

Klamath River Fall Chinook Salmon Age-Specific Escapement, River Harvest, and Run Size Estimates, 2008 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 2008 was estimated to be:

| <i>Age</i> | <i>Run Size</i> | |
|--------------|-----------------|-------------------|
| | <i>Number</i> | <i>Proportion</i> |
| 2 | 25,338 | 0.26 |
| 3 | 18,648 | 0.19 |
| 4 | 50,187 | 0.52 |
| 5 | 1,737 | 0.02 |
| Total | 95,910 | 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>Pre / Post</i> |
| <i>Run Size</i> | 115,400 | 70,600 | 1.63 |
| <i>Fishery Mortality</i> | | | |
| Tribal Harvest | 27,000 | 22,300 | 1.21 |
| Recreational Harvest | 22,500 | 1,900 | 11.84 |
| Drop-off Mortality | 2,800 | 2,000 | 1.40 |
| | 52,300 | 26,200 | 2.00 |
| <i>Escapement</i> | | | |
| Hatchery Spawners | 22,400 | 13,600 | 1.65 |
| Natural Area Spawners | 40,700 | 30,900 | 1.32 |
| | 63,100 | 44,500 | 1.42 |

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 2008. The estimates provided in this report are consistent with the Klamath Basin Megatable (CDFG 2009) and with the 2009 forecast of ocean stock abundance (KRTAT 2009).

Age-specific escapement estimates for 2008 and previous years, coupled with the coded-wire tag (CWT) recovery data from Basin hatchery stocks, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall Chinook (KRTAT 2009, Mohr 2006a, 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 2009). These forecasts are necessary inputs to the Klamath Ocean Harvest Model (Mohr 2006b); the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on Klamath River fall Chinook.

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; see Appendix H for adjustments to the 2008 Salmon River escapement estimation methodology) to obtain the data from which the Klamath Basin Megatable totals and estimates of age composition were derived. 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.

Estimates of age composition were based on random samples of scales (Table 2) whenever possible. Generally, each scale was aged independently by two trained readers. In cases of disagreement, a third read was used to arbitrate. Statistical methods (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.

In cases where scales were believed to be non-representative of the age-two component, the KRTAT relied on analysis of length-frequency histograms. In these cases, all fish less than or equal to a given fork-length "cutoff" were assumed to be age-two, and all fish greater than the cutoff length were assumed to be adults. The cutoff value varied by sector, and was based on location of the length-frequency nadir and, if appropriate, known-age (CWT) length-frequencies. As before, scales were used to estimate the age composition of adults (Appendix A).

An indirect method was used to estimate age composition for natural spawners in the Trinity River above the Willow Creek Weir (WCW). The number of age-two fall Chinook that immigrated above WCW was estimated using a Peterson mark-recapture estimator for fish less than or equal to 57 cm. Age-specific numbers of adult (greater than 57 cm) fall Chinook that immigrated above the WCW were estimated by applying the age composition from scales collected at the weir to the estimate of adult abundance above the weir. Next, the age composition of 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.

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 B for the Klamath River and Appendix C for the Trinity River.

Results

A total of 11,097 scales from 15 different sectors were aged for this analysis (Table 2). Of these, 978 were from known-age (CWT) fish. Known-age scales provide a direct check, or "validation," of accuracy of the scale-based age estimates (Tables 4a and 4b, Appendices D and E). Overall, the scale-based ages were generally accurate. For the Trinity River, accuracy was 98% for age-2 fish, 100% for age-3 fish, 99% for age-4 fish, and 100% for age-5 fish. For the Klamath River the accuracy was 93% for age-2 fish, 92% for age-3 fish, 95% age-4 fish, and 50% 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. Table 6 displays the Table 5 estimates as proportions. Calculations underlying the results summarized in Table 1 are presented in Appendix F.

New methods were used to estimate Salmon River escapement in 2008, owing to the inability to sample Wooley Creek because of forest fires (Appendix G).

The final estimates of the 2007 Klamath Basin age composition were slightly modified from the preliminary age composition. Final estimates 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 |
| KRTT | Klamath River Technical Team |
| KT | Karuk Tribe |
| LRC | Lower Klamath River Creel |
| M&U | Klamath River below Weitchpec: “middle” section (Hwy 101–Surpur Ck) and “upper” section (Surpur Ck—Trinity River) |
| SCS | Siskiyou County Schools |
| SRRC | Salmon River Restoration Council |
| TRH | Trinity River Hatchery |
| UR TRIBS | Upper Klamath River Tributaries |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| WCW | Willow Creek Weir |
| YT | Yurok Tribe |
| YTFP | Yurok Tribal Fisheries Program |

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Klamath River Technical Advisory Team Participants

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

Hoop Valley Tribe
George Kautsky
Billy C. Matilton

KMZ Ocean Recreational Fishery
Jerry Barnes

National Marine Fisheries Service
Michael O'Farrell

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 2008 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, HVT |
| Natural Spawners | | |
| Salmon River Basin | Redd count twice weekly. Adults = 2 * redd counts+live fish observed on last survey; total run = adults/(1-jack% from scale sample proportion). Bio-data (scales, FLs, marks) collected from carcasses. Could not use mark-recapture methods because high flow event during peak of run. Wooley Creek could not be surveyed due to forest fires. Total run increased by 8.08% (average contribution of Wooley Creek to Salmon River escapement 1998-2007 based on redd counts) to account for spawning escapement in Wooley Creek. | CDFG,USFS,YT, KT, SRRC, SCS |
| Scott River Basin | Video count above weir at river mile 21, and mark-recapture carcass estimate (Schaefer) below weir with reaches surveyed twice weekly. Bio-data (scales, FLs, marks, sex) collected from all carcasses. | CDFG, SCS |
| Shasta River Basin | Video count above weir. Bio-data (scales, FLs, sex, marks) collected from carcasses upstream of video weir site 1-day per week and mortalities stranded on weir. | CDFG, SCS |
| Bogus Creek Basin | Video count above weir and daily direct carcass count below weir. Systematic random sample (1:4) bio-sampled for FL, scales, sex, and all ad-clipped fish bio-sampled. | CDFG, YT |
| Klamath River mainstem (IGH to Shasta R) | Petersen mark-recapture carcass estimate. River sections are surveyed 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, KT |
| Klamath Tributaries (above Trinity, including Pine Creek) | Periodic redd surveys, once every 10 days. Adults=2 * redd counts+live fish observed on last day surveyed. Total Run=adults/(1-%jacks estimated for Shasta, Scott, and Salmon surrogate). | USFS,CDFG |
| Blue Creek | Weekly surveys. 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 stratified for jacks and adults; 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) | Weekly redd surveys. Adults = 2 * redd counts. Total run = adults/(1-%jacks estimated for upper Trinity natural escapement). | HVT |
| Trinity Tributaries (above Reservation; below WCW) | Redd surveys. Adults = 2 * redd counts. Total run = adults/(1-%jacks estimated for upper Trinity natural escapement). | CDFG |
| Hoopa Reservation Tributaries | Redd surveys. Adults = 2 * redd counts. Total run = adults/(1-%jacks estimated for upper Trinity natural escapement). | HVT |
| Recreational Harvest | | |
| Klamath River (below Hwy 101 bridge) | Jack and adult estimates based on access point creel survey during three randomly selected days per statistical week. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews. | CDFG |
| Klamath River (Hwy 101 to Weitchpec) | Jack and adult estimates based on access point creel survey during three randomly selected days per statistical week. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews. | CDFG |
| Klamath River (Weitchpec to IGH) | No survey, used ratio of adult harvest (lower river : upper river) from 1999-2002 to estimate adult harvest. Total harvest = adults/(1-%jacks estimated for IGH and Bogus weighted average). | CDFG |
| Trinity River Basin (above WCW) | Jack and adult harvest estimates based on estimated harvest rates from recovery of reward tags (applied at WCW) multiplied by WCW jack and adult run sizes. | CDFG |
| Trinity River Basin (below WCW) | Roving access creel survey during three randomly selected days per statistical week stratified by weekdays and weekend days (1 weekday and 2 weekend), Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews. | HVT |
| Tribal Harvest | | |
| Klamath River (below Hwy 101) | Daily harvest estimates based on effort and catch-per-effort surveys. Bio-data (FLs, scales, fin-clips, marks) collected during net harvest interviews. | YT |
| Klamath River (Hwy 101 to Trinity mouth) | Daily harvest estimates based on 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 2. Scale sampling locations and numbers of scales collected for the 2008 Klamath Basin fall Chinook age-composition assessment.

