2004 Fall Chinook Salmon Run Size in the Scott River, Salmon River and Miscellaneous Tributary Streams of the Mid-Klamath Basin

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ABSTRACT

Cooperative spawning ground surveys were conducted on the Scott River, Salmon River, and in miscellaneous tributary streams to the Klamath River during the 2004 fall Chinook salmon spawning season. The fall Chinook salmon run size estimate for the Scott and Salmon Rivers was calculated using mark recapture estimators. The run size estimate for miscellaneous tributary streams was derived from redd surveys, assuming that each redd supports two adult salmon. The California Department of Fish and Game (Department) estimates that approximately 438 fall Chinook salmon returned to the Scott River in the fall of 2004. Of these, 404 were adults and 34 were grilse. Fall Chinook salmon ranged in fork length from 39 cm to 105 cm. Grilse were determined to be ≤ 55 cm in fork length. Approximately 333 fall Chinook salmon were estimated to have returned to the Salmon River in 2004. Of these, 300 were adults and 33 were grilse. Fork lengths ranged from 38 cm to 101 cm and grilse were estimated to be ≤ 55 cm. A minimum of 477 fall Chinook salmon were estimated to have returned to the smaller tributary streams located with in the basin upstream of the confluence of the Trinity River.

INTRODUCTION

The primary objective of the Klamath River Project (KRP) is to determine the size, composition, distribution and timing of runs of fall Chinook salmon in the Klamath River basin, excluding the Trinity River basin, annually. The California Department of Fish and Game (Department) has been monitoring fall Chinook salmon spawning escapement levels in the Klamath basin since 1978. To achieve this task the KRP employs several techniques which include a creel survey of sport fishing efforts, recovery of fish returning to Iron Gate Hatchery (IGH), completion of cooperative spawning ground surveys in major tributary streams and rivers, and operation of video fish counting weirs on the Shasta River and Bogus Creek.

The methods used to develop fall Chinook salmon run size estimates for the Salmon River have evolved since the late 1970's. From 1979 through 1984 the estimate was derived from a limited number of spawning ground surveys that were generally completed by either the Department or the U.S. Forest Service (USFS). In 1985 the number of surveys and area covered by the survey was increased to improve the estimate. The area surveyed expanded to include twelve miles of the main stem, the South Fork from Hotelling Gulch to Forks of Salmon, and the North Fork from Sawyers Bar to Forks of Salmon. A temporary weir and fish marking facility was operated near the mouth of the Salmon River at Oak Bottom from 1986 to 1991. Spawning ground surveys were conducted to recover marked fish and document spawning distribution. The operation of the temporary weir was discontinued in 1992 in favor of conducting more intensive cooperative spawning ground surveys twice weekly. Elimination of the weir was deemed desirable to eliminate unnecessary handling stress on adult salmon during their migration upstream. The weir was also vulnerable to high flow and required a large investment of money and time to operate effectively. Over the years, participation in the cooperative spawning ground survey has grown substantially, and in recent years has included staff

from the Department, USFS, the Yurok, and Karuk Tribes, the Salmon River Restoration Council, County schools, and local volunteers.

Similar efforts also have occurred on the Scott River since 1979. In the early years of the KRP, spawning ground surveys were conducted in the major spawning areas of the river which included about 5.5 miles of the Scott River near Etna and 4.75 miles of river downstream of the State Highway 3 Bridge crossing near Fort Jones. From 1989 through 1991 spawning ground surveys were limited to the lower river because low flows hampered the migration of fall Chinook salmon to spawning areas upstream. In 1982 a temporary fish marking weir was installed on the lower river at river mile 1.6 and was operated during each spawning season until 1991. Operation of the weir was often affected by high flows, and beginning in 1992 operation of the weir was dropped in favor in conducting more intensive mark recapture spawning ground surveys in cooperation with USFS fisheries staff.

