

Klamath River Fall Chinook Age-Specific Escapement, 2001 Run

Klamath River Technical Advisory Team
4 March 2003

Executive Summary

The number of Klamath River fall chinook returning to the Klamath River Basin in 2001 was estimated to be

<u>Age</u>	<u>Number</u>	<u>Proportion</u>
2	11,365	0.06
3	99,977	0.50
4	89,171	0.44
5	67	0.00
<u>Total</u>	<u>200,579</u>	

Klamath Ocean Harvest Model preseason forecasts of fall chinook to the Klamath River Basin and their postseason estimates are:

<u>Sector</u>	<u>Adult Preseason Forecast</u>	<u>Adult Postseason Estimate</u>
Run Size	187,100	189,214
Tribal Harvest	75,500	40,442
Recreational Harvest	29,800	12,128
Hatchery Spawners	27,700	55,111
Natural Area Spawners	47,000	78,056

Age-specific returns to the Basin's hatcheries and spawning grounds, and harvest in the Basin's tribal and recreational fisheries are presented in Table 1.

Introduction

This report describes the data and methods used by the Klamath River Technical Team (KRTAT) to estimate age-specific numbers of fall chinook returning to the Basin in 2001. The estimates provided in this report are compatible and consistent with the so-called Klamath River Megatable (CDFG 2002) and with the 2002 forecast of ocean stock abundance (KRTAT 2002), but may differ slightly from the most recent version of the Klamath River Megatable (CDFG 2003).

Age-specific escapement estimates for 2001 and previous years, coupled with the coded-wire tag 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 2002, Goldwasser et al. 2001). Cohort reconstruction results enable forecasts to be developed of the upcoming year's ocean stock abundance, percent of spawners expected in natural areas and ocean fishery contact rates, as described in a companion report (KRTAT 2002). These forecasts are essential 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 basic approach used by the KRTAT to develop age-specific estimates of returning fall chinook to the Basin's hatcheries, spawning grounds, and fisheries, was to develop an age-composition estimate for each sector and then apply this composition to the corresponding sector total (age-unspecific) reported in the Klamath River Megatable. Random sampling methods of various types

were used throughout the Basin (Table 2) to obtain the data from which the Megatable totals and the age-composition estimates were derived.

Where possible, an age composition estimate was based on the reading of a random sample of scales (Table 3). For Trinity River ageing, each scale was read independently by two readers, and a third reader was used to resolve any disagreement between the two primary readers. For Klamath River ageing, each scale was read independently by two readers, and any disagreement was resolved by the two readers re-reading the scale together and agreeing upon a single age. Statistical methods (Kimura and Chikuni 1987, Cook and Lord 1978, Cook 1983) were then used to correct for the possibility of reader ageing-bias, by correlating known-age cwt scales with their corresponding scale-read age assignments.

In some cases, however, the scale sample was either known or thought to be non-random with respect to the jack component. In these cases, the so-called length "cutoff" method (all fish less than a certain length are assumed to be jacks, and all fish greater than that length are assumed to be adults) was used to estimate the jack component percentage based on a random sample of length frequencies. The length "cutoff" value varied by sector and was based on the location of the sample length frequency nadir, and if appropriate, known-age (cwt) length frequencies. Scale reading was used to estimate the adult age composition in these instances.

In still other cases, the scale sample size was insufficient to develop a reliable age composition estimate, or was altogether lacking. In these cases the KRTAT used "surrogate" age composition estimates from other sectors where such estimates were available, and were thought most likely to reflect the age composition of the sector of interest.

For Trinity River natural area spawners, an indirect method was used as follows. Age-specific numbers of fall chinook passing the Willow Creek Weir (WCW) were estimated by applying the WCW scale-age composition to the above WCW total run size estimate. Next, the age composition of Trinity River Hatchery (TRH) returns, and angler harvest between WCW and TRH, were determined based on scale-age assessments and any known-age cwt fish collected at these recovery points. Natural area spawner age composition was then taken as the difference between the WCW run-size at age and the sum of TRH returns and the angler harvest above WCW. The resulting age composition for the natural escapement above WCW was assumed to apply to Trinity River natural area spawners both above and below WCW.

Results

The specific protocol used to develop age composition estimates in each sector are provided in Table 4, and a summary of the KRTAT surrounding discussion is given in Appendices A and B for the Klamath and Trinity Rivers, respectively.

A total of 18,005 scales from 16 different sectors were read (Table 3), and of these 499 and 3,451 were cwt'd fish from the Klamath and Trinity Rivers, respectively. The scale-age results for these cwt fish provides a direct check on the accuracy of the scale read age assignments, and allowed us to estimate the known-age, scale-age "validation" matrix used in the bias correction statistical methods (Tables 5a, 5b). Overall, the scale readings were quite accurate and precise, particularly in the case of the Trinity River (>95% accuracy, all ages). For known age-2 fish, the Klamath River readings were biased toward age-3 fish 19% of the time. The statistical bias correction methods employed can account for this type of bias, but the methods assume that the known-age, scale-age "validation" matrices are themselves well-estimated. This is suspect for the age-2 and age-5 components due to the small sample sizes involved.

