Klamath River Fall Chinook Age-Specific Escapement, River Harvest, and Run Size Estimates, 2006 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 2006 was estimated to be:

	Run Size	
Age	*Number*	*Proportion*
2	27,100	0.31
3	18,600	0.21
4	41,800	0.47
5	1,300	0.01
Total	88,700	1.00

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

	Adults	
Sector	*Preseason Forecast*	*Postseason Estimate*
Run Size	47,600	61,600
Fishery Mortality		
Tribal Harvest	10,000	10,300
Recreational Harvest	0	100
Drop-off Mortality	900	1,000
Hook/Release Mortality	300	400
	11,200	11,700
Escapement		
Hatchery Spawners	15,300	19,500
Natural Area Spawners	21,100	30,400
	36,400	49,900

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 2006. The estimates provided in this report are consistent with the Klamath River Megatable (CDFG 2007) and with the 2007 forecast of ocean stock abundance (KRTAT 2007).

Age-specific escapement estimates for 2006 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 2007, Goldwasser et al. 2001). 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 (KRTAT 2007). 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 1) 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 2) 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. The method used to combine the random sample's known ages (CWT fish) and unknown read ages for estimation of the escapement age-composition is described in Appendix A.

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 (Appendix A).

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.

Alternative methods were employed to estimate the age-composition of the Shasta River run (Appendix B).

Methods used to estimate adult non-catch mortality associated with the 2006 jack-retention only recreational fishery 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 KRTAT 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 12,749 scales from 15 different sectors were used for this analysis (Table 2). Of these, 1,102 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 accurate and precise. For the Trinity River, accuracy was > 95% for age-2, age-3, and age-4 fish, and was 50% for age-5 fish. For the Klamath River the accuracy was ≥ 86% for age-2, age-3, and age-4 fish, and 59% 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 vs. 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. Calculations underlying the results summarized in Table 1 are presented in Appendix H.

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
KT	Karuk Tribe
M&U	Klamath River below Weitchpec: “middle” section (Hwy 101–Surpur Ck) and “upper” section (Surpur Ck—Trinity River)
SRRC	Salmon River Restoration Council
TRH	Trinity River Hatchery
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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Klamath River Technical Advisory Team
Participants

California Department of Fish and Game
Melodie Palmer-Zwahlen
Wade Sinnen

Hoopa Valley Tribe
George Kautsky
Billy C. Matilton

KMZ Ocean Recreational Fishery
Jerry Barnes

National Marine Fisheries Service
Michael Mohr

Oregon Department of Fish and Wildlife
Craig Foster

U.S. Fish and Wildlife Service
Joe Polos

Yurok Tribe
Desma Williams

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Table 1. Estimation and sampling methods used for the 2006 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	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio-data (scales, FLs, marks) collected from carcasses where possible, however, samplers tended to collect scales off larger fish.	CDFG,USFS,YT, KT, SRRC
Scott River Basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio-data (scales, FLs, marks) collected from all fresh carcasses.	CDFG & Others
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=Jack Estimate+Adult Estimate. River sections are surveyed once weekly. Bio-data (scales, FLs marks) 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-%jacks estimated in IGH to Shasta reach).	USFWS
Klamath Tributaries (above Reservation)	Periodic redd surveys. Adults=2 * redd counts+live fish observed on last day surveyed. Total Run=adults/(1-%jacks estimated in IGH to Shasta reach).	USFS,CDFG
Yurok Reservation Tributaries	Only surveyed stream is Blue Creek. Jacks and adults estimated as the peak count of successive weekly snorkel surveys.	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 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)	Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement estimated above WCW).	HVT
Trinity Tributaries (above Reservation; below WCW)	Only stream surveyed in 2006 was Horse Linto Cr. Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement above WCW).	USFS, CDFG
Hoopa Reservation Tributaries	Redd surveys. Adults = 2 * redd counts. Total run = adults / % adults (natural escapement estimated above WCW). No surveys completed in Pine Creek.	HVT
Recreational Harvest		
Klamath River (below Hwy 101 bridge)	Total harvest estimate based on weekly stratified, access point creel survey, on four randomly selected days per statistical week. No retention of adults (>55cm) after 15 August in 2006 regulations. 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 two randomly selected days per statistical week. No retention of adults (>55cm) after 15 August in 2006 regulations. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Weitchpec to IGH)	No survey, used ratio of adult harvest in lower river to adult harvest in the upper river and ratio of jacks lower to upper (1999-2002 data). No retention of adults (>55cm) per 2006 regulations.	CDFG
Trinity River Basin (above WCW)	Adult harvest: No retention of adults (>55cm) per 2006 regulations, no WCW program tags recovered from presumed adults in the rec. fishery. Jack harvest: Estimated jack harvest rate from recovery of reward/non-reward tags (applied at WCW) multiplied by WCW jack run size.	CDFG
Trinity River Basin (below WCW)	Estimate based on a three randomly selected days per statistical week 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), hourly 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)	Daily 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
Hook and Release Adult Mortality (Rec.)	10%catch and release mortality applied to the estimated released adults (>55cm).	CDFG

Table 2. Scale sampling locations and numbers of scales used for the 2006 Klamath River Basin fall Chinook age-composition assessment.