| Sampling Location | Scales collected | | | Total | Agency |
|--------------------------------------|---------------------------|-------------------------|------------------------|---------------|-----------|
| | Read | | Not read ^{c/} | | |
| | Unknown-age ^{a/} | Known-age ^{b/} | | | |
| <u>Hatchery Spawners</u> | | | | | |
| Iron Gate Hatchery (IGH) | 1,075 | 489 | 258 | 1,822 | CDFG |
| Trinity River Hatchery (TRH) | 797 | 213 | 29 | 1,039 | HVT |
| <u>Natural Spawners</u> | | | | | |
| Salmon River Carcass Survey | 297 | 0 | 5 | 302 | CDFG |
| Scott River Carcass Survey | 1,107 | 0 | 17 | 1,124 | CDFG |
| Shasta River Carcass | 203 | 1 | 786 ^{d/} | 990 | CDFG |
| Bogus Creek Weir | 658 | 31 | 12 | 701 | CDFG |
| Klamath River mainstem | 888 | 0 | 37 | 925 | USFWS |
| Upper Klamath River tributaries | 0 | 0 | 0 | 0 | USFS |
| Blue Creek Snorkle | 47 | 0 | 0 | 47 | YT |
| Willow Creek Weir | 879 | 41 | 18 | 938 | CDFG, HVT |
| Lower Trinity River Carcass | 0 | 0 | 0 | 0 | HVT |
| Lower Trinity River tributaries | 5 | 0 | 0 | 5 | HVT |
| <u>Recreational Harvest</u> | | | | | |
| Lower Klamath River Creel | 767 | 26 | 25 | 818 | CDFG |
| Lower Trinity River Creel | 19 | 1 | 0 | 20 | HVT |
| <u>Tribal Harvest</u> | | | | | |
| Klamath River (below Hwy 101) | 1,179 | 99 | 3,404 | 4,682 | YT |
| Klamath River (Hwy 101 to Trinity R) | 1,437 | 17 | 109 | 1,563 | YT |
| Trinity River (Hoopa Reservation) | 761 | 60 | 8 | 829 | HVT |
| TOTAL | 10,119 | 978 | 4,708 | 15,805 | |

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

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

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

d/ Includes scales collected from "washbacks" at the weir. These scales were read but not used for age-composition analysis due to over-representation of age-two fish.

Table 3. Age-composition methods used for the 2008 Klamath Basin fall Chinook run assessment.

| Sampling Location | Age Composition Method |
|--|---|
| <u>Hatchery Spawners</u> | |
| Iron Gate Hatchery (IGH) | Jack/adult structure from scale-age analysis. |
| Trinity River Hatchery (TRH) | Jacks (<58cm) from length frequency and 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 | Jack/adult structure from scale-age analysis of carcass scale samples only. |
| 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 Shasta, Scott and Salmon Rivers. |
| Blue Creek | Jacks estimated by direct observation. Adult structure from scale-age analysis. |
| Trinity River (above WCW) ^{a/} | Direct estimate of jack (<58cm) component using Petersen M-R and adult age structure from scale-age analysis. |
| Trinity River (mainstem below WCW) | Surrogate: Mainstem natural spawners above WCW age-structure. |
| Trinity Tributaries (above Reservation to WCW) | Surrogate: Mainstem natural spawners above WCW age-structure. |
| Hoopla Reservation Tributaries | 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) | Surrogate: IGH and Bogus Creek weighted age composition. |
| Trinity River Basin (above WCW) | Jack component based on estimated jack harvest. Surrogate: Adult age composition from Trinity River Basin Recreational Harvest (below WCW). |
| 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 (Hoopla Reservation) | Jack/adult structure from scale-age analysis. |

a/ The jack proportion determined by scale ages at WCW was substantially higher than in recovery areas above WCW (TRH and mainstem carcass survey). As a result, estimates of jack and adult abundance were determined by a stratified Petersen estimate, where jacks and adults were estimated separately. Typically, the total abundance of both jacks and adults has been determined using an unstratified Petersen estimate.

Table 4a. 2008 Klamath River Basin scale validation matrices.

| <u>Number</u> | | Known Age | | | | |
|---------------|---|-----------|-----|-----|---|--------------|
| | | 2 | 3 | 4 | 5 | |
| Read Age | 2 | 238 | 3 | 1 | 0 | Total 821 |
| | 3 | 18 | 303 | 11 | 0 | |
| | 4 | 0 | 25 | 220 | 1 | |
| | 5 | 0 | 0 | 0 | 1 | |
| Total | | 256 | 331 | 232 | 2 | |

| <u>Percentage</u> | | Known Age | | | | |
|-------------------|---|-----------|------|------|------|---------------|
| | | 2 | 3 | 4 | 5 | |
| Read Age | 2 | 0.93 | 0.01 | 0.00 | 0.00 | Total 1.00 |
| | 3 | 0.07 | 0.92 | 0.05 | 0.00 | |
| | 4 | 0.00 | 0.08 | 0.95 | 0.50 | |
| | 5 | 0.00 | 0.00 | 0.00 | 0.50 | |
| Total | | 1.00 | 1.00 | 1.00 | 1.00 | |

Table 4b. 2008 Trinity River Basin scale validation matrices.

| <u>Number</u> | | Known Age | | | | |
|---------------|---|-----------|-----|-----|---|--------------|
| | | 2 | 3 | 4 | 5 | |
| Read Age | 2 | 43 | 0 | 0 | 0 | Total 315 |
| | 3 | 1 | 109 | 2 | 0 | |
| | 4 | 0 | 0 | 159 | 0 | |
| | 5 | 0 | 0 | 0 | 1 | |
| Total | | 44 | 109 | 161 | 1 | |

| <u>Percentage</u> | | Known Age | | | | |
|-------------------|---|-----------|------|------|------|---------------|
| | | 2 | 3 | 4 | 5 | |
| Read Age | 2 | 0.98 | 0.00 | 0.00 | 0.00 | Total 0.00 |
| | 3 | 0.02 | 1.00 | 0.01 | 0.00 | |
| | 4 | 0.00 | 0.00 | 0.99 | 0.00 | |
| | 5 | 0.00 | 0.00 | 0.00 | 1.00 | |
| Total | | 1.00 | 1.00 | 1.00 | 0.00 | |