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

Literature Cited

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Table 1. Age Composition of the 2001 Klamath River fall chinook run as determined by the Klamath River Technical Advisory Team, with assistance from CDFG's Klamath and Trinity River projects.*

Escapment & Harvest	AGE				Total Adults	Total Run
	2	3	4	5		
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,364	20,483	16,718	3	37,204	38,568
Trinity River (TRH)	267	10,822	7,084	1	17,907	18,174
Subtotals	1,631	31,305	23,802	4	55,111	56,742
Natural Spawners						
Trinity River mainstem above WCW	1,333	16,586	19,374	1	35,962	37,295
Trinity River mainstem above WCW	9	116	136	0	252	261
Salmon River basin	743	1,433	1,174	0	2,607	3,350
Scott River basin	744	3,083	2,293	23	5,398	6,142
Shasta River Basin	2,641	4,837	3,615	0	8,452	11,093
Bogus Creek Basin	648	8,200	3,716	11	11,927	12,575
Klamath River mainstem (IGH to Shasta R)	739	3,505	3,643	0	7,148	7,887
Klamath River mainstem (Shasta R to Indian Cr)	277	1,316	1,368	0	2,684	2,961
Trinity Tributaries above Reservation	27	336	393	0	729	756
Klamath Tributaries above Reservation	538	1,265	972	3	2,240	2,778
Hoopaa Reservation Tributaries	6	78	91	0	169	175
Yurok Reservation Tributaries	48	268	220	0	488	536
Subtotals	7,753	41,024	36,994	38	78,056	85,810
Total Spawner Escapement	9,384	72,329	60,796	42	133,167	142,552
Angler Harvest						
Klamath River (below Hwy 101 bridge)	298	2,621	1,988	11	4,620	4,918
Klamath River (Hwy 101 to Coon Cr. Falls)	825	1,132	824	4	1,960	2,785
Klamath River (Coon Cr. Falls to IGH)	242	1,726	1,308	7	3,041	3,283
Trinity River basin (above WCW)	65	1,337	459	0	1,796	1,861
Trinity River basin (below WCW)	70	472	238	0	710	780
Subtotals	1,499	7,289	4,817	22	12,128	13,627
Indian Net Harvest						
Klamath River (below Hwy 101)	275	13,738	16,733	1	30,472	30,747
Klamath River (Hwy 101 to Trinity mouth)	83	2,633	2,383	0	5,016	5,099
Trinity River (Hoopaa Reservation)	60	2,346	2,608	0	4,954	5,014
Subtotals	418	18,716	21,724	1	40,442	40,860
Total in-river Harvest	1,918	26,005	26,541	23	52,569	54,487
Totals						
In-River Harvest and Escapement	11,302	98,334	87,337	65	185,737	197,039
Angling Mortality (2% of harvest)	30	146	96	<1	242	272
Net Mortality (8% of harvest)	33	1,497	1,738	<1	3,235	3,268
Total In-river Run	11,365	99,977	89,171	67	189,214	200,579

*Preliminary Feb 9, 2002 (special thanks to Wade Sinnen)
(Excel .xls version)

Table 2. Documentation of the methods used to sample 2001 Klamath River fall chinook run.

Sampling Location	Estimation Method	Agency
<u>Hatchery Spawners</u>		
Iron Gate Hatchery (IGH)	Direct count. All fish examined for fin clips, tags, marks. Systematic random sample ~10% bio sampled for FL, scales, sex.	CDFG
Trinity River (TRH)	Direct count. All fish bio sampled for FL, fin-clips, marks sex. Scales collected from all Ad clipped fish and ~10% of non Ads.	CDFG
<u>Natural Spawners</u>		
Trinity River mainstem above WCW	Peterson mark-recapture run-size estimate. All fish at weir bio sampled for FL, marks, fin-clips. Scale samples taken from all Ad-clipped fish and every other non Ad clipped fish.	CDFG
Trinity River mainstem below WCW	Adult escapement estimate based on Redd count times 2. Several surveys performed. Count is additive for survey period.	HVT
Salmon River basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio data (scales, FL's' marks) collected from all fresh carcasses.	CDFG,USFS
Scott River basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio data (scales, FL's' marks) collected from all fresh carcasses.	CDFG
Shasta River Basin	Video count at lower river weir site. Bio data (Scales, FL's, sex, marks) collected from carcasses upstream of site Attempt to recover 10% of estimate	CDFG
Bogus Creek Basin	Peterson mark-recapture estimate above weir, carcass count below weir. Fish are biosampled (scales, FL's, sex, fin-clips) during recapture spawning ground surveys.	CDFG
Klamath main stem (IGH to Shasta R)	Mark-recapture carcass estimate. River sections are surveyed once weekly. Bio data (scales, FL's' marks) collected from fresh carcasses.	USFWS
Klamath main stem (Shasta R to Indian Cr)	Redd count based on weekly surveys. Cumulative count based on flagging old redds. Adult estimate is redds times 2.	USFWS
Trinity Tributaries above Reservation	Only 1 trib, Horse Linto Cr. Adult estimate based on weekly redd counts. Previous weeks redds flagged to avoid double counting.	USFS
Klamath Tributaries above Reservation	Periodic redd surveys. Prior weeks redds flagged, only new redds counted. Estimate is redds times 2 + live fish observed on last survey date.	USFS
Hoopa Reservation Tributaries	Adult estimate based on redd surveys. Survey redd totals are cumulative. Final adult estimate is redds times 2.	HVT
Yurok Reservation Tributaries	Only surveyed stream is Blue Creek. Jacks and adult count based on the peak weekly snokle survey. Weekly dives performed Oct - Dec.	YT
<u>Angler Harvest</u>		
Klamath River (below Hwy 101 bridge)	Estimate is based on a stratified access point creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Hwy 101 to Coon Cr. Falls)	Estimate is based on a stratified access point creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Coon Cr. Falls to IGH)	Estimate based on a stratified access/roving creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Trinity River basin (above WCW)	Estimate is based on the return of reward tags placed on fish at weir. Return rate is applied to run-size estimate to estimate harvest. Due to low numbers of grilse tagged and the lack of any tag returns, grilse harvest was estimated using an upper river roving/access creel survey this season.	CDFG
Trinity River basin (below WCW)	Estimate based on a stratified roving/access creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	HVT
<u>Indian Net Harvest</u>		
Klamath River (below Hwy 101)	Stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews	YT
Klamath River (Hwy 101 to Trinity mouth)	Stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews	YT
Trinity River (Hoopa Reservation)	Two stage stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews	HVT