In 1994 the California State Legislature passed the Leslie Amendment (SB 779). The passage of SB 779 requires Departmental staff to obtain landowner permission prior to accessing private lands to conduct biological investigations. The entire length of the Scott River within the Scott Valley passes through privately owned agricultural lands. In 1994 the KRP began requesting landowner permission to access the Scott River as it passes through private lands prior to conducting spawning ground surveys along the river. As a result, since 1994, spawning ground surveys have been limited to those areas of the river on private land where landowner permission was granted each year. The level of cooperation from local landowners has varied over the years. However, during the 2004 spawning season, the number of landowners that denied permission for access increased dramatically. Controversies associated with the proposed listing of coho salmon under the California Endangered Species Act (CESA) in 2000 substantially reduced the amount of cooperation provided by local landowners to the extent that the Department was denied permission to survey nearly all of the Chinook salmon spawning reaches present in the Scott Valley during the 2001 and 2002 spawning seasons.

Spawning ground surveys have also been conducted in several other miscellaneous tributary streams since establishment of the KRP. All of the surveys are conducted with the assistance of the USFS, Yurok Tribe, Karuk Tribe, Salmon River Restoration Council and local volunteers. Although the number and location of tributary streams surveyed each year varies based on run size and availability of staff, most of the major streams have been surveyed on a fairly consistent basis each year. These have generally included Aikens Creek, Beaver Creek, Bluff Creek, Boise Creek, Camp Creek, China Creek, Clear Creek, Dillon Creek, Elk Creek, Grider Creek, Horse Creek, Independence Creek, Indian Creek, Irving Creek, Perch Creek, Red Cap Creek, Rock Creek, Swillup Creek, Slate Creek, Thompson Creek, Ti Creek, and Walker Creek.

METHODS

The annual Chinook salmon run-size estimate for the Salmon and Scott Rivers is derived from mark recapture data obtained from salmon carcasses observed during the

cooperative spawning ground survey. The run-size estimate for other tributary streams is developed from redd counts extrapolated by an assumed number of two fish per redd plus the number of live fish observed on the last day of the survey. The Salmon and Scott Rivers were surveyed twice each week during the spawning run. The Salmon River survey was conducted on every Monday and Thursday and the Scott River survey was conducted on every Tuesday and Friday. Miscellaneous tributary streams were surveyed every Wednesday. Surveys began during the second week of October and continued until November 29th on the Salmon River, November 23rd on the Scott River and, through December 20th on miscellaneous tributary streams in the basin.

On the morning of each survey, several crews of at least two people per crew were given daily instructions, data sheets, field equipment, vehicle assignments, and were assigned a survey reach. Crews walked or kayaked their assigned reach in a downstream direction looking for salmon carcasses and spawning redds. All new redds were flagged along the river bank at a location perpendicular to the upstream limit of the redd pit. Redds were not flagged on private lands at the request of some landowners however, redds were still counted and recorded on survey data sheets. Redd locations were periodically mapped on USGS topographic maps through out the duration of the survey. When a carcass was located crew members identified each to species and gender, checked for marks or tags, obtained a fork length (FL) measurement, collected a scale sample for age composition analysis, and examined females for spawning success.

For purposes of the mark recapture estimate, each carcass was categorized into one of four pathways (Paths). Fresh carcasses, those with clear eyes and/or firm flesh were designated as Path 1. Individually numbered jaw tags were attached to the lower right jaw of all Path 1 carcasses and returned to the river for potential recapture during later surveys. Older carcasses, those with cloudy eyes and/or mushy flesh, were categorized as Path 2. All Path 2 carcasses were cut in half and returned to the river after all biological data was collected. Path 3 carcasses included all of the Path 1 carcasses (with jaw tag) that were recaptured during subsequent surveys. Any carcasses that could be observed by a survey crew but could not be retrieved for data collection, because they were located in inaccessible or unsafe locations, were designated as Path 4. Path 4 designations were rarely encountered during the survey.