Table 5. Age composition of the 2008 Klamath Basin fall Chinook run.

| Escapement & Harvest | 2 | 3 | AGE 4 | 5 | Total Adults | Total Run |
|---|---------------|---------------|---------------|--------------|-----------------|---------------|
| <u>Hatchery Spawners</u> | | | | | | |
| Iron Gate Hatchery (IGH) | 2,130 | 5,530 | 3,551 | 21 | 9,101 | 11,231 |
| Trinity River Hatchery (TRH) | 800 | 1,485 | 2,961 | 5 | 4,451 | 5,251 |
| Hatchery Spawner subtotal | 2,930 | 7,015 | 6,512 | 26 | 13,552 | 16,482 |
| <u>Natural Spawners</u> | | | | | | |
| Salmon River Basin | 650 | 431 | 1,286 | 32 | 1,749 | 2,399 |
| Scott River Basin | 1,228 | 167 | 3,227 | 51 | 3,445 | 4,673 |
| Shasta River Basin | 3,621 | 1,222 | 1,456 | 63 | 2,741 | 6,362 |
| Bogus Creek Basin | 1,565 | 1,076 | 1,911 | 14 | 3,001 | 4,566 |
| Klamath River mainstem (IGH to Shasta R) | 834 | 960 | 3,068 | 33 | 4,060 | 4,894 |
| Klamath River mainstem (Shasta R to Indian Cr) | 365 | 415 | 1,341 | 14 | 1,770 | 2,135 |
| Klamath Tributaries (above Trinity, including Pine Creek) | 1,073 | 396 | 1,416 | 33 | 1,845 | 2,918 |
| Blue Creek | 89 | 76 | 242 | 91 | 409 | 498 |
| Klamath Basin subtotal | 9,425 | 4,743 | 13,947 | 330 | 19,020 | 28,445 |
| Trinity River (mainstem above WCW) | 6,997 | 2,444 | 7,962 | 78 | 10,483 | 17,480 |
| Trinity River (mainstem below WCW) | 399 | 139 | 454 | 4 | 598 | 997 |
| Trinity tributaries (above Reservation) | 160 | 56 | 182 | 2 | 240 | 400 |
| Hoopla Reservation tributaries | 390 | 136 | 444 | 4 | 584 | 974 |
| Trinity Basin subtotal | 7,946 | 2,775 | 9,042 | 88 | 11,905 | 19,851 |
| Natural Spawners subtotal | 17,371 | 7,518 | 22,989 | 418 | 30,925 | 48,296 |
| Total Spawner Escapement | 20,301 | 14,533 | 29,501 | 444 | 44,477 | 64,778 |
| <u>Recreational Harvest</u> | | | | | | |
| Klamath River (below Hwy 101 bridge) | 521 | 36 | 99 | 7 | 141 | 662 |
| Klamath River (Hwy 101 to Weitchpec) | 3,358 | 219 | 633 | 44 | 896 | 4,254 |
| Klamath River (Weitchpec to IGH) | 160 | 285 | 236 | 1 | 523 | 683 |
| Trinity River Basin (above WCW) | 139 | 44 | 181 | 0 | 225 | 364 |
| Trinity River Basin (below WCW) | 75 | 14 | 65 | 0 | 78 | 153 |
| Subtotals | 4,253 | 598 | 1,214 | 52 | 1,863 | 6,116 |
| <u>Tribal Harvest</u> | | | | | | |
| Klamath River (below Hwy 101) | 302 | 2,546 | 14,102 | 1,062 | 17,710 | 18,012 |
| Klamath River (Hwy 101 to Trinity mouth) | 187 | 445 | 2,122 | 70 | 2,636 | 2,823 |
| Trinity River (Hoopla Reservation) | 152 | 234 | 1,667 | 12 | 1,913 | 2,065 |
| Subtotals | 641 | 3,225 | 17,891 | 1,144 | 22,259 | 22,900 |
| Total Harvest | 4,894 | 3,823 | 19,105 | 1,196 | 24,122 | 29,016 |
| <u>Totals</u> | | | | | | |
| Harvest and Escapement | 25,195 | 18,356 | 48,606 | 1,640 | 68,599 | 93,794 |
| Recreational Angling Dropoff Mortality 2.04% | 87 | 12 | 25 | 1 | 38 | 125 |
| Tribal Net Dropoff Mortality 8.7% | 56 | 280 | 1,556 | 99 | 1,935 | 1,991 |
| Total River Run | 25,338 | 18,648 | 50,187 | 1,737 | 70,572 | 95,910 |

Table 6. Age proportion of the 2008 Klamath Basin fall Chinook run.

| Escapement & Harvest | AGE | | | |
|---|-------------|-------------|-------------|-------------|
| | 2 | 3 | 4 | 5 |
| <u>Hatchery Spawners</u> | | | | |
| Iron Gate Hatchery (IGH) | 0.19 | 0.49 | 0.32 | 0.00 |
| Trinity River Hatchery (TRH) | 0.15 | 0.28 | 0.56 | 0.00 |
| Hatchery Spawner subtotal | 0.18 | 0.43 | 0.40 | 0.00 |
| <u>Natural Spawners</u> | | | | |
| Salmon River Basin | 0.27 | 0.18 | 0.54 | 0.01 |
| Scott River Basin | 0.26 | 0.04 | 0.69 | 0.01 |
| Shasta River Basin | 0.57 | 0.19 | 0.23 | 0.01 |
| Bogus Creek Basin | 0.34 | 0.24 | 0.42 | 0.00 |
| Klamath River mainstem (IGH to Shasta R) | 0.17 | 0.20 | 0.63 | 0.01 |
| Klamath River mainstem (Shasta R to Indian Cr) | 0.17 | 0.19 | 0.63 | 0.01 |
| Klamath Tributaries (above Trinity, including Pine Creek) | 0.37 | 0.14 | 0.49 | 0.01 |
| Blue Creek | <u>0.18</u> | <u>0.15</u> | <u>0.49</u> | <u>0.18</u> |
| Klamath Basin subtotal | 0.33 | 0.17 | 0.49 | 0.01 |
| Trinity River (mainstem above WCW) | 0.40 | 0.14 | 0.46 | 0.00 |
| Trinity River (mainstem below WCW) | 0.40 | 0.14 | 0.46 | 0.00 |
| Trinity tributaries (above Reservation) | 0.40 | 0.14 | 0.46 | 0.00 |
| Hoopa Reservation tributaries | <u>0.40</u> | <u>0.14</u> | <u>0.46</u> | <u>0.00</u> |
| Trinity Basin subtotal | 0.40 | 0.14 | 0.46 | 0.00 |
| Natural Spawners subtotal | 0.36 | 0.16 | 0.48 | 0.01 |
| Total Spawner Escapement | 0.31 | 0.22 | 0.46 | 0.01 |
| <u>Recreational Harvest</u> | | | | |
| Klamath River (below Hwy 101 bridge) | 0.79 | 0.05 | 0.15 | 0.01 |
| Klamath River (Hwy 101 to Weitchpec) | 0.79 | 0.05 | 0.15 | 0.01 |
| Klamath River (Weitchpec to IGH) | 0.23 | 0.42 | 0.35 | 0.00 |
| Trinity River Basin (above WCW) | 0.38 | 0.12 | 0.50 | 0.00 |
| Trinity River Basin (below WCW) | <u>0.49</u> | <u>0.09</u> | <u>0.42</u> | <u>0.00</u> |
| Subtotals | 0.70 | 0.10 | 0.20 | 0.01 |
| <u>Tribal Harvest</u> | | | | |
| Klamath River (below Hwy 101) | 0.02 | 0.14 | 0.78 | 0.06 |
| Klamath River (Hwy 101 to Trinity mouth) | 0.07 | 0.16 | 0.75 | 0.02 |
| Trinity River (Hoopa Reservation) | <u>0.07</u> | <u>0.11</u> | <u>0.81</u> | <u>0.01</u> |
| Subtotals | 0.03 | 0.14 | 0.78 | 0.05 |
| Total Harvest | 0.17 | 0.13 | 0.66 | 0.04 |
| <u>Totals</u> | | | | |
| Harvest and Escapement | 0.27 | 0.20 | 0.52 | 0.02 |
| Recreational Angling Dropoff Mortality 2.04% | 0.70 | 0.10 | 0.20 | 0.01 |
| Tribal Net Dropoff Mortality 8.7% | 0.03 | 0.14 | 0.78 | 0.05 |
| Total River Run | 0.26 | 0.19 | 0.52 | 0.02 |