Sampling Location	Scales				Agency
	Unknown-age read [a/]	Known-age read [b/]	Not used [c/]	Total	
Hatchery Spawners					
Iron Gate Hatchery (IGH)	1,229	318	5,805	7,352	CDFG
Trinity River Hatchery (TRH)	1,746	455	40	2,241	HVT
Natural Spawners					
Salmon River Carcass Survey	159	0	46	205	CDFG, USFS
Scott River Carcass Survey	1,162	0	33	1,195	CDFG, USFS
Shasta River Weir & Carcass	486	1	5	492	CDFG
Bogus Creek Weir	588	49	33	670	CDFG
Klamath River mainstem	531	0	9	540	USFWS
Upper Klamath River Tribs	0	0	20	20	USFS
Willow Creek Weir	413	31	13	457	CDFG, HVT
Lower Trinity River Carcass	29	0	0	29	HVT
Lower Trinity River Tribs	10	0	0	10	HVT
Recreational Harvest					
Lower Klamath River Creel	983	26	28	1,037	CDFG
Lower Trinity River Creel	33	2	0	35	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	1,108	20	46	1,174	YT
Klamath River (Hwy 101 to Trinity R)	2,211	41	55	2,307	YT
Trinity River (Hoopa Reservation)	959	159	32	1,150	HVT
TOTAL	11,647	1,102	6,165	18,914	

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 from non-ad-clipped fish, mounted and not read, or not mounted; scales from ad-clipped fish with no cwt, mounted and not read, or not mounted; scales from ad-clipped, CWT fish mounted and not read, or not mounted; non-randomly selected fish not read.

Table 3. Age-composition methods used for the 2006 Klamath River 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	Jacks ≤57 cm. Adults apportioned by scale-age analysis.
Scott River Basin	Jack/adult structure from scale-age analysis.
Shasta River Basin	Jacks ≤60 cm. Adults apportioned by scale-age analysis.
Bogus Creek Basin	Jack/adult structure from scale-age analysis.
Klamath River mainstem (IGH to Shasta R)	Jack/adult structure from scale-age analysis.
Klamath River mainstem (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 and Salmon Rivers.
Yurok Reservation Tributaries	Jacks estimated by direct observation. Adult Surrogate: Salmon and Scott 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)	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.
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 adult age structure for adult component of the harvest.
Trinity River Basin (above WCW)	No adults harvested in 2006.
Trinity River Basin (below WCW)	Jack/adult structure from scale-age analysis.
Catch and release mortality of adults	Surrogate: basin-wide adult age composition.
Tribal Harvest	
Klamath River (below Hwy 101)	Jack/adult structure from scale-age analysis.
Klamath River (Hwy 101 to Trinity mouth)	Jack/adult structure from scale-age analysis.
Trinity River (Hoopa Reservation)	Jack/adult structure from scale-age analysis.

Table 4a. 2006 Klamath River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5	Total
2	105	1	3	0	
3	17	95	19	0	
4	0	8	349	7	
5	0	0	5	10	
Total	122	104	376	17	619

Percentage

Read Age	Known Age 2	3	4	5
2	0.861	0.010	0.008	0.000
3	0.139	0.913	0.051	0.000
4	0.000	0.077	0.928	0.412
5	0.000	0.000	0.013	0.588
Total	1.00	1.00	1.00	1.00

Table 4b. 2006 Trinity River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5	Total
2	180	2	0	0	
3	1	109	9	0	
4	0	3	336	2	
5	0	0	3	2	
Total	181	114	348	4	647

Percentage

Read Age	Known Age 2	3	4	5
2	0.994	0.018	0.000	0.000
3	0.006	0.956	0.026	0.000
4	0.000	0.026	0.966	0.500
5	0.000	0.000	0.009	0.500
Total	1.00	1.00	1.00	0.00

Table 5. Age composition of the 2006 Klamath River fall Chinook run.

