0	0	0	0	0	0	scales 0.04749	0.74465	0.13698	0.07087	not surveyed 05		0	
Soctish	0	6	6	0	5	1	0	6	scales 0.04749	0.74465	0.13698	0.07087			3	
Supply Cr.	1	24	25	1	19	3	2	25	scales 0.04749	0.74465	0.13698	0.07087			12	
Tish Tang Cr.	1	22	23	1	17	3	2	23	scales 0.04749	0.74465	0.13698	0.07087			11	
Others	0	0	0	0	0	0	0	0	scales 0.04749	0.74465	0.13698	0.07087			0	
<i>subtotal</i>	<i>4</i>	<i>84</i>	<i>88</i>	<i>4</i>	<i>66</i>	<i>12</i>	<i>6</i>	<i>88</i>	scales 0.04749	0.74465	0.13698	0.07087			42	
Reservation Tributaries-Yurok																
Blue Cr.	68	113	181	68	81	32	0	181	Salmon R	not used	0.56785	0.22559	0.00000	0.79		
<i>reservation tributaries subtotal</i>	<i>72</i>	<i>197</i>	<i>269</i>	<i>72</i>	<i>147</i>	<i>44</i>	<i>6</i>	<i>269</i>	adults	0.71568	0.28432	0.00000	1.00			
<i>Natural spawner subtotal:</i>	<i>1083</i>	<i>27305</i>	<i>28388</i>	<i>1083</i>	<i>19219</i>	<i>5777</i>	<i>2311</i>	<i>28388</i>								
<i>Total spawner subtotal:</i>	<i>1184</i>	<i>55004</i>	<i>56188</i>	<i>1184</i>	<i>37802</i>	<i>13964</i>	<i>3240</i>	<i>56188</i>								
Angler Harvest																
Klamath River (below Hwy 101)	311	243	554	311	190	43	10	554	LRC scales 0.56618	0.33969	0.07495	0.01918	1.00	565	55 cm jack regul	
									LRC cwt	1	4	2	0	7	0	
Klamath River (Hwy 101 to Weichpec)	595	468	1063	595	366	82	20	1063	LRC scales 0.56618	0.33969	0.07495	0.01918	1.00		55 cm jack regul	
									LRC cwt	2	10	3	0	15	0	
Klamath River (Weichpec to IGH)	6	318	324	6	259	51	8	324	0.01950	0.80585	0.14912	0.02553	1.00		55 cm jack regul	
									URC cwt	0	4	4	0	8	0	
Trinity River (below Willow Cr. Weir)	18	100	118	18	86	13	0	118	scales 0.15789	0.73737	0.10474	0.00000	1.00	19		
									lower cwt	0	0	1	0	1	0	
Trinity River (above Willow Cr. Weir)	88	468	556	88	400	67	1	556								
<i>Angler harvest subtotal:</i>	<i>1,018</i>	<i>1,597</i>	<i>2,615</i>	<i>1,018</i>	<i>1,301</i>	<i>256</i>	<i>40</i>	<i>2,615</i>	0.87563	0.12437	0.00000	1.00	Surrogate for adults -lowr creel			
									upper cwt	0	61	19	1	81	adult cwt only	
Tribal Harvest																
Klamath River (Estuary)	21	2233	2254	21	1223	818	193	2254	scales 0.00964	0.54078	0.36327	0.08631	1	1,080	<=50cm	
									YTFP EST cwt	0	54	33	6	93	0	
Klamath River (101 to Trinity R)	38	3313	3351	38	1755	1335	223	3351	scales 0.01162	0.52447	0.39562	0.06829	1	1,179		
									YTFP MU cwt	0	48	48	1	97	0	
Trinity River	11	2409	2420	11	1384	872	153	2420	scales 0.00458	0.56892	0.36243	0.06407	1	437		
									Hoopa cwt	0	42	17	2	61	0	
<i>Tribal harvest subtotal:</i>	<i>70</i>	<i>7955</i>	<i>8025</i>	<i>70</i>	<i>4362</i>	<i>3025</i>	<i>569</i>	<i>8025</i>								
<i>Total harvest</i>	<i>1088</i>	<i>9552</i>	<i>10640</i>	<i>1088</i>	<i>5663</i>	<i>3281</i>	<i>609</i>	<i>10640</i>								
Totals																
<i>In-river run and escapement</i>	<i>2272</i>	<i>64556</i>	<i>66828</i>	<i>2272</i>	<i>43465</i>	<i>17245</i>	<i>3849</i>	<i>66828</i>								
<i>Angling dropoff mortality (2.04%)</i>	<i>21</i>	<i>32</i>	<i>53</i>	<i>21</i>	<i>27</i>	<i>5</i>	<i>0</i>	<i></i>								

Appendix A. Klamath River – 2005 Details.