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

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

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

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

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

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

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

Appendix B. Klamath River – 2008 Details.

Iron Gate Hatchery

A systematic random bio-sample^a was obtained from every tenth Chinook returning to IGH in 2008. Additionally every ad-clip fish not occurring in the random sample was bio-sampled as nonrandom. A representative sub-sample was obtained by systematically discarding every third scale sample packet obtained in the random 1:10 bio-sample collected at IGH. Scale-based age composition was used to apportion all age classes. Age composition was estimated from a total of 1,564 scales of which 489 came from known-age, CWT fish.

Bogus Creek

Total run was estimated by summing carcasses encountered below the video weir and videography (since 2002) counts above the weir. Biological samples were obtained from all areas using a systematic random sample of 1:4. Additionally, biological data were obtained from a non-random collection of every ad-clipped fish encountered. Age composition was estimated from a total of 689 scales of which 31 came from known-age, CWT fish.

Shasta River

Total run estimated by videography (since 1998) while bio-samples were collected from all recovered carcasses for surveys in the lower 7 miles on public and private lands where access is granted. An additional 6 miles of valley area were surveyed on Nature Conservancy and adjoining Busk Ranch properties. Bio-samples were also obtained from all fish that washed back onto the counting weir. Age composition was estimated from a total of 204 scales of which 1 came from known-age, CWT fish.

Scott River

Total escapement was obtained using a Schaefer carcass mark-recapture estimator for reaches below a resistance board weir installed near Jones Beach river mile 21. Videography was used to estimate the population above the weir augmented with carcass surveys above the weir for biological samples. Bio-samples were obtained from all carcasses encountered. Age composition was estimated from a total of 1,107 scales of which none were from known-age, CWT fish.

Salmon River

In past years, carcass mark-recapture was used to estimate total fall Chinook spawners in Salmon River. However, surveys were suspended due to high flows over two weeks in early November coinciding with the peak spawning period. This resulted in poor recoveries for carcasses marked just prior to the high flow event. The total run estimate was generated by redd surveys conducted prior to these high flows and surveys conducted after flows receded. Age composition was estimated from a total of 297 scales of which none were from known-age, CWT fish.

Klamath River Tributaries (above Reservation)

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

Klamath River Mainstem

For the upper reach (IGH to Shasta River section), the total population was estimated by combined Petersen K-sample (multiple mark, multiple recapture). Age composition was estimated from a total of 888 scales of which none were from known-age, CWT fish.

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

Redds were multiplied by two to estimate the adult run in the lower reach (Shasta to Indian Creek section). The scale-age proportion from the upper reach were used as a surrogate to estimate jacks and assign adult age proportions.

Lower Klamath River Creel

The total harvest was estimated by creel census for the combined area (above Highway 101 bridge to Weitchpec, and Highway 101 bridge to mouth). Age composition was estimated from a total of 793 scales of which 26 were from known-age, CWT fish.

Upper Klamath River Recreational Fishery

There was no creel census in this sub-area in 2008. Harvest data were available from creel census of the lower and upper river fisheries in 1999 through 2002. The ratio of average total adult harvest (upper river recreational harvest plus lower river recreational harvest) versus average adult harvest in the lower area for these years (ratio = 1.504) was used to estimate total Klamath river recreational harvest in 2008, given the estimated lower river harvest. The upper river harvest was then calculated indirectly by subtracting the lower river harvest from the total harvest. The number of jacks and adult age assignments were estimated by applying the scale-based age proportions obtained from the weighted average age composition of Bogus Creek and IGH combined.

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 fishery was closed on Wednesdays and Thursdays and between the hours of 10 PM and 8 AM on fishing days. Age composition was estimated from a total of 1,278 scales, of which 99 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. The fishery was closed on Wednesdays and Thursdays. Age composition was estimated from a total of 1,454 scales, of which 17 were from known-age, CWT fish.

Blue Creek

Peak count for jacks and adults from snorkel surveys and adult age-structure derived from scale samples. A total of 47 scales were used of which none were from known-age, CWT fish.

Appendix C. Trinity River – 2008 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 1,010 scales were aged of which 213 scales came from known-age, CWT fish. The jack component was estimated based on a < 58 cm cut off for age-2 fish. Scale samples were used to apportion the adult 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 harvest of jacks and adults was estimated using harvest rate estimates based on returns of WCW program tags and the total run estimated above WCW. The adult age-proportions estimated for the Lower Trinity River Creel were used as a surrogate for the adult component.

Lower Trinity River Creel

Roving creel census implemented in Trinity River below the WCW. A total of 20 scales were aged of which 1 was from known-age, CWT fish. Total harvest was apportioned by age using the scale-age proportions.

Upper Trinity River Natural Escapement

The natural escapement in the upper Trinity River above WCW was estimated by subtracting the age-specific returns to TRH and age-specific recreational harvest above WCW from the total estimated run above WCW. Total run above WCW was estimated using a stratified Petersen mark-recapture estimator for jacks (< 58 cm) and adults, separately. The age structure of the run was estimated using the jack run estimate and the adult age-composition from the scales collected at WCW applied to the adult run portion. A total of 920 scales were aged of which 41 were from known-age, CWT fish.

Lower Trinity River Natural Escapement:

The Lower Trinity natural escapement estimation area included total spawners estimated in both mainstem and tributary sub-areas (redds X 2). No scales were collected from the mainstem, and only 5 scales were collected from the tributary sub-area. Ages were apportioned using the "Upper Trinity Natural Escapement" proportions as a surrogate.