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	2,386	4,215	7,251	138	11,604	13,990
Trinity River Hatchery (TRH)	4,076	2,576	5,244	97	7,918	11,994
Hatchery Spawner subtotal	**6,462**	**6,791**	**12,495**	**235**	**19,522**	**25,984**
Natural Spawners						
Salmon River Basin	791	698	580	0	1,278	2,069
Scott River Basin	1,953	1,759	1,247	1	3,007	4,960
Shasta River Basin	1,395	151	625	13	789	2,184
Bogus Creek Basin	764	1,398	1,929	41	3,368	4,132
Klamath River mainstem (IGH to Shasta R)	577	1048	1904	120	3,072	3,649
Klamath River mainstem (Shasta R to Indian Cr)	276	500	908	58	1,466	1,742
Klamath Tributaries (above Reservation)	739	659	506	0	1,165	1,904
Yurok Reservation Tributaries	20	65	54	0	119	139
Klamath Basin subtotal	6,515	6,278	7,753	233	14,264	20,779
Trinity River (mainstem above WCW)	7,740	2,637	12,450	421	15,508	23,248
Trinity River (mainstem below WCW)	63	21	101	3	126	189
Trinity Tributaries (above Reservation)	71	24	114	4	142	213
Hoopa Reservation Tributaries	191	65	307	10	382	573
Trinity Basin subtotal	8,065	2,747	12,972	438	16,158	24,223
Natural Spawners subtotal	**14,580**	**9,025**	**20,725**	**671**	**30,422**	**45,002**
Total Spawner Escapement	**21,042**	**15,816**	**33,220**	**906**	**49,944**	**70,986**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	60	0	1	0	1	61
Klamath River (Hwy 101 to Weitchpec)	4,421	1	30	7	38	4,459
Klamath River (Weitchpec to IGH)	721	7	11	0	18	739
Trinity River Basin (above WCW)	61	0	0	0	0	61
Trinity River Basin (below WCW)	205	5	0	0	5	210
Subtotals	**5,468**	**13**	**42**	**7**	**62**	**5,530**
Tribal Harvest						
Klamath River (below Hwy 101)	30	688	1,944	94	2,726	2,756
Klamath River (Hwy 101 to Trinity mouth)	240	965	2,300	132	3,396	3,636
Trinity River (Hoopa Reservation)	145	736	3,327	100	4,163	4,308
Subtotals	**415**	**2,388**	**7,571**	**326**	**10,285**	**10,700**
Total Harvest	**5,883**	**2,401**	**7,613**	**333**	**10,347**	**16,230**
Totals						
Harvest and Escapement	26,925	18,217	40,833	1,239	60,291	87,216
Recreational Angling Dropoff Mortality 2.04%	112	23	52	2	76	188
Tribal Net Dropoff Mortality 8.7%	36	208	658	28	894	930
Recreational fishery hook-and-release adult mortality	0	111	250	8	368	368
Total River Run	**27,073**	**18,559**	**41,793**	**1,278**	**61,630**	**88,703**

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

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

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

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

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

2. Age-2 escapement by size-frequency, age 3–5 escapement by scales. Estimate N_2 as the total escapement times the size-frequency based estimated age-2 proportion. Estimate N_a for $a = 3,4,5$ as the sample known-age *a* fish plus the unknown age portion of the adult escapement times the age *a* proportion among adults (bias-corrected):

   $$N_a = \begin{cases} Ns_2, & a = 2 \\ np_a + [N(1-s_2) - n(1-p_2)](r_a^* / r_A^*), & a = 3,4,5 \end{cases}$$

Appendix B: Shasta River escapement age-composition 2006

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 sample,
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 and the weir wash-back samples.

A total of 2,184 fall Chinook salmon were estimated to have passed the weir in 2006. During the spawning ground surveys only 44 carcasses were sampled (22 male, 17 female, 5 unidentified). The KRTAT 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 457 scales collected from carcasses at the weir site yielded a sex composition of 430 males and 27 females. Due to the apparent bias toward the male component of the run, these data were also considered insufficient in themselves for apportioning the run into age classes.

The initial method used to partition the run into age classes, which assumed a 50:50 sex ratio for the run, resulted in a very skewed proportion of males among adults (17.3%). After considerable review, the KRTAT elected to partition the run using data collected from both the carcass survey and wash-back sample as follows. The proportion of males among adults, $P(M|A)$, was estimated using the carcass survey data. Of the 22 males, 7 were determined to be jacks based on length (≤ 60 cm FL) and after removing these fish from the sample, 46.9% of the remaining adults were males (15 of 32). The proportion of jacks (≤ 60 cm FL) among males, $P(J|M)$, was estimated from the wash-back sample to be 79.0%. 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 from the pooled samples of scales.

1. Estimate the proportion of males in the run:

$$P(M) = \frac{P(M \mid A)}{1 - P(J \mid M)[1 - P(M \mid A)]} = \frac{0.46875}{1 - 0.79029[1 - 0.46875]} = 0.80797$$

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:

$$P(J) = P(M) \times P(J \mid M) = (0.80797)(0.79029) = 0.63853.$$

3. Estimate the jack run:

$$J = N \times P(J \mid M) = (2{,}184)(0.63853) = 1{,}395.$$

4. Estimate the adult run:

$$A = N - J = 789.$$

Appendix C: River recreational fishery adult impacts 2006

The approach for estimating adult age-specific impacts for the 2006 jack-only river recreational fishery (catch-and-release of adults) was as follows:

1. Estimate the contact rate of adults, *c*, based on the observed harvest rate of jacks, $h_{J,2006}$, and the ratio of the average harvest rate of adults, $\bar{h}_A$, to that for jacks, $\bar{h}_J$, over the 1978–2005 period:

$$c = \left(\frac{\bar{h}_A}{\bar{h}_J}\right) h_{J,2006} = \left(\frac{0.068}{0.226}\right)(0.20197) = 0.06077.$$