Table 3. Scale sampling locations and numbers of scales collected for the 2001 Klamath River Basin fall chinook age-composition.

Sampling Location	Total Scales	Unknown Scales	CWT Scales	Not Used	Agency
<u>Hatchery Spawners</u>					
Iron Gate Hatchery	2,558	1,880	498	180	CDFG
Trinity River Hatchery	4,556	1,395	3,110	51	HVT
<u>Natural Spawners</u>					
Klamath River mainstem	501	483	0	18	USFWS
Salmon River Carcass Survey	328	316	0	12	CDFG, USFS
Scott River Carcass Survey	558	538	0	20	CDFG
Shasta River Weir & Carcass	282	280	0	2	CDFG
Bogus Creek Weir	1,380	1,203	11	166	CDFG
Lower Trinity River Carcass	6	6	0	0	HVT
Willow Creek Weir	1,541	1,266	227	48	CDFG, HVT
<u>Angler Harvest</u>					
Lower Klamath River Creel Census	1,943	1,731	176	36	CDFG
Upper Klamath River Creel Census	22	22	0	0	CDFG
Lower Trinity River Creel	139	129	7	3	HVT
Upper Trinity River Creel	378	370	0	8	CDFG
<u>Net Harvest</u>					
Hoopla Tribal Net Harvest	1,117	942	157	18	HVT
Yurok Tribal Net Harvest (Mouth to Hwy 101)	1,236	1,127	89	20	YT
Yurok Tribal Net Harvest (Hwy 101 to Weitchpec)	1,460	1,313	133	14	YT
TOTAL	18,005	13,001	4,408	596	

Table 4. Documentation of the methods used by the KRTAT to determine the age composition of the 2001 Klamath River fall chinook run.

Age computation methods	
<u>Hatchery Spawners</u>	
Iron Gate Hatchery (IGH)	Jack, adult breakout from scale age analysis.
Trinity River (TRH)	Jack, adult breakout from scale age analysis.
<u>Natural Spawners</u>	
Trinity River mainstem above WCW	Calculated from total Willow Creek Weir (age structure from scales) minus TRH (age structure from scales) minus recreational harvest (jacks from CDFG Megatable(MT); adults from scales).
Trinity River mainstem below WCW	Used age% from TR nat. spawners mainstem above WCW to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Salmon River basin	Jack, adult breakout from scale age analysis.
Scott River basin	Jack, adult breakout from scale age analysis.
Shasta River Basin	Jack, adult breakout from scale analysis.
Bogus Creek Basin	FL< =64 for jacks, adult structure from scale age analysis.
Klamath main stem (IGH to Shasta R)	USFW mark-recapture carcass survey; used Schaefer estimate (minus week 1) for adults; Jack, adult breakout from scale analysis.
Klamath main stem (Shasta R to Indian Cr)	Used scale age% from Klamath main stem (IGH to Shasta R) to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Trinity Tributaries above Reservation	Used age% from TR nat. spawners mainstem above WCW to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Klamath Tributaries above Reservation	Surrogate based on unweighted average age structure from the Shasta, Scott, and Salmon Rivers.
Hoopa Reservation Tributaries	Used age% from TR nat. spawners mainstem above WCW to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Yurok Reservation Tributaries	Surrogate based on jacks observed during Blue Creek dive surveys; adult breakout from Salmon River scales analysis.
<u>Angler Harvest</u>	
Klamath River (below Hwy 101 bridge)	Lower Klamath R. creel census, jacks from Megatable, adult structure from scales
Klamath River (Hwy 101 to Coon Cr. Falls)	Lower Klamath R. creel census, jacks from Megatable, adult structure from scales
Klamath River (Coon Cr. Falls to IGH)	Lower Klamath R. creel census, jacks from Megatable, adult structure from scales
Trinity River basin (above WCW)	Jack and adult structure from scale analysis.
Trinity River basin (below WCW)	Jack and adult structure from scale analysis.
<u>Indian Net Harvest</u>	
Klamath River (below Hwy 101)	FL< 61 for jacks, adult structure from scale analysis.
Klamath River (Hwy 101 to Trinity mouth)	Jack and adult structure from scale analysis.
Trinity River (Hoopa Reservation)	Jack and adult breakout from scale analysis.