Hoop Valley Tribal Harvest

Hoop Valley Tribal harvest is a composite of the gillnet and hook-and-line fisheries prosecuted by Tribal members. A total of 821 scales were aged of which 60 were from known-age, CWT fish. The total harvest was apportioned by age using these scale-age proportions.

Appendix D. 2008 Klamath age analysis

| Unknown scales age composition as read | | | | | |
|---|--------|--------|--------|--------|-------|
| | AGE 2 | AGE 3 | AGE 4 | AGE 5 | TOTAL |
| BOGUS | 213 | 169 | 275 | 1 | 658 |
| IGH | 197 | 510 | 367 | 1 | 1,075 |
| SALMON | 76 | 62 | 157 | 2 | 297 |
| SCOTT | 274 | 93 | 734 | 6 | 1,107 |
| SHASTA (no weir) | 108 | 46 | 48 | 1 | 203 |
| MAINSTEM | 145 | 195 | 545 | 3 | 888 |
| UR TRIBS | 0 | 0 | 0 | 0 | 0 |
| LRC | 565 | 83 | 115 | 4 | 767 |
| YTFP EST | 24 | 196 | 924 | 35 | 1,179 |
| YTFP M&U | 96 | 263 | 1,060 | 18 | 1,437 |
| BLUE CRK | 20 | 5 | 16 | 6 | 47 |
| | 1718 | 1622 | 4241 | 77 | 7658 |
| Unknown scales corrected age proportions (Kimura method) | | | | | |
| | AGE 2 | AGE 3 | AGE 4 | AGE 5 | TOTAL |
| BOGUS | 0.3440 | 0.2324 | 0.4206 | 0.0030 | 1.0 |
| IGH | 0.1909 | 0.4870 | 0.3202 | 0.0019 | 1.0 |
| SALMON | 0.2710 | 0.1795 | 0.5361 | 0.0135 | 1.0 |
| SCOTT | 0.2627 | 0.0358 | 0.6907 | 0.0108 | 1.0 |
| SHASTA (no weir) | 0.5693 | 0.1920 | 0.2289 | 0.0099 | 1.0 |
| MAINSTEM | 0.1708 | 0.1942 | 0.6282 | 0.0068 | 1.0 |
| UR TRIBS | | | | | |
| LRC | 0.7912 | 0.0497 | 0.1487 | 0.0104 | 1.0 |
| YTFP EST | 0.0169 | 0.1397 | 0.7840 | 0.0594 | 1.0 |
| YTFP M&U | 0.0669 | 0.1558 | 0.7523 | 0.0251 | 1.0 |
| BLUE CRK | 0.4255 | 0.1064 | 0.3404 | 0.1277 | 1.0 |
| Known CWT ages ^{a/} | | | | | |
| | AGE 2 | AGE 3 | AGE 4 | AGE 5 | TOTAL |
| BOGUS | 10 | 25 | 9 | 0 | 44 |
| IGH | 119 | 399 | 177 | 1 | 696 |
| SALMON | 0 | 0 | 0 | 0 | 0 |
| SCOTT | 0 | 0 | 0 | 0 | 0 |
| SHASTA | 0 | 1 | 0 | 0 | 1 |
| MAINSTEM | 3 | 15 | 13 | 0 | 31 |
| UR TRIBS | 0 | 0 | 0 | 0 | 0 |
| LRC | 14 | 12 | 6 | 0 | 32 |
| YTFP EST | 0 | 50 | 94 | 1 | 145 |
| YTFP M&U | 0 | 9 | 19 | 0 | 28 |
| BLUE CRK | 0 | 0 | 0 | 0 | 0 |
| | 146 | 511 | 318 | 2 | 977 |
| <u>Breakout within strata</u> | | | | | |
| Bogus1 | 3 | 9 | 7 | 0 | 19 |
| Bogus2 | 7 | 16 | 2 | 0 | 25 |
| LRC - lo | 0 | 3 | 1 | 0 | 4 |
| LRC - mid | 14 | 9 | 5 | 0 | 28 |
| YTFP MID | 0 | 5 | 5 | 0 | 10 |
| YTFP UP | 0 | 4 | 14 | 0 | 18 |

^{a/} Table includes known-age fish whose scales were not mounted / read.

Appendix E. 2008 Trinity age analysis

WCW = Willow Ck. Weir

| | | Cwt Age | | | | | |
|---------------|------------|---------|---|----|----|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | 17 | 0 | 1 | 0 | 0 | 18 |
| | 2 | 501 | 7 | 0 | 0 | 0 | 508 |
| | 3 | 111 | 0 | 17 | 1 | 0 | 129 |
| | 4 | 265 | 0 | 0 | 16 | 0 | 281 |
| | 5 | 1 | 0 | 0 | 0 | 0 | 2 |
| | 879 | 896 | 7 | 18 | 17 | 0 | 938 |

LOWTRINREC = Lower Trinity Recreational

| | | Cwt Age | | | | | |
|---------------|------------|---------|---|---|---|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | 1 | 0 | 0 | 0 | 0 | 1 |
| | 2 | 9 | 1 | 0 | 0 | 0 | 10 |
| | 3 | 2 | 0 | 0 | 0 | 0 | 2 |
| | 4 | 8 | 0 | 0 | 0 | 0 | 8 |
| | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 19 | 20 | 1 | 0 | 0 | 0 | 21 |

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

| | | Cwt Age | | | | | |
|---------------|------------|---------|---|----|----|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | 8 | 0 | 0 | 0 | 0 | 8 |
| | 2 | 56 | 1 | 0 | 0 | 0 | 57 |
| | 3 | 93 | 0 | 13 | 1 | 0 | 107 |
| | 4 | 608 | 0 | 0 | 44 | 1 | 652 |
| | 5 | 4 | 0 | 0 | 0 | 0 | 5 |
| | 761 | 769 | 1 | 13 | 45 | 1 | 829 |

TRH = Trinity River Hatchery

| | | Cwt Age | | | | | |
|---------------|------------|---------|----|----|-----|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | 24 | 0 | 3 | 2 | 0 | 29 |
| | 2 | 113 | 34 | 0 | 0 | 0 | 147 |
| | 3 | 229 | 1 | 79 | 0 | 0 | 309 |
| | 4 | 454 | 0 | 0 | 99 | 0 | 553 |
| | 5 | 1 | 0 | 0 | 0 | 0 | 1 |
| | 797 | 821 | 35 | 82 | 101 | 0 | 1039 |

LOWTRINTRIBS = Lower Trinity Tribs

| | | Cwt Age | | | | | |
|---------------|------------|---------|---|---|---|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2 | 2 | 0 | 0 | 0 | 0 | 2 |
| | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4 | 2 | 0 | 0 | 0 | 0 | 2 |
| | 5 | 1 | 0 | 0 | 0 | 0 | 1 |
| | 5 | 5 | 0 | 0 | 0 | 0 | 5 |

UPKLAMREC Upper Klamath Recreational

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

LOWTRINMAINSTEM = Lower Trinity Mainstem

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

TribesAboveHoopa

| | | Cwt Age | | | | | |
|---------------|------------|---------|---|---|---|---|-------|
| | | no cwt | 2 | 3 | 4 | 5 | Total |
| Scale Ages | unreadable | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 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.)