Iron Gate Hatchery

A systematic random bio-sample was obtained from every tenth Chinook returning to IGH in 2005. Additionally every ad-clip fish not occurring in the random sample was bio-sampled (length and scale collected with CWT) as nonrandom.

A total of 13,997 Chinook were recovered at IGH of which 1,749 scales were used, and 475 were from known-age fish. Only three age-two CWT fish were recovered and all three were properly aged. This result apparently affected the utility of the reader bias correction method for correcting age proportions. Generally, in recovery areas where three-year-old reads greatly dominated the age-two read fish, the bias correction method adjusts low proportions of age-two fish to zero proportions. The KRTAT concluded that a length-based criteria of jacks ≤ 50 cm would be appropriate. This produced the result of 42 jacks (0.3%) and 13,955 adults (99.7%). Adult ages were apportioned scale analysis.

Bogus Creek

There were a total of 986 scales used of which 89 were from known-age CWT fish. The KRTAT determined that scale samples used from Bogus Creek were non-representative of the jack component. The Team decided to assign jacks by length frequency analysis using ≤ 52 cm. The adult age classes were apportioned by scale-based analysis.

Shasta River

The KRTAT determined that scale samples collected in Shasta River were representative of the adult run component only. Scale sampling appeared to over-represent the male component of the run when compared to expected sex ratios based on videography. Hence, the KRTAT decided to use a ≤ 52 cm cut off to identify the jack proportion observed in the male length frequency of weir wash-back samples (carcasses impinging on the up-steam side of weir). Adult ages were apportioned by scale analysis. There were a total of 404 scales were read of which 9 were from known-age, CWT fish.

Scott River

There were a total of 151 scales used of which none were from known-age fish. There were no age-four fish in the scale-aged fish, the KRTAT used the scale age proportions to assign all ages to Scott River. The Team verified that the aged scales were a representative sub-sample of the total number of carcasses seen during the spawner surveys.

Salmon River

Three approaches for estimating total escapement were presented by field biologists; redd counts, Schaefer, and Peterson mark-recapture methodologies. The KRTAT used peak redd counts (198 redds) prior to 1 November flood event plus the peak redd count after this event (51), times two=498, plus 15 fish counted from Wooley Creek, plus 76 last day live, minus 83 (spring chinook counted within an overlapping reach). This math produced a total run of 506.

A total of 54 scales were used, none of which were from known-age, CWT fish. The KRTAT used scale-based age proportions for jack/adult age apportionment.

Klamath River Tributaries

The total run estimate was obtained by multiplying total redd counts by two and adding the total of live adult fish observed during the final survey in each tributary. Due to insufficient collection of scales, these tributaries were apportioned by age according to the un-weighted average proportions resulting from analyses of the Salmon, Scott, and Shasta rivers.

Klamath River Main stem

For the IGH to Shasta River section, 214 scales were used to apportion adult ages. The KRTAT determined that scale samples misrepresented age-two fish as scales were collected from fresh carcasses only. A length-based criteria of ≤ 52 cm from the Shasta and Bogus analyses was used as a

surrogate. In the Shasta to Indian Creek section, the same age proportions were applied to total spawners which were estimated by redd counts multiplied by two.

Lower Klamath River Creel

For both sub-areas (above/below Highway 101) scale age proportions were used to apportion all ages for the estimated harvest totals. A total of 590 scales were examined of which 25 were taken from known-age, CWT fish.

Upper Klamath River creel

This area was sampled by Hoopa Valley Tribal Fisheries Department personnel on a 3d/week roving creel census. The KRTAT apportioned all ages based on the corrected scale-age proportions obtained from a total of 52 scales read from this fishery, seven of which were from known-age, CWT fish.

Yurok Tribal Estuary Fishery (Klamath mouth to Hwy 101)

Yurok harvest in the estuary area was allocated by age using scales obtained in this fishery. A total of 1,170 scales were aged of which 90 were from known-age, CWT fish.

Yurok Tribal Above 101

Yurok harvest in the mid and upper-Klamath area was segregated into jacks and adults based upon scale ageing. A total of 1,264 scales were used of which 85 came from known-age, CWT fish.

Blue Creek

Snorkel surveys were used to produce the total escapement estimate. Visual counts revealed 68 jacks and 113 adults. Adult age composition was approximated using the age structure of Salmon River as a surrogate.