Table 5a. 2001 Klamath River scale validation matrices.

<u>Number</u>		Known Age			
		2	3	4	5
Read Age	2	13	5	0	0
	3	3	299	12	0
	4	0	27	140	0
	5	0	0	0	1
Total		16	331	152	1

<u>Percentage</u>		Known Age			
		2	3	4	5
Read Age	2	0.81	0.02	0.00	0.00
	3	0.19	0.90	0.08	0.00
	4	0.00	0.08	0.92	0.00
	5	0.00	0.00	0.00	1.00
Total		1.00	1.00	1.00	1.00

Table 5b. 2001 Trinity River scale validation matrices.

<u>Number</u>		Known Age			
		2	3	4	5
Read Age	2	21	0	0	0
	3	1	2035	36	0
	4	0	24	1334	0
	5	0	0	0	0
Total		22	2059	1370	0

<u>Percentage</u>		Known Age			
		2	3	4	5
Read Age	2	0.95	0.00	0.00	0.00
	3	0.05	0.99	0.03	0.00
	4	0.00	0.01	0.97	0.00
	5	0.00	0.00	0.00	0.00
Total		1.00	1.00	1.00	0.00

Table 6. 2001 age-composition results.

	MEGATABLE			Klamath Basin Age Comp (Feb 11 '02)					PROPORTIONS AT AGE					Notes	
	Grise	Adults	Total	2	3	4	5	Total	2	3	4	5	Total		
Hatchery spawners															
Iron Gate Hatchery	1384	37204	38588	1384	20483	16718	3	38588	scales 0.03533	0.62933	0.45634	0.00000	1.0	Scale Analysis	
Trinity	287	17907	18174	287	10822	7084	1	18174	IGH cwt's	19	330	144	3	496	Scale Analysis
Hatchery sub-total:	1631	55111	56742	1631	31305	23802	4	56742	scales 0.01822	0.689202	0.392579	0.00000	0	0	Scale Analysis
									TRH cwt's	29	3128	1957	1	5115	Scale Analysis
Natural Spawners															
Trinity River mainstem above WCW	1333	35982	37295	1333	18588	19374	1	37295	scales 0.03576	0.44473	0.61949	0.00003	1.0	Scale Analysis	
Trinity River mainstem below WCW	9	252	261	9	116	136	0	261	TR nat above	0.03576	0.44473	0.61949	0.00003		
Salmon River Basin-includes Woolley Cr.	743	2607	3350	743	1433	1174	0	3350	scales 0.22184	0.42760	0.35038	0.00000	1.0	Scale Analysis	
Scott River	744	5368	6142	744	3083	2293	23	6142	scales 0.12107	0.60193	0.37329	0.00372	1.0	Scale Analysis	
Shasta River	2841	8452	11093	2841	4837	3815	0	11093	scales 0.23805	0.43608	0.32687	0.00000	1.0	Scale Analysis	
Bogus Creek	648	11927	12575	648	8200	3718	11	12575	scales <84 FL	0.61802	0.28010	0.00083	0.8990	Scale Analysis	
Main stem Klamath (IGH to Shasta R)	739	7148	7887	739	3505	3843	0	7887	scales 0.09368	0.44442	0.48191	0.00000	1.0	Scale Analysis	
Main stem Klamath (Shasta R to Indian Cr)	277	2684	2961	277	1318	1388	0	2961	Upper main	0.09368	0.44442	0.48191	0.00000		Surrogate-upper main
sub-total:	7134	74430	81584	7134	38077	35319	35	81584							
									Unweighted Scott Shasta Salmon (SSS) - SURROGATE						
Klamath Tributaries									SSS 0.19365	0.45527	0.34984	0.00124	1.0		
Surrogate															
Aiken Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Beaver Cr.	102	428	528	102	241	185	1	528	SSS 0.19365	0.45527	0.34984	0.00124			
Bluff Cr.	8	33	41	8	19	14	0	41	SSS 0.19365	0.45527	0.34984	0.00124			
Boise Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Camp Cr.	54	224	278	54	128	97	0	278	SSS 0.19365	0.45527	0.34984	0.00124			
Clear Cr.	59	248	305	59	139	107	0	305	SSS 0.19365	0.45527	0.34984	0.00124			
Dillon Cr.	34	140	174	34	79	61	0	174	SSS 0.19365	0.45527	0.34984	0.00124			
Elk Cr.	48	200	248	48	113	87	0	248	SSS 0.19365	0.45527	0.34984	0.00124			
Grider Cr.	108	449	557	108	254	195	1	557	SSS 0.19365	0.45527	0.34984	0.00124			
Horse Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Independence Cr.	4	16	20	4	9	7	0	20	SSS 0.19365	0.45527	0.34984	0.00124			
Indian Cr.	38	149	185	38	84	65	0	185	SSS 0.19365	0.45527	0.34984	0.00124			
Irving Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Perch Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Red Cap Cr.	33	139	172	33	78	60	0	172	SSS 0.19365	0.45527	0.34984	0.00124			
Thompson Cr.	52	218	270	52	123	95	0	270	SSS 0.19365	0.45527	0.34984	0.00124			
Ti Cr.	0	0	0	0	0	0	0	0	SSS 0.19365	0.45527	0.34984	0.00124			