| | | Cwt Age | | | | |
|--------------------------|---|---------|-----|-----|---|------------|
| | | 2 | 3 | 4 | 5 | Total |
| 4x4 Validation Matrix | 2 | 43 | 0 | 0 | 0 | 0 |
| | 3 | 1 | 109 | 2 | 0 | 0 |
| | 4 | 0 | 0 | 159 | 0 | 0 |
| | 5 | 0 | 0 | 0 | 1 | 1 |
| | | | | | | 0.99047619 |

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

| | | Cwt Age | | | | |
|-----------------------------|---|---------|--------|--------|--------|--------|
| | | 2 | 3 | 4 | 5 | Total |
| 4x4 Scale-CWT age matrix | 2 | 0.9773 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 3 | 0.0227 | 1.0000 | 0.0124 | 0.0000 | 0.0000 |
| | 4 | 0.0000 | 0.0000 | 0.9876 | 0.0000 | 0.0000 |
| | 5 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |

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

| | | | | | | |
|----------------|-----|-----|----|-----|---|------|
| known scales | 41 | 60 | 1 | 213 | 0 | 315 |
| unknown scales | 879 | 761 | 19 | 797 | 5 | 2461 |

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

| | | Cwt Age | | | | |
|--------------------------|---|---------|--------|---------|--------|--------|
| | | 2 | 3 | 4 | 5 | Total |
| 4x4 Correction Matrix | 2 | 1.0233 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 3 | -0.0233 | 1.0000 | -0.0126 | 0.0000 | 0.0000 |
| | 4 | 0.0000 | 0.0000 | 1.0126 | 0.0000 | 0.0000 |
| | 5 | 0.0000 | 0.0000 | 0.0000 | 1.0000 | 0.0000 |

| 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 | 0.5832 | 0.0753 | 0.4847 | 0.1451 | | | 0.0000 | 0.0000 |
| 3 | 0.1092 | 0.1104 | 0.0890 | 0.2769 | | 0.1726 | 0.2331 | 0.0000 |
| 4 | 0.3053 | 0.8090 | 0.4263 | 0.5768 | | 0.8274 | 0.7595 | 1.0000 |
| 5 | 0.0023 | 0.0053 | 0.0000 | 0.0013 | | 0.0000 | 0.0074 | 0.0000 |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

UNKNOWN CWTS

| CWTS Age | 7 | | 6 | | 14 | | (Estimated) | | (Estimated) | |
|-------------|--------------------------|-----------------------------|------------------------------|-----------------|--------------------------|------------------------------|--------------------------|--------------------|-------------|--|
| | 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 | 0 | 1 | 1 | 149 | | 5 | 124 | | | |
| 3 | 0 | 13 | 0 | 340 | | 10 | 309 | | | |
| 4 | 0 | 45 | 0 | 575 | | 17 | 522 | | | |
| 5 | 0 | 1 | 0 | 0 | | 0 | 0 | | | |
| | 0 | 60 | 1 | 1064 | | 32 | 955 | | | |

WCW scales

| Age | WCW nocwts | 0 known age cwts scales | Total age all scales | WCW age proportions |
|-----|------------|-------------------------------|-------------------------|------------------------|
| 2 | 513 | 0 | 513 | 0.5832 |
| 3 | 96 | 0 | 96 | 0.1092 |
| 4 | 268 | 0 | 268 | 0.3053 |
| 5 | 2 | 0 | 2 | 0.0023 |
| | 879 | 0 | 879 | |

Total Adults only

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

| Rec above WCW | ADULTS ONLY 225 CDFG | Age | proportions | TRH + Rec above WCW+Natural | Add each season if needed Fudge | Apportioned Natural Escapement minus TRH #s minus above WCW creel #s | Proprs |
|---------------|-------------------------|-----|-------------|--------------------------------|---------------------------------------|---|--------|
| | | | | Escapement | | Escapement | |
| TRH | 4451 Megatable | 3 | 0.2621 | 3973 | 0 | 2444 | 0.2331 |
| Naturals | 10483 Megatable | 4 | 0.7325 | 11103 | 0 | 7962 | 0.7595 |
| Total | 15159 | 5 | 0.0055 | 83 | 0 | 78 | 0.0074 |
| | | | | 15159 | | | |

Appendix F. 2008 Klamath Basin fall Chinook age-composition calculation worksheet.