The preliminary Chinook salmon run-size estimate was calculated using the Petersen Method and the Schaefer Method was used to calculate the final estimate (Ricker, 1975). The Petersen Method is used to calculate the preliminary estimate because of its relative simplicity. The Petersen calculation is as follows:

$$\text{Escapement} = (M+1)(C+1)\ (R+1)$$

Where:
- M = The number of salmon carcasses tagged (Path 1) during the survey.
- C = The total number of salmon carcasses examined during the survey.
- R = The number of tagged salmon carcasses recovered (Path 3) during the survey.

The Schaefer equation was used to estimate the final fall-run Chinook salmon run size for each river based as follows:

$$\text{Escapement} = \sum((R_{ij})(M_i/R_i)(C_j/R_j))$$

Where: M_i = The number of fish marked in period i
R_i = The total number of marked fish recaptured in period i
R_j = The total number of marked fish recaptured in period j
C_j = The total number of fish recaptured in period j

The final run size estimate for both the Salmon and Scott rivers was derived by adding the number of live Chinook salmon observed on the last day of the survey to the Schaefer estimate. On the Salmon River, the number of spring-run Chinook salmon observed during the USFS spring-run Chinook and summer steelhead surveys, conducted in July, is subtracted from the population estimate in those reaches where spawning of spring-run and fall-run Chinook salmon overlap.

On the Scott River, KRP staff was not granted permission by local landowners to conduct the survey in some locations within the Scott Valley. To estimate the number of salmon that likely spawned in those locations, where landowner permission was not granted, an expansion factor was applied based on the proportion of the total length of sampled locations versus un-sampled locations. The number of live fish seen on the last day of surveys was added to that number to produce the final run size estimate.

SURVEY REACHES

The survey reaches have remained fairly consistent since the beginning of the cooperative spawning ground survey in 1992. During the Chinook salmon spawning season, decisions regarding which reaches should be surveyed were based on the known distribution of the Chinook salmon run each week, the available labor force present during each survey, and on private lands was limited to those areas where permission had been granted.

A total of 16 survey reaches, covering about 56 river miles, have been identified on the Scott River (Table 1). Since 1992, when the cooperative spawning ground survey began, the Department has found that spawning use in some of the identified survey reaches is extremely limited due to either poor spawning habitat conditions or because migration barriers exist that limit Chinook salmon access during low flow. Therefore, the Department places a higher priority on those reaches where fall Chinook salmon have consistently been observed spawning over time. Limited funding and refusal of some landowners to allow the Department access to the river across their property also eliminate the possibility of surveying all of the identified reaches in any given year. The most important Chinook salmon spawning areas within Scott Valley are located downstream of the State Highway 3 Bridge crossing (rm 34.6) to the USGS gauging station located at river mile 21 (Reaches 8, 9, and 10), and in that reach of the river located downstream of Young's Dam (rm 48) to about river mile 42 located upstream of

the Eller Lane Bridge crossing (Reaches 12, 13, and 14). Favorable spawning habitat exists upstream of Young's Dam however, Chinook salmon access to those areas is often hampered by low flow and passage problems associated with the structure. Access to private lands with in the Scott Valley greatly improves the accuracy of the Chinook salmon population estimate.

Table 1. Description of cooperative spawning ground survey reach locations along the Scott River, CA.

Reach Number	Downstream Limit	Upstream limit	Approximate Length (miles)
1	Mouth	Mid Point	2.60
2	Mid Point	Pat Ford Ck	2.30
3	Pat Ford Ck	George Allen Gulch	2.90
4	George Allen Gulch	Townsend Gulch	2.70
5	Townsend Gulch	Bridge Flat	3.70
6	Bridge Flat	Jones Beach	4.00
7	Jones Beach	USGS Stream Gage	2.80
8	USGS Stream Gage	Meamber Bridge	3.40
9	Meamber Bridge	Dunlop	3.54
10	Dunlop	Highway 3 Bridge	4.03
11	Highway 3 Bridge	Eller Lane	6.42
12	Eller Lane	Sweezy Bridge	2.38
13	Sweezy Bridge	Horn Lane	2.65
14	Horn Lane	Young's Dam	1.97
15	Young's Dam	Fay Lane	3.65
16	Fay Lane	East Fork Confluence	6.86

A total of 14 survey reaches have been identified for fall Chinook salmon within the Salmon River which includes 6 reaches within the South Fork Salmon River and 4 reaches within the North Fork Salmon River (Table 2). Wooly Creek is also included in the survey and is denoted as reach 13.