Klamath Tribs sub-totals	538	2240	2778	538	1265	972	3	2778	SSS 0.19365	0.45527	0.34984	0.00124			
Trinity Tributaries															
Horse Linto Cr.	21	574	595	21	265	309	0	595	TR nat above	0.03575	0.44473	0.61949	0.00003		
Willow Cr.	5	158	161	5	72	84	0	161	TR nat above	0.03575	0.44473	0.61949	0.00003		
sub-totals	26	730	758	26	338	393	0	758							
Non-Reservation Misc. tribs sub total	584	2970	3534	585	1601	1365	3	3534							
Reservation Tributaries-Hoop Valley															
Campbell Cr.	0	0	0	0	0	0	0	0	TR nat above	0.03575	0.44473	0.61949	0.00003		
Hostler	0	0	0	0	0	0	0	0	TR nat above	0.03575	0.44473	0.61949	0.00003		
Mill	3	98	101	4	45	52	0	101	TR nat above	0.03575	0.44473	0.61949	0.00003		
Scottish	0	0	0	0	0	0	0	0	TR nat above	0.03575	0.44473	0.61949	0.00003		
Supply Cr.	1	24	25	1	11	13	0	25	TR nat above	0.03575	0.44473	0.61949	0.00003		
Tish Tang Cr.	1	42	43	2	19	22	0	43	TR nat above	0.03575	0.44473	0.61949	0.00003		
Others	0	6	6	0	3	3	0	6	TR nat above	0.03575	0.44473	0.61949	0.00003		
sub-total	5	170	175	6	78	91	0	175	TR nat above	0.03575	0.44473	0.61949	0.00003		
Reservation Tributaries-Yurok															
Blue Cr.	48	488	536	48	268	220	0	536	Salmon R	not used	0.42760	0.35038	0.00000	0.7782	
reservation tributaries sub-total	53	658	711	54	348	311	0	711							
Natural spawner sub-total:	7751	78058	85810	7753	41024	36994	38	85810							
Total spawner sub-total:	9382	133189	142552	9384	72329	60796	42	142552							
Angler Harvest															
Klamath River-below Hwy 101	288	4820	4918	288	2621	1888	11	4918	LRC scales <82 FL	0.44881	0.33884	0.00173	0.787	Scale Analysis	
									LRC cwt's	40	31	1	72	Scale Analysis	
Klamath River- Hwy 101 to Coon Cr	825	1980	2785	825	1132	824	4	2785	LRC scales <82 FL	0.44881	0.33884	0.00173	0.787	Scale Analysis	
									LRC cwt's	74	22	0	98	Scale Analysis	
Klamath River- Coon Cr. to IGH	242	3041	3283	242	1726	1308	7	3283	<82 FL	0.44881	0.33884	0.00173	0.787	Surrogate LRC scales	
Trinity River-below Willow Cr. weir	70	710	780	70	472	238	0	780	scales 0.0900	0.6043	0.3057	0	1.00	Scale Analysis	
									lower cwt's	0	5	2	0	7	
Trinity River-upstream of Willow Cr. weir	85	1788	1881	85	1337	459	0	1881	scales 0.0347	0.7185	0.2487	0	1.00	Scale Analysis	
Angler harvest subtotal:	1499	12128	13827	1499	7289	4817	22	13827	upper cwt's	0	0	0	0	0	
Indian Net Harvest															
Klamath River-Below 101 hwy	275	30472	30747	275	13738	16733	1	30747	scales <81 FL	0.4510	0.5487	0.0000	0.9996	Klam scales (AA15)	
									YTFP EST cwt	33	59	1	83	Klam cwt's (AA29)	
Klamath River-101 to Trinity	83	5016	5099	83	2633	2383	0	5099	scales 0.0187	0.5138	0.4697	0.0000	1.00	Klam scales (AA15)	
									YTFP MU cwt	0	79	48	0	127	Klam cwt's (AA29)
Trinity River	80	4954	5014	80	2348	2608	0	5014	scales 0.0124	0.4852	0.5223	0	1.00	Scale Analysis	
Net harvest sub-total:	418	40442	40860	418	16716	21724	1	40860	Hoop's cwt's	0	88	71	0	157.00	
Total harvest	1918	52569	54487	1918	26005	26541	23	54487							
Totals															
In-river run and escapement	11302	185737	197039	11302	98334	87337	66	197039							
Angling mortality (2% of harvest)	30	243	273	30	146	96	0	272							
Net mortality (8% of harvest)	33	3236	3269	33	1497	1738	0	3268							
Total In-river run	11385	189215	200580	11385	99977	89171	66	200579							

Appendix A. Klamath River – 2001 Details.

Iron Gate Hatchery

Length frequencies for scale aged samples indicated age 2 fish were from 40 to 65 cm (with a 89 cm age-2 fish being discarded). The total number of jacks predicted by scale ageing was 1,342 fish and an analysis of lengths for CWT fish compared favorably with an evaluation of all fish sampled at IGH (approximately 5%) resulting in a jack total of 1,408 fish. The KRTAT decided that a scale-based segregation of jacks was appropriate.