2. Estimate the river run of adults, *R*, including recreational impacts, *I*:

$$R = \frac{(R - I) + H(1 - v)}{1 - c(d + v)} = \frac{61{,}185 + 62(1 - 0.1)}{1 - 0.06077(0.02041 + 0.1)} = 61{,}630$$

based on the relationship:

$$R = (R - I) + I = (R - I) + (H + D + V) = (R - I) + [H + Cd + (C - H)v]$$
$$= (R - I) + Rc(d + v) + H(1 - v)$$

where, referring to the expressions defined below, *H* is the retained harvest, *D* is the dropoff mortality, *V* is the catch-and-release mortality, *C* is the contacts, *d* is the dropoff mortality rate (assumed equal to 0.02/[1-0.02]=0.02041), and *v* is the catch-and-release mortality rate (assumed equal to 0.1).

3. Estimate the number of contacts as the river run times the contact rate:

$$C = R \times c = 61{,}630 \times 0.06077 = 3{,}745.$$

4. Estimate the dropoff mortality as the contacts times the dropoff mortality rate:

$$D = C \times d = 3{,}745 \times 0.02041 = 76.$$

5. Estimate the catch-and-release mortality as the released fish (contacts − retained harvest) times the catch-and-release mortality rate:

$$V = (C - H) \times v = (3{,}745 - 62) \times 0.1 = 368.$$

6. Estimate the adult impacts: retained harvest + dropoff mortality + catch-and-release mortality.

$$I = H + D + V = 62 + 76 + 368 = 507.$$

7. Apportion the adult retained harvest by age using scales, and the adult dropoff and catch-and-release mortality using the adult overall river run age composition.

Appendix D. Klamath River – 2006 details.

Iron Gate Hatchery
A systematic random bio-sample was obtained from every tenth Chinook returning to IGH in 2006. Additionally every ad-clip fish not occurring in the random sample was bio-sampled (length and scale collected with CWT) as nonrandom. However, 222 heads recovered 4 October through 12 October from adipose-fin-clipped fish were misplaced and unavailable for scale age validation. The Team agreed that notwithstanding these missing data, the remaining CWT ages were sufficient for validation of the IGH scales.

A total of 1,547 scales were used and 318 were from known-age, CWT fish. All ages were apportioned using scale analysis.

Bogus Creek
Total run was estimated by videography and biological samples were obtained from a systematic random sample of 1:4. Additionally, biological data were obtained from a non-random collection of every ad-clipped fish encountered. There were a total of 637 scales used of which 49 were from known-age, CWT fish. All age classes were apportioned by scale-based analysis.

Shasta River
Total run estimated by videography while bio samples were collected from carcass surveys and fish that washed back onto the counting weir. Due to biases in data collected in the wash-back samples at the weir, the KRTAT determined that this was not a suitable sample to apportion the total run into age classes. The KRTAT determined that scale samples collected from fish >60 cm fork-length in Shasta River were representative of the adult run component only. The proportion of age-2 fish was estimated by utilizing (1) the estimated total number of fish passing the video weir (jacks and adults combined), (2) the proportion of males among adults in the carcass survey sample, (3) the proportion of jacks among males in the weir wash-back sample, and (4) the adult age composition based on the pooled adult scales collected in the carcass survey and the weir wash-back samples (see Appendix B for details). A total of 487 scales were used of which one was from a known-age, CWT fish.

Scott River
Total escapement estimated through carcass mark-recapture. There were a total of 1,162 scales used of which none were from known-age fish. Scale age proportions were used to assign all ages. 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
Total escapement was estimated by carcass mark-recapture. Scale collection bias resulted in a poor representation of jacks. However, length frequencies were based on measurements of all carcasses, hence length frequencies were used to delineate age-two fish while scales were used to apportion adult age classes only. A total of 159 scales were used, none of which were from known-age, CWT fish.

Klamath River Tributaries
The adult 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. Jacks were estimated using the surrogate jack proportions observed in the IGH to Shasta River reach of the Klamath mainstem. 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 and Scott rivers. (Shasta River was not used in this composite due to the concern over the wash-back samples used to age that sub-system).

Klamath River Mainstem
For the upper reach (IGH to Shasta River section), 531 scales were used none of which were from known-age, CWT fish. Scales were used to apportion all age-classes. In the lower reach (Shasta to Indian Creek section), redds were multiplied by two to estimate the adult run. Jacks were then added by their proportional representation to adults observed in the IGH to Shasta River reach to estimate the total run. Finally, the total run was then reapportioned to all age classes using the age proportions from the upper reach.

Lower Klamath River Creel
The total harvest was estimated by creel census. 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 1,009 scales were used of which 26 were taken from known-age, CWT fish.