Table 2. Description of cooperative spawning ground survey reach locations along the Salmon River, CA.

Reach Number	River	Downstream Limit	RM	Upstream limit	RM	Length (miles)
1	Main Stem	Mouth	0.00	Wooley Ck.	5.00	5.00
2	Main Stem	Wooley Ck.	5.00	Grant Bluffs	9.00	4.00
3	Main Stem	Grant Bluffs	9.00	Nordheimer Ck.	14.80	5.80
4	Main Stem	Nordheimer Ck	14.80	Forks of Salmon	19.50	4.70
5a	South Fork	Forks of Salmon	0.00	Henry Bell Ck.	3.00	3.00
5b	South Fork	Henry Bell Ck.	3.00	O'Farrel Gulch	5.00	2.00
6a	South Fork	O'Farrel Gulch	5.00	Indian Ck.	8.20	3.20
6b	South Fork	Indian Ck.	8.20	Matthews Ck.	10.00	1.80
7	South Fork	Matthews Ck.	10.00	French Ck.	14.10	4.10
8	South Fork	French Ck.	14.10	Cecilville	17.50	3.40
9	North Fork	Forks of Salmon	0.00	Post Mile 4.0	4.00	4.00
10	North Fork	Post Mile 4.0	4.00	Post Mile 8.0	8.00	4.00
11	North Fork	Post Mile 8.0	8.00	Post Mile 12.0	12.00	4.00
12	North Fork	Post Mile 12.0	12.00	Post Mile 16.0	16.00	4.00

RESULTS

SCOTT RIVER

Spawning ground surveys were conducted in nearly all of the river reaches (Reaches 1 through 7) located with in the lower canyon reach of the river from the mouth upstream to the USGS gauge. Unfortunately the Department was not allowed access to several important spawning reaches located within the Scott Valley where the river crosses over private property. In Reach 8, from the Meamber Road Bridge downstream to the USGS gauge, the Department had permission to survey approximately 81.5% of the river. In Reach 9, from the Dunlap Bridge downstream to Meamber, the Department had permission to conduct surveys in about the lower 1.3 miles of this reach. However, this area contains very little spawning habitat and surveys were not conducted in this section. Instead, survey effort was directed to other reaches of the river further upstream where permission was granted. Permission was not granted to survey the upper portions of Reach 9 and this area is known to provide valuable spawning habitat and gravel mining operations currently occur in this area. In Reach 10, from the Highway 3 Bridge downstream to Dunlap crossing, the Department received permission to survey approximately 76.6% of the reach. This reach contains several important spawning areas that are consistently used by Chinook salmon. No surveys were conducted in Reach 11 as this reach contains very little spawning habitat. Reach 11 is characterized by low gradients and is dominated by long reaches of slow water and fine sediments.

Several important spawning areas are present in Reaches 12, 13, and 14, from Young's Dam downstream to Eller Lane. During the 2003 season approximately 85% of the major spawning areas located in Reach 12 and 13 were surveyed by either Department staff or by local landowners who agreed to assist the Department in this effort. Unfortunately, landowner participation during the 2004 spawning season decreased, and as a result, only 42.7% of the river in Reaches 12 and 13 were surveyed. Reach 14 extends from Young's Dam downstream to Horn Lane, a distance of approximately 1.97 miles. The landowner in Reach 14 granted permission allowing local students from Etna High School to conduct spawning ground surveys throughout this reach. Etna High School students, with assistance from the Siskiyou Resource Conservation District, conducted 5 surveys during the season and they recorded a total of 8 live Chinook salmon and 19 spawning redds.