Bogus Creek

The separation of jacks by scales (1,258 jacks) was compared with a length frequency-based approach (648 jacks). The two estimates were different enough to stimulate extensive reflection on the available data and associated methodologies. There were no age-2 CWT fish recovered. The proportion of jacks in Bogus Creek based on a length "cutoff" of <64 cm provided a jack proportion of approximately 5%. This is greater than the 3.7% jack proportion at IGH derived from a <62 cm length "cutoff". Meanwhile the scale age-based distribution predicts a 10% proportion of age-2 fish. Upon further examination of the length distribution for the scale samples, it became apparent that the age-2 fish were sampled at a greater frequency than the sample drawn for the length frequency histogram. This could not be explained as the scale age sample was drawn from the carcass recovery. Desma Williams observed that she was provided a bag of scales with no explanation as to how the sample was drawn. For these reasons, Bogus Creek jacks were segregated by virtue of their length "cutoff" at <64.

Upper Klamath River main stem

The UFSWS mark-recapture experiment and redd-count estimates of spawners for the mainstem Klamath River from above Shasta River to below IGH resulted in approximately 9,000 adult fish (spawners and pre-spawn mortality), versus some 825 redds which if multiplied by 2 would result in 1,650 spawners. However, the KRTAT acknowledged that the two approaches are estimating different populations. The mark-recapture experiment estimates total fish escaping to the area whereas the redd count approach only attempts to estimate actual spawning adults. There were a total of 2,705 unique carcasses encountered.

Issac Sanders also observed a recapture rate of 40% which lead him to believe that many carcasses were never contacted. Hence, the redd count appears to grossly underestimate the total area escapement. The confidence interval about the mark-recapture point estimate was narrow, approximately ± 400 fish. The Peterson estimate using a modified week 1 set (where the estimate was adjusted to account for low recovery in the initial sampling week) produced a point estimate of 8,448 fish. The Schaefer estimate using a modified week 1 set produced an estimated 7,952 adults in this area. The KRTAT concluded that a conservative estimate of 7,148 adults as estimated by the Schaefer method in which week 1 and reach 1 are excluded was most appropriate. The number of jacks were estimated to be 739, assuming the jack proportion of 0.09373.

Lower Klamath River Main Stem

For the main stem reach from Shasta River to Indian Creek, total adults were estimated using redd counts. Age structure applied in past years was a surrogate from Shasta and Scott River un-weighted average. However, this year, given the additional effort in collecting scales from fish recovered in the mark-recapture spawner survey in the mainstem above Shasta River, the KRTAT elected to use this scale-based age composition for the lower mainstem reach as well.

Salmon River

A total of 316 scales were aged. Of these, approximately 22% were age-two fish. This result compared favorably to 19% jacks from a length "cutoff" of <57 cm. Accordingly, the scale based age distribution was used for all ages, including jacks.

Scott River

A total of 538 scales were aged. Of these, approximately 12% were classified as age-2 as compared with approximately 15% jacks from a length "cutoff" of <64 cm was observed for 2-year-olds. In the interest of maintaining consistency, the KRTAT decided that a scale-based age composition would be appropriate for all ages, including jacks. There was no reason to suspect that the scale ages were biased.

Shasta River

A total of 280 scales were aged. Of these, approximately 23% were classified as age-2 as compared with approximately 22% jacks based on a <64 cm length. Here again, the scale based age composition for all ages was applied.

Remaining Klamath Tributaries

Age distribution for last year was derived using a Shasta-Salmon-Scott (SSS) surrogate. The KRTAT did not identify a better methodology and elected to continue using this approach. As noted above, the SSS composite (un-weighted mean of the respective proportions) is based on the scale-age-based separation of age-2 fish.

Blue Creek

In past years, the Salmon River age composition was used as surrogate for Blue Creek adults. The jack proportion was determined by visual sightings from diver counts. Whereas the KRTAT suggested that an attempt be made to collect scales from carcasses in Blue Creek, the approach developed for last year was used again this year.

Yurok Tribal Harvest

A scale-based jack length "cutoff" of <61 cm was derived for the estuary fishery which yielded 249 jacks. In the mid and upper zone fishery, the direct scale-aged proportion of age-2 fish was used.

Lower Klamath River Creel

The provisional 55 cm jack "cutoff" was changed to 61 cm for Mega-Table creel numbers after reviewing the length frequency histograms. The angler harvest below Coon Creek Falls was apportioned into jacks and adults based upon length with the adult age composition derived from scales. Below Highway 101, the jacks were 298 and the adults were 4,620. Additionally, angler harvest in the area from Highway 101 to Coon Creek Falls had 825 jacks and 1,960 adults.

Upper Klamath River Creel

A discrepancy between scale and length "cutoff" jack estimates was noted. Scales estimated a four-fold jack estimate over the length "cutoff" method. Only 22 scales were collected from Coon Creek to IGH, and the KRTAT was concerned that there should have been more scales collected for this fishery since 6,000 fish were harvested above Coon Creek. Sara Borok clarified that scale samples from the recreational fishery included spring chinook if the samples were collected prior to August 20. Desma Williams responded that she excluded all scales collected prior to August 28. Sara Borok clarified that only 22 scales were collected from the upper Klamath River Creel. Therefore, the Lower Klamath River Creel jack "cutoff" (<62 cm) was used for the jack estimate and the Lower Klamath River Creel scale-based age composition was used as a surrogate for the adult estimate.