Upper Klamath River Recreational Fishery
There was no creel census in this sub-area in 2006. Separate ratio estimators for jacks and adults were used to estimate the upper Klamath River recreational harvest. Harvest data were available from creel census of the lower and upper river fisheries in 1999 through 2002. The ratios of average harvest in the upper versus lower area in these years were applied to the 2006 jack and adult harvest in the lower area fishery to estimate their respective harvest in the upper area. Adult age proportions were assigned using the scale-age compositions estimated for IGH.

Yurok Tribal Estuary Fishery (Klamath mouth to Hwy 101)
Yurok harvest in the estuary area was estimated by hourly stratified effort and catch-per-effort methods. The harvest total was allocated by age using scales obtained in this fishery. A total of 1,128 scales were used of which 20 were from known-age, CWT fish.

Yurok Tribal Above 101
Yurok harvest in this sub area was estimated by daily effort and catch-per-effort estimation. Yurok harvest in the mid and upper-Klamath area was segregated into jacks and adults based upon scale ageing. A total of 2,252 scales were used of which 41 came from known-age, CWT fish.

Blue Creek
Snorkel surveys were used to produce the total escapement estimate. Visual counts yielded 20 jacks and 119 adults. Adult age composition was approximated using the un-weighted composite age structure of Salmon and Scott Rivers as a surrogate.

Klamath Basin Recreational Fishery Adult Non-Catch Mortality
Estimates of basin wide adult drop-off and catch-and-release mortality associated with the 2006 jack-only recreational fishery were derived based on an estimated adult contact rate of 6.1%, and assumed drop-off and catch-and-release mortality rates of 2% and 10%, respectively (see Appendix C for details).

Appendix E. Trinity River – 2006 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 2,201 scales were aged of which 455 scales came from CWT fish. Scale samples were used to apportion the total 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 subsequently returned by anglers. 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 2006, CDFG reported a 0.0% harvest rate on adult Chinook based on no return of adult program tags. This result is consistent with the expectation that in 2006 there would be no adults retained in the recreational fishery as regulations prohibited their retention (see Appendix C for associated non-catch mortality). However, there were sufficient recoveries of program tags applied to jacks at WCW to estimate a jack harvest rate. This calculation produced a jack harvest rate of 0.5%, yielding a total harvest of 61 age-two Chinook. There were no scales recovered from this fishery as no creel census was implemented in 2006.

Lower Trinity River Creel
A total of 35 scales were aged of which two were from known-age fish. One of the 35 scales was aged as an age-3 fish, the rest were all age-2 fish. Regulations prohibited retention of adult chinook (>55cm) (see Appendix C for associated non-catch mortality). Total harvest was apportioned by age using the scale-age proportions.

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 scales is accomplished with known-age fish later recovered at either TRH or natural spawning areas which are also referenced to WCW by a unique "program tag" (spaghetti tag applied at WCW with unique identifying number). A total of 444 scales were used in estimation of the WCW run including 31 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 main-stem and tributary sub-areas. A total of 29 scales were collected from the mainstem, and

10 scales were 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 1,118 scales were aged of which 159 were from known-age fish. The total harvest was apportioned by age using these scale-age proportions.

Appendix F. 2006 Klamath scale age analysis

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	98	211	272	7	588
LRC	896	79	7	1	983
IGH	189	404	621	15	1229
SALMON	39	66	54	0	159
SCOTT	400	455	303	4	1162
SHASTA	336	75	73	2	486
YTFP EST	19	295	761	33	1108
YTFP M&U	144	632	1369	66	2211
MAINSTEM	76	165	276	14	531
	2197	2382	3736	142	8457

Unknown scales corrected age proportions (Kimura method)

		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	p	0.186	0.339	0.466	0.010	1.0
LRC	p	0.992	0.000	0.007	0.002	1.0
IGH	p	0.170	0.305	0.515	0.009	1.0
SALMON	p	0.277	0.394	0.328	0.000	1.0
SCOTT	p	0.394	0.355	0.251	0.000	1.0
SHASTA	p	0.801	0.038	0.157	0.003	1.0
YTFP EST	p	0.011	0.251	0.704	0.035	1.0
YTFP M&U	p	0.067	0.268	0.629	0.037	1.0
MAINSTEM	p	0.158	0.287	0.522	0.033	1.0

Known CWT ages

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL	#CWTS UNKNOWN
BOGUS	7	15	27	1	50	8
LRC	24	1	0	0	25	1
IGH	78	82	280	15	455	231
SALMON	0	0	0	0	0	0
SCOTT	0	0	0	0	0	0
SHASTA	0	0	1	0	1	0
YTFP EST	1	7	35	0	43	7
YTFP M&U	1	7	53	1	62	14
MAINSTEM	0	0	1	0	1	0
Bogus1	0	3	7	1	11	1
Bogus2	7	12	20	0	39	7
LRC - lo	0	0	0	0	0	0
LRC - mid	24	1	0	0	25	1
YTFP MID	0	1	18	0	19	6
YTFP UP	1	6	35	1	43	8