Fall Chinook Salmon Run Size and Population Characteristics

A total of 173 carcasses were examined during the survey on the Scott River. Of these, survey crews tagged 101 (Path 1) carcasses and recovered 41 (Path 3) carcasses for a recovery rate of 40.5%. The Petersen model estimated the run size to be 449 fish (Appendix A) and the Schaefer model estimated a run size of 376 fish (Appendix B). The reaches that were not fully surveyed were expanded to account for un-sampled areas yielding a Schafer estimate of 413. The number of live Chinook salmon that were observed on the last day of the survey was 25 fish, which was added to the expanded Schaefer Estimate to yield a total run size estimate of 438 fish.

Chinook salmon females ranged in fork length from 43 cm to 98 cm (Figure 1) and Chinook salmon males ranged in fork length from 39 cm to 105 cm (Figure 2). Grilse were determined to be <55 cm in fork length and comprised approximately 7.6% of the total run.

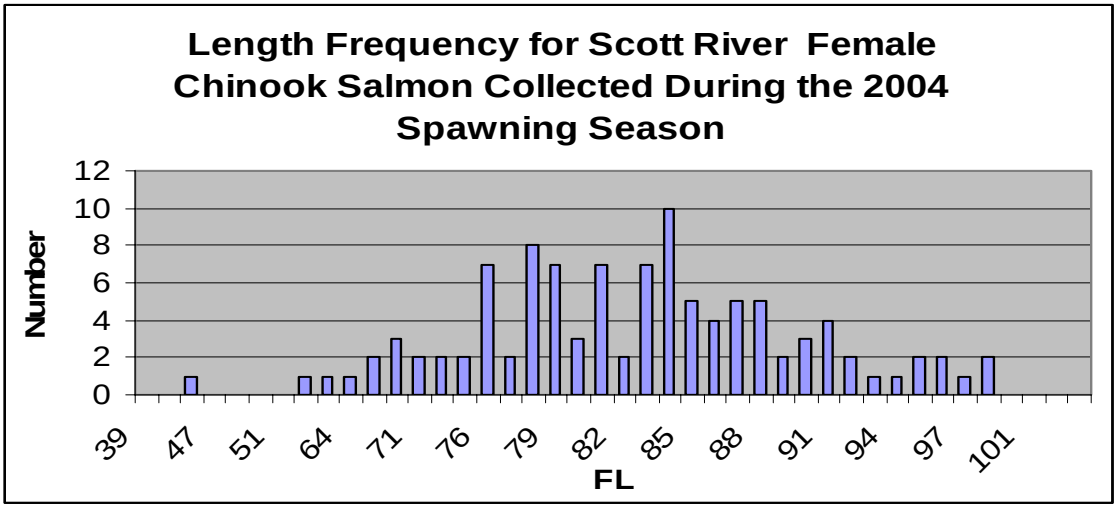

Figure 1. Length frequency distribution of female Chinook salmon carcasses observed on the Scott River during the 2004 spawning ground survey.