| Hatchery spawners | # Grilse | # Adults | Total Run | CALCULATED AGE | | | | | SCALE AGE PROPORTIONS (unknowns) | | | | | Scales read or | Length Freq & Redd counts | | |
|---|----------|----------|-----------|----------------|-------|--------|------|--------|----------------------------------|--|---------|---------|---------|-----------------------------|------------------------------|-----------|--------|
| | | | | 2 | 3 | 4 | 5 | Total | 2 | 3 | 4 | 5 | Total | | | | |
| Iron Gate Hatchery (IGH) | 2130 | 9101 | 11231 | 2130 | 5530 | 3551 | 21 | 11231 | scales | 0.1909 | 0.4870 | 0.3202 | 0.0019 | 1.0 | 1,075 | <=59cm | |
| Trinity River Hatchery (TRH) | 800 | 4451 | 5251 | 800 | 1485 | 2961 | 5 | 5251 | IGH cwt | 119 | 399 | 177 | 1 | 696 | | | |
| Hatchery spawner subtotal: | 2930 | 13552 | 16482 | 2930 | 7015 | 6512 | 26 | 16482 | scales count | 0.3238 | 0.6747 | 0.0015 | 1.000 | 797 | <=57cm | act count | |
| | 0.152 | | | | | | | | TRH cwt | 149 | 340 | 575 | 0 | 915 | | | |
| | | | | | | | | | | 0.16 | 0.37 | 0.63 | 0.00 | | | | |
| Natural Spawners | | | | | | | | | | stratified jack estimate | | | | | | Live | |
| Trinity River mainstem above WCW | 6997 | 10483 | 17480 | 6997 | 2444 | 7962 | 78 | 17480 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | Redds | |
| Trinity River mainstem below WCW | 399 | 598 | 997 | 399 | 139 | 454 | 4 | 997 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | TR above WCW | 299 | adults |
| Salmon River Basin (includes Wooley Cr) | 650 | 1748 | 2399 | 650 | 431 | 1286 | 32 | 2399 | scales | 0.27101 | 0.17946 | 0.53606 | 0.01347 | 1.0 | | 779 | 54 |
| Scott River | 1228 | 3445 | 4673 | 1228 | 167 | 3227 | 51 | 4673 | scales | 0.26268 | 0.03583 | 0.69065 | 0.01084 | 1.0 | 1,107 | <=60cm | |
| Shasta River | 3621 | 2741 | 6362 | 3621 | 1222 | 1456 | 63 | 6362 | scales | 0.56932 | 0.19196 | 0.22887 | 0.00985 | 1.0 | 203 | <=59cm | |
| Bogus Creek | 1565 | 3001 | 4566 | 1565 | 1076 | 1911 | 14 | 4566 | Shasta CWT | 0 | 1 | 0 | 0 | 1 | | | |
| Main stem Klamath (IGH to Shasta R) | 834 | 4060 | 4894 | 834 | 960 | 3068 | 33 | 4894 | scales | 0.34397 | 0.23237 | 0.42062 | 0.00304 | 1.0 | 658 | <=62cm | |
| Main stem Klamath (Shasta R to Indian Cr) | 365 | 1770 | 2135 | 365 | 415 | 1341 | 14 | 2135 | Bogus CWT | 10 | 25 | 9 | 0 | 44 | | | |
| subtotal: | 15,659 | 27,847 | 43,506 | 15,659 | 6,854 | 20,705 | 289 | 43,506 | scales | 0.17083 | 0.19423 | 0.62818 | 0.00676 | 1.0 | 888 | <=59cm | |
| | | | | | | | | | | 3 | 15 | 13 | 0 | 31 | | | |
| | | | | | | | | | Upper main | 0.17083 | 0.19423 | 0.62818 | 0.00676 | 1.0 | Upper Klam main | 885 | redds |
| | | | | | | | | | | Unweighted Salmon Scott Shasta (SSS) - SURROGATE | | | | | | Live | |
| | | | | | | | | | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | 1.0 | | Redds |
| Klamath Tributaries | | | | | | | | | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | adults |
| Aiken Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Beaver Cr. | 209 | 360 | 569 | 209 | 77 | 276 | 6 | 569 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 180 |
| Bluff Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Boise Cr. | 12 | 20 | 32 | 12 | 4 | 15 | 0 | 32 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 10 |
| Camp Cr. | 206 | 354 | 560 | 206 | 76 | 272 | 6 | 560 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 177 |
| Clear Cr. | 98 | 168 | 266 | 98 | 36 | 129 | 3 | 266 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 84 |
| Dillon Cr. | 37 | 63 | 100 | 37 | 14 | 48 | 1 | 100 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 31 |
| Elk Cr. | 113 | 194 | 307 | 113 | 42 | 149 | 3 | 307 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 97 |
| Grider Cr. | 29 | 50 | 79 | 29 | 11 | 38 | 1 | 79 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 25 |
| Horse Cr. | 8 | 14 | 22 | 8 | 3 | 11 | 0 | 22 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 7 |
| Independence Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Indian Cr. | 63 | 108 | 171 | 63 | 23 | 83 | 2 | 171 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 54 |
| Irving Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Perch Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Red Cap Cr. | 217 | 373 | 590 | 217 | 80 | 286 | 7 | 590 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 186 |
| Rock Cr | 17 | 29 | 46 | 17 | 6 | 22 | 1 | 46 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 14 |
| Slate Cr | 2 | 4 | 6 | 2 | 1 | 3 | 0 | 6 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 2 |
| Seiad | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 0 |
| Thompson Cr. | 26 | 44 | 70 | 26 | 9 | 34 | 1 | 70 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 22 |
| Ti Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | 0.63 | | 0 |
| Pine Cr (previously in Trin Tribs) | 37 | 64 | 101 | 37 | 14 | 49 | 1 | 101 | | SSS | 0.36767 | 0.13575 | 0.48519 | 0.01139 | | | 32 |
| Klamath Tribs subtotal | 1073 | 1845 | 2918 | 1073 | 396 | 1416 | 33 | 2918 | | | 0.21468 | 0.76731 | 0.01801 | | | | 921 |
| | | | | | | | | | | | | | | | | | 3 |
| Trinity Tributaries | | | | | | | | | | SURROGATE Trinity River Mainstem | | | | | | Live | |
| Horse Linto Cr. | 112 | 168 | 280 | 112 | 39 | 128 | 1 | 280 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 84 | redds |
| Cedar Cr (trib to Horse Linto) | 48 | 72 | 120 | 48 | 17 | 55 | 1 | 120 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 36 | redds |
| subtotal | 160 | 240 | 400 | 160 | 56 | 182 | 2 | 400 | | | | | | | | | |
| Non-Reservation Misc. tribs sub total | 1233 | 2085 | 3318 | 1233 | 452 | 1598 | 35 | 3318 | | | | | | | | | |
| Reservation Tributaries-Hoopa Valley | | | | | | | | | | | | | | | | | Live |
| Campbell Cr. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 0 | adults |
| Hostler | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 0 | |
| Mill | 240 | 360 | 600 | 240 | 84 | 273 | 3 | 600 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 180 | |
| Pine Cr. (moved in 2007 to Klam tribs) | | | | | | | | | | | | | | | | | |
| Soctish | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 0 | |
| Supply Cr. | 9 | 14 | 23 | 9 | 3 | 11 | 0 | 23 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 7 | |
| Tish Tang Cr. | 140 | 210 | 350 | 140 | 49 | 159 | 2 | 350 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 105 | |
| Others | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 0 | |
| subtotal | 390 | 584 | 974 | 390 | 136 | 444 | 4 | 974 | scales | 0.40029 | 0.23311 | 0.75949 | 0.00740 | 1.0 | | 292 | |
| Reservation Tributaries-Yurok | | | | | | | | | | | | | | | | | Live |
| Blue Cr. | 89 | 409 | 498 | 89 | 76 | 242 | 91 | 498 | all ages | | | | | | | Redds | adults |
| | | | | | | | | | scales count | 0.18519 | 0.59259 | 0.22222 | 1.00 | 47 | | 220 | 217 |
| reservation tributaries subtotal | 479 | 993 | 1472 | 479 | 212 | 686 | 95 | 1472 | | | | | | | | | |
| Natural spawner subtotal: | 17371 | 30925 | 48296 | 17371 | 7518 | 22989 | 419 | 48296 | | | | | | | | | |
| Total spawner subtotal: | 20301 | 44477 | 64778 | 20301 | 14533 | 29501 | 445 | 64778 | | | | | | | | | |
| Angler Harvest | | | | | | | | | | | | | | | | | |
| Klamath River (below Hwy 101) | 521 | 141 | 662 | 521 | 36 | 99 | 7 | 662 | LRC scales | 0.79117 | 0.04974 | 0.14865 | 0.01043 | 1.00 | 767 | <=62cm | |
| Klamath River (Hwy 101 to Weitchpec) | 3358 | 896 | 4254 | 3358 | 219 | 633 | 44 | 4254 | LRC cwt | 0 | 3 | 1 | 0 | 4 | | | |
| Klamath River (Weitchpec to IGH) | 160 | 523 | 683 | 160 | 285 | 236 | 1 | 683 | LRC scales | 0.79117 | 0.04974 | 0.14865 | 0.01043 | 1.00 | | <=62cm | |
| Trinity River (above Willow Cr. Weir) | 139 | 225 | 364 | 139 | 44 | 181 | 0 | 364 | LRC cwt | 14 | 9 | 5 | 0 | 28 | | | |
| Trinity River (below Willow Cr. Weir) | 75 | 78 | 153 | 75 | 14 | 65 | 0 | 153 | | 0.23393 | 0.41814 | 0.34575 | 0.00217 | 1.00 | Surrogate IGH+Bogus weighted | | |
| | | | | | | | | | | | 0.370 | | | | | | |
| | | | | | | | | | h rate | 0.17262 | 0.82738 | 0.00000 | 1.00 | Surrogate adults -low creel | | | |
| | | | | | | | | | upper cwt | 5 | 10 | 17 | 0 | 27 | papercwt | | |
| | | | | | | | | | scales | 0.48470 | 0.08895 | 0.42635 | 0.00000 | 1.00 | 19 | | |
| | | | | | | | | | lower cwt | 1 | 0 | 0 | 0 | 1 | | | |
| Angler harvest subtotal: | 4,253 | 1,863 | 6,116 | 4,253 | 598 | 1,214 | 51 | 6,116 | | | | | | | | | |
| Tribal Harvest | | | | | | | | | | | | | | | | | |
| Klamath River (Estuary) | 302 | 17710 | 18012 | 302 | 2546 | 14102 | 1062 | 18012 | scales | 0.0169 | 0.1397 | 0.7840 | 0.0594 | 1 | 1,179 | <=62cm | |
| Klamath River (101 to Trinity R) | 187 | 2636 | 2823 | 187 | 445 | 2122 | 70 | 2823 | YTFP EST cwt | 0 | 50 | 94 | 1 | 145 | | | |
| Trinity River | 152 | 1913 | 2065 | 152 | 234 | 1667 | 12 | 2065 | scales | 0.0669 | 0.1558 | 0.7523 | 0 | | | | |