Appendix B. Trinity River – 2001 Details.

Trinity River Hatchery

The scale-age apportionment for jacks and adults was used.

Upper Trinity Recreation Creel

The catch was apportioned into ages by scales for jacks and adults. A total of 370 scales were aged. No known ages were provided by CWT recoveries in the fishery. It was observed that ad-clipped salmon were sampled and CWTs were recovered, however these fish are not correlated with any respective scale samples. Future sampling efforts will need to correlate scale samples with all recovered CWTs. The KRTAT decided that the close accuracy in the pooled matrix provided evidence that scale-based age composition for this fishery was adequate to classify all age proportions. The Megatable provisional jack tally for this fishery was 96 as compared to the scale-aged result of 65 jacks.

Hoopa Valley Tribal Fishery

All ages were apportioned by scale analysis. Typically, few jacks are encountered in this fishery due to net selectivity. Length frequency analysis of aged two year olds suggested that the largest jack sampled in the fishery was 58 cm which would be 3 cm greater than the provisional 55 cm or less classification for jacks. The scale-based result was 60 jacks compared with length frequency result of 35 jacks. One concern was that jack scales might have been contaminated with spring chinook samples. It was suggested that in the future, scale sample collection be delayed until 90% or more of the fish present are fall chinook. The fishery is presently apportioned based on CWT recoveries. There are scale samples that represent fish from both fall and spring chinook races during a 2 to 3 week overlap period. When these scales are being aged as fall chinook, some of them may actually be spring chinook.

Lower Trinity River Main Stem and Tributaries

Two pieces of missing information were noted. We are missing scale samples from Horse Linto Creek and Willow Creek and an estimate of jacks from the redd counts. The KRTAT is aware that scales are collected by USFS and these samples were used for age analysis in the past. The KRTAT also discussed the manner in which the total estimated spawning adults is derived from redd count surveys. Provisionally, we have used a doubling of the redd count with 3% of the total added for an estimate of jacks.

Trinity River Naturals

Determining the age composition of "naturals" based directly on scale samples is problematic due to the small number of scales collected from natural escapement. Only six scales were recovered in the Hoopa Tributaries. Therefore, the natural age composition was determined indirectly by subtracting off from the WCW estimated numbers at age, the estimated numbers at age returning to TRH and those removed by the recreational fishery between WCW and TRH, as described in the Methods. However, while an age-5 cwt fish was recovered at the hatchery, no age-5 fish were taken in the scale sample at WCW. To accommodate this particular age-5 TRH fish in the above method, one age-4 fish was shifted into the age-5 category in the WCW estimated age composition. The resulting age composition for the natural escapement above WCW was assumed to apply to Trinity River natural area spawners both above and below WCW.

Appendix C. 2001 Klamath scale age analysis (Feb 2002).

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	110	721	371	1	1203
LRC	311	814	603	3	1731
URC	7	10	5	0	22
IGH	69	976	835	0	1880
SALMON	59	144	113	0	316
SCOTT	57	272	207	2	538
SHASTA	56	130	94	0	280
YTFP EST	8	508	611	0	1127
YTFP M&U	28	662	623	0	1313
MAINSTEM	40	220	223	0	483
					8893

Unknown scales corrected age proportions (Kimura method)

		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	p	0.1010	0.6180	0.2801	0.0008	1
LRC	p	0.2128	0.4468	0.3386	0.0017	1
URC	p	0.3841	0.4050	0.2109	0.0000	1
IGH	p	0.0353	0.5293	0.4353	0.0000	1
SALMON	p	0.2218	0.4278	0.3504	0.0000	1
SCOTT	p	0.1211	0.5019	0.3733	0.0037	1
SHASTA	p	0.2380	0.4361	0.3259	0.0000	1
YTFP EST	p	0.0004	0.4510	0.5487	0.0000	1
YTFP M&U	p	0.0167	0.5136	0.4697	0.0000	1
MAINSTEM	p	0.0937	0.4444	0.4619	0.0000	1

Known CWT ages

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0	23	12	0	35
LRC (see below for breakout)	2	114	53	1	170
URC	0	4	0	0	4
IGH	19	330	144	3	496
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	0	0	0	0	0
YTFP EST	0	33	59	1	93
YTFP M&U	0	79	48	0	127
MAINSTEM	0	0	0	0	0
LRC - below 101	0	40	31	1	72
LRC - above 101	2	74	22	0	98
	2	114	53	1	170

Need to match up

Validation Matrix

		Known Age			
		2	3	4	5
Read Age	2	13	5	0	0
	3	3	299	12	0
	4	0	27	140	0
	5	0	0	0	1
Total		16	331	152	1

Percentages from validation matrix

		Known Age			
		2	3	4	5
Read Age	2	0.81	0.02	0.00	0.00
	3	0.19	0.90	0.08	0.00
	4	0.00	0.08	0.92	0.00
	5	0.00	0.00	0.00	1.00
Total		1.00	1.00	1.00	1.00

Appendix D. 2001 Trinity scale age analysis (Feb 2002).