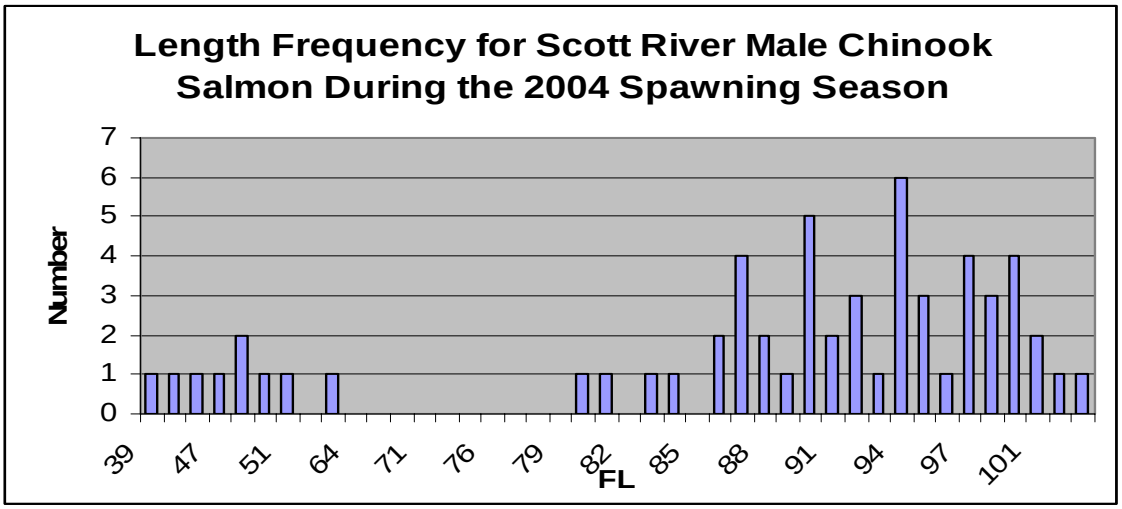

Figure 2. Length frequency distribution of male Chinook salmon carcasses observed on the Scott River during the 2004 spawning ground survey.

Scott River fall Chinook salmon survey data with results of the carcass survey and redd survey is summarized by Reach and date in Appendix C.

No coho salmon were observed during the fall Chinook salmon spawning surveys.

Scott River Flows

At the beginning of the survey effort, in mid October, flows in the Scott River measured at the USGS gauge (Gauge # 11519500) downstream of Fort Jones were 32 cfs. Three storm events occurred with in the Scott River basin during the spawning ground survey. The first storm occurred towards the end of October and run off associated with this storm increased flows in the river to approximately 130 cfs on October 24th. In response to this flow increase, adult salmon moved further up river and spawning activity in the Scott Valley increased. Flows then remained between 100 to 125 CFS for the major portion of the surveys. Another storm system occurred at the end of November, at which time surveys ceased because most of the spawning had already occurred (Figure 3).