Appendix G: Estimation of Salmon River escapement in 2008, with accounting for missing Wooley Creek surveys.

Customarily, the escapement estimate for the Salmon River includes an escapement estimate made in Wooley Creek, based on redd surveys. In 2008, redd surveys were not conducted in Wooley Creek due to forest fire activity in the area. To account for the missing Wooley Creek redd counts, we used the ratio of total redds in the Salmon River basin (including Wooley Creek) to redds in the Salmon River (excluding Wooley Creek) to estimate the total number of redds expected if Wooley Creek were sampled.

Define the total number of redds in the Salmon River basin as T , and the number of redds in the Salmon River (excluding Wooley Creek) as S . The predicted total number of fall run redds in the Salmon River basin in 2008 is defined as

$$T_{2008} = S_{2008} \times \frac{\text{mean}(T)}{\text{mean}(S)},$$

where *mean* denotes the arithmetic mean for the years 1997-2007. Using this relationship,

$$T_{2008} = \frac{1015}{933} \times 779 = 848 \text{ redds, with an estimated 69 redds from Wooley Creek.}$$

Total Salmon River basin adult escapement is estimated by multiplying the total redds by 2 and adding the number of adults counted alive on the last day of surveys. In 2008, 54 adults were counted on the last survey day, and the final estimate of adult escapement in the Salmon Basin is $(848 \times 2) + 54 = 1749$.

Appendix H. Age composition of the 2007 Klamath River fall Chinook run (finalized Feb 03, 2009).

| Escapement & Harvest | AGE | | | | Total Adults | Total Run |
|---|--------------|----------------|---------------|--------------|----------------|----------------|
| | 2 | 3 | 4 | 5 | | |
| <u>Hatchery Spawners</u> | | | | | | |
| Iron Gate Hatchery (IGH) | 180 | 16,528 | 381 | 59 | 16,969 | 17,149 |
| Trinity River Hatchery (TRH) | 33 | 17,545 | 473 | 63 | 18,081 | 18,114 |
| Hatchery Spawner subtotal | 213 | 34,073 | 854 | 122 | 35,050 | 35,263 |
| <u>Natural Spawners</u> | | | | | | |
| Salmon River Basin | 55 | 1,004 | 373 | 0 | 1,377 | 1,432 |
| Scott River Basin | 11 | 3,397 | 1,097 | 0 | 4,494 | 4,505 |
| Shasta River Basin | 27 | 1,855 | 146 | 8 | 2,009 | 2,036 |
| Bogus Creek Basin | 64 | 4,513 | 144 | 20 | 4,677 | 4,741 |
| Klamath River mainstem (IGH to Shasta R) | 33 | 5,009 | 466 | 15 | 5,490 | 5,523 |
| Klamath River mainstem (Shasta R to Indian Cr) | 8 | 1,299 | 121 | 4 | 1,424 | 1,432 |
| Klamath Tributaries (above Trinity, including Pine Creek) | 26 | 1,136 | 276 | 2 | 1,414 | 1,440 |
| Blue Creek | 8 | 109 | 232 | 66 | 407 | 415 |
| Klamath Basin subtotal | 232 | 18,322 | 2,855 | 115 | 21,292 | 21,524 |
| Trinity River (mainstem above WCW) | 831 | 36,003 | 2,828 | 149 | 38,980 | 39,811 |
| Trinity River (mainstem below WCW) | 1 | 54 | 4 | 0 | 58 | 59 |
| Trinity tributaries (above Reservation) | 5 | 227 | 18 | 1 | 246 | 251 |
| Hoopaa Reservation tributaries | 2 | 87 | 7 | 0 | 94 | 96 |
| Trinity Basin subtotal | 839 | 36,371 | 2,857 | 150 | 39,378 | 40,217 |
| Natural Spawners subtotal | 1,071 | 54,693 | 5,712 | 265 | 60,670 | 61,741 |
| Total Spawner Escapement | 1,284 | 88,766 | 6,566 | 387 | 95,720 | 97,004 |
| <u>Recreational Harvest</u> | | | | | | |
| Klamath River (below Hwy 101 bridge) | 20 | 969 | 105 | 23 | 1,097 | 1,117 |
| Klamath River (Hwy 101 to Weitchpec) | 218 | 1,953 | 212 | 46 | 2,211 | 2,429 |
| Klamath River (Weitchpec to IGH) | 19 | 1,620 | 40 | 6 | 1,667 | 1,686 |
| Trinity River Basin (above WCW) | 89 | 835 | 101 | 0 | 936 | 1,025 |
| Trinity River Basin (below WCW) | 23 | 357 | 44 | 0 | 401 | 424 |
| Subtotals | 369 | 5,734 | 502 | 76 | 6,312 | 6,681 |
| <u>Tribal Harvest</u> | | | | | | |
| Klamath River (below Hwy 101) | 16 | 14,323 | 8,194 | 958 | 23,475 | 23,491 |
| Klamath River (Hwy 101 to Trinity mouth) | 5 | 1,302 | 456 | 42 | 1,800 | 1,805 |
| Trinity River (Hoopaa Reservation) | 0 | 1,919 | 337 | 42 | 2,298 | 2,298 |
| Subtotals | 21 | 17,544 | 8,987 | 1,042 | 27,573 | 27,594 |
| Total Harvest | 390 | 23,278 | 9,489 | 1,118 | 33,885 | 34,275 |
| <u>Totals</u> | | | | | | |
| Harvest and Escapement | 1,674 | 112,044 | 16,055 | 1,505 | 129,605 | 131,279 |
| Recreational Angling Dropoff Mortality 2.04% | 8 | 117 | 10 | 2 | 129 | 137 |
| Tribal Net Dropoff Mortality 8.7% | 2 | 1,525 | 781 | 91 | 2,397 | 2,399 |
| Total River Run | 1,684 | 113,686 | 16,846 | 1,599 | 132,131 | 133,815 |