Appendix B. Trinity River – 2005 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 2,522 scales were aged of which 602 scales came from CWT fish. This was the largest validation component for the entire Trinity River ageing project. Jacks were identified by scales, as were the age proportions for adult 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 subsequently recovered by the program. The CWT “run-size” analysis allocated proportions of tag codes observed at TRH to natural spawning areas and the recreational fishery occurring in the river reach between TRH and WCW. In 2005, CDFG reported a total adult harvest based on an estimated harvest rate from return of program tags. As of this report date however, there were no angler returns of program tags needed to estimate the jacks harvest rate. KRTAT developed a surrogate harvest rate for jacks using the estimated adult harvest rate above the weir, multiplied by the harvest of jacks to adults below the weir, and divided by the relative proportions of jacks to adults above the weir. This calculation produced a jack harvest rate of 10.8%, yielding a total harvest of 88 age-two chinook.

There were no scales recovered from this fishery as no creel census was implemented in 2005. The age composition of the adult fish was apportioned by both the CWT run-size estimates provided by CDFG and the scale-age proportions developed in the lower Trinity creel.

Lower Trinity River Creel

A total of 20 scales were aged of which one sample was from a known-age fish. Team concluded that sufficient scale samples were drawn to enable direct ageing by scales for all ages. However, there was concern expressed over the fact that there was no sampling on Tuesdays and Wednesdays, when adult retention was prohibited under the 2005 regulations.

Upper Trinity Natural Escapement

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 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 read scales is accomplished with known-aged 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 699 scales were used in estimation of the WCW run including 60 CWT records subsequently recovered at TRH.

The age-structure for fish passing above WCW was estimated using these scales and known-age fish recovered in upper river areas 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 Natural Escapement estimation area included total spawners estimated in both mainstem and tributary sub-areas. A total of 26 scales were collected from the mainstem, and one scale was collected from the tributary sub-area. None of these scales were associated with a CWT recovery. The single scale recovered in the tributary sub-area was from Hoopa tributaries. The Team concluded that scale collections were inadequate to provide age distributions for both sub-areas for all ages. 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. A total of 495 scales were aged of which 58 were from known-age fish. The total harvest was apportioned by age using these scale-age proportions.

Appendix C. 2005 Klamath scale age analysis

Unknown scales age composition as read						
		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS		5	617	258	17	897
LRC		268	228	60	9	565
URC		1	33	10	1	45
IGH		5	771	474	24	1274
SALMON		12	30	12	0	54
SCOTT		15	120	12	4	151
SHASTA		18	254	118	5	395
YTFP EST		13	549	440	78	1080
YTFP M&U		16	581	512	70	1179
MAINSTEM		3	100	100	11	214
UR TRIBS		1	3	1	0	5
		357	3286	1997	219	5859

Unknown scales corrected age proportions (Kimura method)						
		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	p	0.0000	0.6954	0.2444	0.0602	1.0
LRC	p	0.5662	0.3397	0.0750	0.0192	1.0
URC	p	0.0195	0.8058	0.1491	0.0255	1.0
IGH	p	0.0000	0.5938	0.3454	0.0608	1.0
SALMON	p	0.2066	0.5678	0.2256	0.0000	1.0
SCOTT	p	0.0769	0.8544	0.0000	0.0687	1.0
SHASTA	p	0.0274	0.6574	0.2770	0.0382	1.0
YTFP EST	p	0.0096	0.5408	0.3633	0.0863	1.0
YTFP M&U	p	0.0116	0.5245	0.3956	0.0683	1.0
MAINSTEM	p	0.0008	0.4563	0.3648	0.1780	1.0

Known CWT ages						#CWTS UNKNOWN	
		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL	
BOGUS			55	37	3	96	3
LRC		3	14	5	0	22	6
URC		0	4	4	0	8	0
IGH		3	334	425	40	802	37
SALMON		0	0	0	0	0	0
SCOTT		0	0	0	0	0	0
SHASTA		0	4	7	0	11	1
YTFP EST		0	54	33	6	93	14
YTFP M&U		0	48	48	1	97	17
MAINSTEM		0	0	0	0	0	0
UR TRIBS		0	0	0	0	0	0
Bogus1		0	18	14	3	35	1
Bogus2		1	37	23	0	61	2
LRC - lo		1	4	2	0	7	3
LRC - mid		2	10	3	0	15	2
YTFP MID		0	5	7	0	12	6
YTFP UP		0	43	41	1	85	11