Appendix G. 2006 Trinity scale age analysis

WCW = Willow Ck. Weir

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	12	0	0	1	0	13
	2	144	6	0	0	0	150
Scale	3	65	0	4	0	0	69
Ages	4	199	0	0	21	0	220
31	5	5	0	0	0	0	5
413		425	6	4	22	0	457

LOWTRINREC = Lower Trinity Recreational

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	0	0	0	0	0	0
	2	32	2	0	0	0	34
Scale	3	1	0	0	0	0	1
Ages	4	0	0	0	0	0	0
2	5	0	0	0	0	0	0
33		33	2	0	0	0	35

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

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	28	0	0	4	0	32
	2	36	2	0	0	0	38
Scale	3	176	0	28	0	0	204
Ages	4	729	0	1	128	0	858
159	5	18	0	0	0	0	18
959		987	2	29	132	0	1150

TRH = Trinity River Hatchery

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	30	2	1	7	0	40
	2	599	170	2	0	0	771
Scale	3	399	1	77	9	0	486
Ages	4	735	0	2	187	2	926
455	5	13	0	0	3	2	18
1746		1776	173	82	206	4	2241

LOWTRINTRIBS = Lower Trinity Tribs

includes 3 scales from Horse Linto

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	0	0	0	0	0	0
	2	2	0	0	0	0	0
Scale	3	5	0	0	0	0	0
Ages	4	3	0	0	0	0	0
0	5	0	0	0	0	0	0
10		10	0	0	0	0	10

UPKLAMREC Upper Klamath Recreational

not sampled in 06

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable						
	2						
Scale	3						
Ages	4						
0	5						
0		0	0	0	0	0	0

LOWTRINMAINSTEM = Lower Trinity Mainstem

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	unreadable	0	0	0	0	0	0
	2	4	0	0	0	0	4
Scale	3	8	0	0	0	0	8
Ages	4	14	0	0	0	0	14
0	5	3	0	0	0	0	3
29		29	0	0	0	0	29

TribsAboveHoopa

NO DATA

Scale Ages		Cwt Age: no cwt	2	3	4	5	Total
	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	180	2	0	0	
	3	1	109	9	0	
4x4	4	0	3	336	2	
	5	0	0	3	2	647

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

	2	3	4	5
2	0.9945	0.0175	0.0000	0.0000
3	0.0055	0.9561	0.0259	0.0000
4	0.0000	0.0263	0.9655	0.5000
5	0.0000	0.0000	0.0086	0.5000

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

known scales	31	159	2	455	0		0	647
# unknown scales	413	959	33	1746	29		10	3190

Age	Willow Creek Weir WCW	Hoopa Tribal NET HARVEST	Lower Trinity REC HARVEST	TRH HATCHERY	Lower Trinity CARCASS	Upper Trinity REC HARVEST	Upper Trin Nat Escape	Lower Trin Tribs
2	0.3480	0.0347	0.9748	0.3410	0.1338		0.3329	0.1920
3	0.1494	0.1709	0.0252	0.2255	0.2772		0.1134	0.5140
4	0.4868	0.7701	0.0000	0.4259	0.3888		0.5355	0.2940
5	0.0158	0.0243	0.0000	0.0075	0.2002		0.0181	0.0000
	1	1	kimura used	1	1		1	kimura used

Correction Matrix for ages 2,3,4,5 .
(Inverse of Scale-CWT age proportion matrix.)

	2	3	4	5
2	1.0057	-0.0185	0.0005	-0.0005
3	-0.0058	1.0468	-0.0283	0.0283
4	0.0002	-0.0288	1.0458	-1.0458
5	0.0000	0.0005	-0.0180	2.0180

UNKNOWN CWTS		9	1	40	0	0	0	0
						(Estimated)	(Estimated)	

CWTS Age	Willow Creek Weir WCW	Hoopa Tribal NET HARVEST	Lower Trinity REC HARVEST	TRH HATCHERY	Lower Trinity CARCASS	Upper Trinity REC HARVEST	Upper Trinity Natural	Hoopa Hook&Line
2	6	1	9	854		6	955	
3	4	29	0	445		0	503	
4	22	141	0	1219		0	1377	
5	0	0	0	26		0	28	
	32	171	9	2544	0	6	2863	0

WCW scales

Age	Corrected proportions applied to 413 unknown WCW nocwts	known age cwts scales	Total age all scales	WCW age proportions
2	144	6	150	0.3364
3	62	4	66	0.1477
4	201	22	223	0.5012
5	7	0	7	0.0147
	413	32	445	

Total Adult + Jacks
Natural Escapement, Trinity basin above WCW: Apportioned to age structure.

Rec above WCW	61	CDFG
TRH	11994	Megatable
Naturals	23248	Megatable
Total	35303	

Age	WCW age proportions	TRH + Rec above WCW + Nat Escapement	Add each season if needed Fudge	Apportioned Natural Escapement minus TRH #s minus above WCW creel #s Escapement	Props
2	0.3364	11877	0	7740	0.3329
3	0.1477	5213	0	2637	0.1134
4	0.5012	17694	0	12450	0.5355
5	0.0147	518	0	421	0.0181
		35303			

Appendix H. 2006 Klamath age-composition calculation worksheet.