WCW = Willow Ck Weir Cwt Age unreadable no cwt 2 3 4 5 2 28 0 0 0 0 3 632 1 100 1 0 4 588 0 3 112 0 5 1288 1 109 117 0					LOWTRINREC = Lower Trinity Recreational Cwt Age unreadable no cwt 2 3 4 5 2 29 0 0 0 0 3 78 0 3 0 0 4 883 0 0 2 0 5 0 0 0 0 0				
HUPANET = Hoopa Tribal Net Harvest Cwt Age unreadable no cwt 2 3 4 5 2 11 0 0 0 0 3 438 0 83 1 0 4 478 0 2 69 0 5 942 0 88 71 0					TRH = Trinity River Hatchery Cwt Age unreadable no cwt 2 3 4 5 2 18 0 0 0 0 3 523 24 20 1849 34 4 547 819 1 19 1151 5 0 537 0 0 0				
LOWTRINRCASS = Lower Trinity Trbs Cwt Age unreadable no cwt 2 3 4 5 2 2 0 0 0 0 3 2 0 0 0 0 4 1 0 0 0 0 5 1 0 0 0 0					UPTRINREC = Upper Trinity Recreational (No CWTs) Cwt Age unreadable no cwt 2 3 4 5 2 0 0 0 0 0 3 2 12 0 0 0 4 2 280 0 0 0 5 1 90 0 0 0				

(A) POOLED data from all areas: Scale age-CWT age matrix.
(includes only fish with both scale age and CWT known age.)

Age	2	3	4	5
2	21	0	0	0
3	1	2035	38	0
4	0	24	1334	0
5	0	0	0	0

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

Age	2	3	4	5
2	0.9545	0.0000	0.0000	0.0000
3	0.0455	0.9883	0.0283	0.0000
4	0.0000	0.0117	0.9737	0.0000
5	0.0000	0.0000	0.0000	0.0000
	1.0000	1.0000	1.0000	0.0000

(Note: column sums same for matrix of ages 2-4 as for 2-5)

(C) Uncorrected age vectors for ages 2,3,4,5 read from UNKNOWN scales only
All unknown aged scales combined

Age	Count	Proportion	WCW	HUPANET	LOWTRINREC	TRH	LOWTRINRCASS	UPTRINREC
2	68	0.02184	0.0228	0.0119	0.0859	0.0174	0.3333	0.03314917
3	2230	0.55335	0.5147	0.4741	0.6094	0.5935	0.3333	0.71823204
4	1711	0.42457	0.4825	0.5140	0.3047	0.3891	0.1687	0.24881878
5	1	0.00025	0.0000	0.0000	0.0000	0.0000	0.1687	0
	4030	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

(D) Correction Matrix for ages 2,3,4.

Age	2	3	4
2	1.048	0.000	0.000
3	-0.048	1.012	-0.027
4	0.001	-0.012	1.027

Uncorrected age vectors for age 2 - 4

Age	2	3	4	5
2	0.0228	0.0119	0.0859	0.0174
3	0.5147	0.4741	0.6094	0.5935
4	0.4825	0.5140	0.3047	0.3891
	1.0000	1.0000	1.0000	1.0000

(E) Corrected Scale age proportion vectors for scale-aged 2 - 4 fish, and integrated with uncorrected proportions of age 5 fish.

Age	WCW	wAge5	HUPANET	wAge5	LOWTRINREC	wAge5	TRH	wAge5	LOWTRINRCASS	wAge5	UPTRINREC	wAge5
2	0.0239	0.0239	0.0124	0.0124	0.0900	0.0900	0.0182	0.0182	0.4190	0.3492	0.0347	0.0347
3	0.5072	0.5072	0.4852	0.4852	0.6043	0.6043	0.5892	0.5892	0.3801	0.3188	0.7185	0.7185
4	0.4690	0.4690	0.5223	0.5223	0.3057	0.3057	0.3928	0.3928	0.2008	0.1674	0.2487	0.2487
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1687	0.1687	0.0000	0.0000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

(1) Recalculate WCW non-CWT

age-proportion vector using correction matrix:

Age	#	Uncorrected age vectors	Corrected Proportions
2	27	0.0277	0.0290
3	496	0.5092	0.5014
4	451	0.4630	0.4695
5	0	0.0000	0.0000
	974	1.00000	1.0000

Note: Ad-clip fish were sampled at WCW more intensively than non-ad clip fish, but non-Ad-clip hatchery fish were necessarily sampled in the same random way as non-hatchery fish. Therefore, the WCW corrected age-proportion vector is recalculated here using only ages of fish with no adipose clip.

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

Total Adults + jacks above WCW	Age	TRH + Rec above WCW age proportions	Add each WCW + Nat Escapement
		WCW age proportions	WCW + Nat Escapement
Rec above WCW	2	0.0290	1865
TRH	3	0.5014	28747
Naturals	4	0.4695	26918
Total	5	0.0000	0
		1	57330

Subtract known TRH and Rec

TRH	267	65
Rec Harvest	10822	1337
	7084	459
	1	0
	4549	843

Apportioned Natural Escapement

Age	2	3	4	5
Age	2	1333	0.0357	
	3	18589	0.4448	
	4	18374	0.5195	
	5	0	0.0000	
		37295	1	

Used Combo of #s
WCW (J&A scales)
- TRH (J&A scales)
- Rec harvest above WCW (J & A scales)