Appendix D. 2005 Trinity scale age analysis

WCW = Willow Ck. Weir <table border="1"> <tr><th colspan="2"></th><th colspan="5">Cwt Age</th><th>Total</th></tr> <tr><th colspan="2"></th><th>no cwt</th><th>2</th><th>3</th><th>4</th><th>5</th><th></th></tr> <tr><th>Scale</th><th>Age</th><td>unreadable</td><td>18</td><td>0</td><td>0</td><td>0</td><td>18</td></tr> <tr><td>2</td><td>3</td><td>20</td><td>0</td><td>0</td><td>0</td><td>20</td></tr> <tr><td>4</td><td>2</td><td>477</td><td>0</td><td>48</td><td>1</td><td>526</td></tr> <tr><td>60</td><td>4</td><td>122</td><td>0</td><td>1</td><td>10</td><td>133</td></tr> <tr><td>639</td><td>5</td><td>20</td><td>0</td><td>0</td><td>0</td><td>20</td></tr> <tr><td colspan="2"></td><td>657</td><td>0</td><td>49</td><td>11</td><td>717</td></tr> </table>								Cwt Age					Total			no cwt	2	3	4	5		Scale	Age	unreadable	18	0	0	0	18	2	3	20	0	0	0	20	4	2	477	0	48	1	526	60	4	122	0	1	10	133	639	5	20	0	0	0	20			657	0	49	11	717	LOWTRINREC = Lower Trinity Recreational <table border="1"> <tr><th colspan="2"></th><th colspan="5">Cwt Age</th><th>Total</th></tr> <tr><th colspan="2"></th><th>no cwt</th><th>2</th><th>3</th><th>4</th><th>5</th><th></th></tr> <tr><th>Scale</th><th>Age</th><td>unreadable</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>2</td><td>3</td><td>3</td><td>0</td><td>0</td><td>0</td><td>3</td></tr> <tr><td>4</td><td>2</td><td>14</td><td>0</td><td>0</td><td>0</td><td>14</td></tr> <tr><td>1</td><td>4</td><td>2</td><td>0</td><td>0</td><td>1</td><td>3</td></tr> <tr><td>19</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td colspan="2"></td><td>20</td><td>0</td><td>0</td><td>1</td><td>21</td></tr> </table>								Cwt Age					Total			no cwt	2	3	4	5		Scale	Age	unreadable	1	0	0	0	1	2	3	3	0	0	0	3	4	2	14	0	0	0	14	1	4	2	0	0	1	3	19	5	0	0	0	0	0			20	0	0	1	21					
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<p>Trinity Upper Rec Harvest (Lower Trinity surrogate for adults)</p> <table border="1"> <tr><th colspan="2"></th><th colspan="5">Cwt Age</th><th>Total</th></tr> <tr><th colspan="2"></th><th>no cwt</th><th>2</th><th>3</th><th>4</th><th>5</th><th></th></tr> <tr><th>Scale</th><th>Age</th><td>unreadable</td><td>17</td><td>2</td><td>34</td><td>0</td><td>53</td></tr> <tr><td>2</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>3</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>4</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td colspan="2"></td><td>17</td><td>2</td><td>34</td><td>0</td><td>53</td></tr> </table>								Cwt Age					Total			no cwt	2	3	4	5		Scale	Age	unreadable	17	2	34	0	53	2	2	0	0	0	0	0	3	3	0	0	0	0	0	4	4	0	0	0	0	0	1	5	0	0	0	0	0			17	2	34	0	53	<p>Surrogate L.Trin harvest</p> <table border="1"> <tr><th colspan="2"></th><th colspan="4">Cwt Age</th><th>Total</th><th>Proportions</th></tr> <tr><th colspan="2"></th><th>no cwt</th><th>2</th><th>3</th><th>4</th><th>5</th><th></th></tr> <tr><th>Scale</th><th>Age</th><td>unreadable</td><td>17</td><td>2</td><td>34</td><td>0</td><td>53</td></tr> <tr><td>2</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.0000</td></tr> <tr><td>3</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.8544</td></tr> <tr><td>4</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.1434</td></tr> <tr><td>1</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.0021</td></tr> <tr><td colspan="2"></td><td>17</td><td>2</td><td>34</td><td>0</td><td>53</td><td></td></tr> </table>								Cwt Age				Total	Proportions			no cwt	2	3	4	5		Scale	Age	unreadable	17	2	34	0	53	2	2	0	0	0	0	0	0.0000	3	3	0	0	0	0	0	0.8544	4	4	0	0	0	0	0	0.1434	1	5	0	0	0	0	0	0.0021			17	2	34	0	53	
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