2006

Hatchery spawners	# Grilse	# Adults	Total Run	CALCULATED AGE 2	3	4	5	Total	SCALE AGE PROPORTIONS	2	3	4	5	Total	Scales read or unknown CWTs	Redd counts	
Iron Gate Hatchery (IGH)	2386	11604	13990	2386	4215	7251	138	13990	scales	0.170	0.305	0.515	0.009	1.0	1,229	<59cm	
				0.17	0.301	0.52	0.01		IGH cwts	78	82	280	15	455	0		
Trinity River Hatchery (TRH)	4076	7918	11994	4076	2576	5244	97	11994	scales	0.341	0.226	0.426	0.008	1.0	1746		
Hatchery spawner subtotal:	6462	19522	25984	6462	6791	12495	235	25984	TRH cwts	854	445	1219	26	2544	0		
						proportion hatchery		0.293									
Natural Spawners																	
Trinity River mainstem above WCW	7740	15508	23248	7740	2637	12450	421	23248	scales	0.33291	0.11343	0.53554	0.01811	1.0			
Trinity River mainstem below WCW	63	126	189	63	21	101	3	189	**scales**	**0.33291**	**0.11343**	**0.53554**	**0.01811**	**1.0**	**surrogate above**	63	redds
Salmon River Basin (includes Wooley Cr)	791	1278	2069	791	698	580	0	2069	scales	0.38230	0.33727	0.28043	0.00000	1.0	159	<=56cm	0.3823
Scott River	1953	3007	4960	1953	1759	1247	1	4960	scales	0.39367	0.35470	0.25146	0.00017	1.0	1,162	<=59cm	0.3651
Shasta River	1395	789	2184	1395	151	625	13	2184	scales	0.63853	0.06916	0.28604	0.00627	1.0	486	see Shasta worksheet	
									Shasta CWT	0	0	1	0	1	0		
Bogus Creek	764	3368	4132	764	1398	1929	41	4132	scales	0.18555	0.33876	0.46599	0.00970	1.0	588	<=58cm	0.1533
									Bogus CWT	7	15	27	1	50			
Main stem Klamath (IGH to Shasta R)	577	3072	3649	577	1048	1904	120	3649	scales	0.15826	0.28718	0.52153	0.03303	1.0	531	<=60cm	0.1198
										0	0	1	0	1			
Main stem Klamath (Shasta R to Indian Cr)	276	1466	1742	276	500	908	58	1742	Upper main	0.15826	0.28718	0.52153	0.03303	1.0	Surrogate used	733	redds
subtotal:	13,559	28,614	42,173	0 13,559	8,212	19,744	657	42,173									
				0.0054	0.0054	0.0054	0.0054		Unweighted Salmon Scott(SS) - SURROGATE								
		Surrogate							SS	0.38799	0.34598	0.26595	0.00008	1.0			Live
Klamath Tributaries																Redds	adults
Aiken Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Beaver Cr.	30	48	78	30	27	21	0	78	SS	0.38799	0.34598	0.26595	0.00008			24	0
Bluff Cr.	1	2	3	1	1	1	0	3	SS	0.38799	0.34598	0.26595	0.00008			1	0
Boise Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Camp Cr.	245	387	632	245	219	168	0	632	SS	0.38799	0.34598	0.26595	0.00008			135	117
Clear Cr.	108	170	278	108	96	74	0	278	SS	0.38799	0.34598	0.26595	0.00008			84	2
Dillon Cr.	41	65	106	41	37	28	0	106	SS	0.38799	0.34598	0.26595	0.00008			30	5
Elk Cr.	67	106	173	67	60	46	0	173	SS	0.38799	0.34598	0.26595	0.00008			50	6
Grider Cr.	28	44	72	28	25	19	0	72	SS	0.38799	0.34598	0.26595	0.00008			22	0
Horse Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008				
Independence Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Indian Cr.	165	260	425	165	147	113	0	425	SS	0.38799	0.34598	0.26595	0.00008			126	8
Irving Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Perch Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Red Cap Cr.	46	73	119	46	41	32	0	119	SS	0.38799	0.34598	0.26595	0.00008			35	3
Thompson Cr.	0	0	0	0	0	0	0	0	SS	0.38799	0.34598	0.26595	0.00008			0	0
Slate Cr	6	10	16	6	6	4	0	16	SS	0.38799	0.34598	0.26595	0.00008	0.61		4	2
Klamath Tribs subtotal	739	1165	1904	739	659	506	0	1904			0.56532	0.43454	0.00014			511	143
Trinity Tributaries																	
Horse Linto Cr.	40	80	120	40	14	64	2	120	scales	0.33291	0.11343	0.53554	0.01811	1.0		40	redds
Cedar Cr (trib to Horse Linto)	31	62	93	31	11	50	2	93	scales	0.33291	0.11343	0.53554	0.01811	1.0		31	redds
subtotal	71	142	213	71	24	114	4	213	surrogate Trinity River Mainstem								
Non-Reservation Misc. tribs sub total	810	1307	2117	810	683	620	4	2117									
																	Live
Reservation Tributaries-Hoopa Valley																Redds	adults
Campbell Cr.	0	0	0	0	0	0	0	0	scales	0.33291	0.11343	0.53554	0.01811			0	
Hostler	0	0	0	0	0	0	0	0	scales	0.33291	0.11343	0.53554	0.01811			0	
Mill	133	266	399	133	45	214	7	399	scales	0.33291	0.11343	0.53554	0.01811			133	
Pine Cr.	0	0	0	0	0	0	0	0	scales	0.33291	0.11343	0.53554	0.01811				
Soctish	0	0	0	0	0	0	0	0	scales	0.33291	0.11343	0.53554	0.01811			0	
Supply Cr.	10	20	30	10	3	16	1	30	scales	0.33291	0.11343	0.53554	0.01811			10	
Tish Tang Cr.	48	96	144	48	16	77	3	144	scales	0.33291	0.11343	0.53554	0.01811			48	
Others	0	0	0	0	0	0	0	0	scales	0.33291	0.11343	0.53554	0.01811			0	
subtotal	191	382	573	191	65	307	10	573	scales	0.33291	0.11343	0.53554	0.01811			191	
Reservation Tributaries-Yurok																	
Blue Cr.	20	119	139	20	65	54	0	139	Salmon R	not used	0.33727	0.28043	0.00000	0.62			
reservation tributaries subtotal	211	501	712	211	130	361	10	712		adults	0.54601	0.45399	0.00000	1.00			
Natural spawner subtotal:	14580	30422	45002	14580	9025	20725	671	45002		30421							
Total spawner subtotal:	**21042**	**49944**	**70986**	**21042**	**15816**	**33220**	**906**	**70986**									
Angler Harvest																	
Klamath River (below Hwy 101)	60	1	61	60	0.0	1	0.00	61	LRC scales	0.99160	0.00000	0.00679	0.00160	1.00	983		
									LRC cwts	0	0	0	0	0	0		
Klamath River (Hwy 101 to Weichpec)	4421	38	4459	4421	1	30	7	4459	LRC scales	0.99160	0.00000	0.00679	0.00160	1.00			
									LRC cwts	24	1	0	0	25	0		
Klamath River (Weitchpec to IGH)	721	18	739	721	7	11	0	739		0.97564	**0.00897**	**0.01512**	**0.00027**	1.00			
											IGH scales adult surrogate						
Trinity River (below Willow Cr. Weir)	205	5	210	205	5	0	0	210	scales	0.97479	0.02521	0.00000	0.00000	1.00	33		
									lower cwts	9	0	0	0	9	0		
Trinity River (above Willow Cr. Weir)	61	0	61	61	0	0	0	61		1.00000	0.00000	0.00000	0.00000	0.00	Surrogate for adults -lowr creel		
Angler harvest subtotal:	5,468	62	5,530	5,468	13	42	7	5,530	upper cwts	6	0	0	0	0	adult cwts only		
Tribal Harvest																	
Klamath River (Estuary)	30	2726	2756	30	688	1944	94	2756	scales	0.01060	0.25092	0.70376	0.03472	1	1,108	<=58cm	0.019
									YTFP EST cwt	1	7	35	0	43	0		
Klamath River (101 to Trinity R)	240	3396	3636	240	965	2300	132	3636	scales	0.06685	0.26795	0.62867	0.03653	1	2,211	<=58cm	0.053
									YTFP MU cwt	1	7	53	1	62	0		
Trinity River	145	4163	4308	145	736	3327	100	4308	scales	0.03473	0.17091	0.77009	0.02426	1	959		
									Hoopa cwts	1	29	141	0	171	0		
Tribal harvest subtotal:	415	10285	10700	415	2389	7571	326	10700									
Total harvest	**5883**	**10347**	**16230**	**5883**	**2402**	**7613**	**333**	**16230**									
Totals																	
In-river run and escapement	26925	60291	87216	26925	18218	40833	1239	87216									
Angling dropoff mortality (2.04%)	112	76	188	112	23	52	2	188	0.02041 angler dropoff mort rate on harvest (not total contacts)								
Net dropoff mortality (8.7%)	36	894	930	36	208	658	28	930	0.08696 net dropoff mort rate on harvest (not total contacts)								
									age comp of adults in total run								
Sport harvest H&R adult mortalities	0	368	368	0	111	250	8	368			0.301	0.678	0.021	1.000			
Total in-river run	27073	61630	88703	27073	18560	41793	1277	88703									
				30.5%	20.9%	47.1%	1.4%				20.9%	47.1%	1.4%	69.4%			