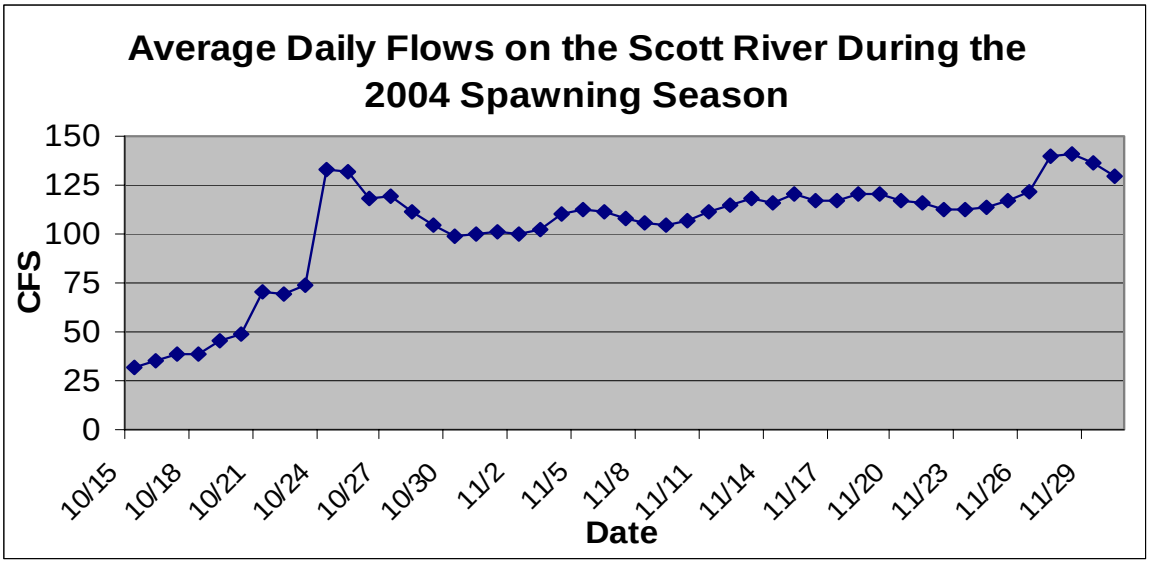

Figure 3. Average daily flows (cfs) observed in the Scott River from October 15 through November 30, 2004 at the USGS gauge (#11519500) located near Fort Jones. Data are provisional at this time and may be subject to revision.

SALMON RIVER

A total of 11 cooperative surveys were conducted on the Salmon River between October 18th and November 24th. The Forest Service and cooperators conducted three additional surveys on the lower mainstem Salmon River. A total of 135 Chinook salmon carcasses were examined on the Salmon River during the survey and 5 carcasses were observed but could not be recovered (Path 4) during the 2004 season. Seventy-one (71) carcasses were tagged (Path 1) and 11 tagged carcasses were recovered (Path 3) for a recovery rate of 15.5%. The Petersen model estimated the run size to be 677 fish (Appendix A) and the Schaefer model estimated a total of 333 Chinook salmon (Appendix B).

Male Chinook salmon ranged in FL from 38 cm to 105 cm (Figure 4), and females ranged in FL from 43 cm to 96 cm (Figure 5). Based on examination of the length frequency distribution, grilse were determined to be <55 cm in fork length. Based on this analysis, adult salmon comprised 90.0% (300 fish) of the run and grilse comprised 9.9% (33 fish) of the run.

Salmon River fall Chinook salmon survey data with results of the carcass survey and redd survey is summarized by Reach and date in Appendix D.

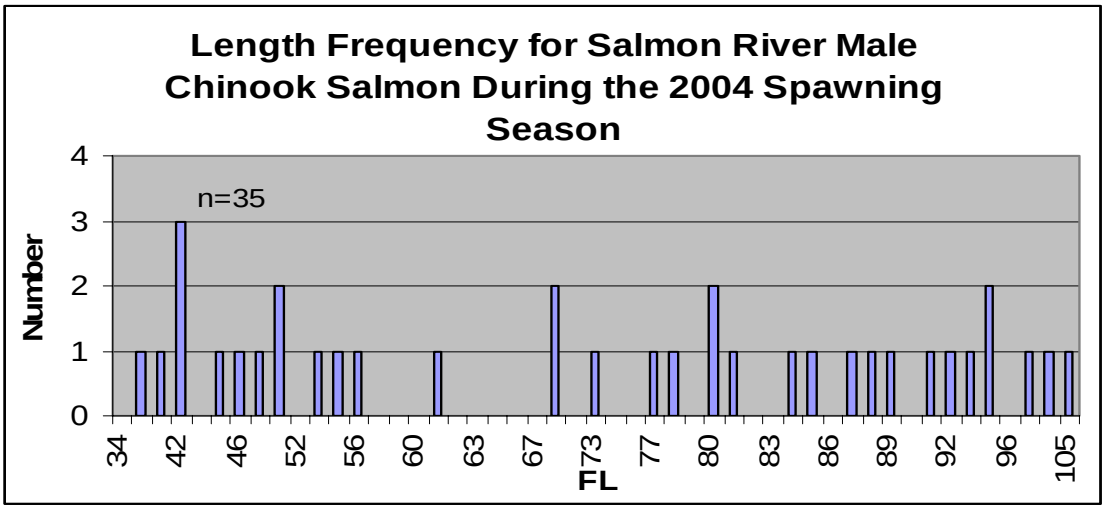

Figure 4. Length frequency distribution of male Chinook salmon carcasses observed on the Salmon River during spawning ground surveys conducted during the 2004 season.

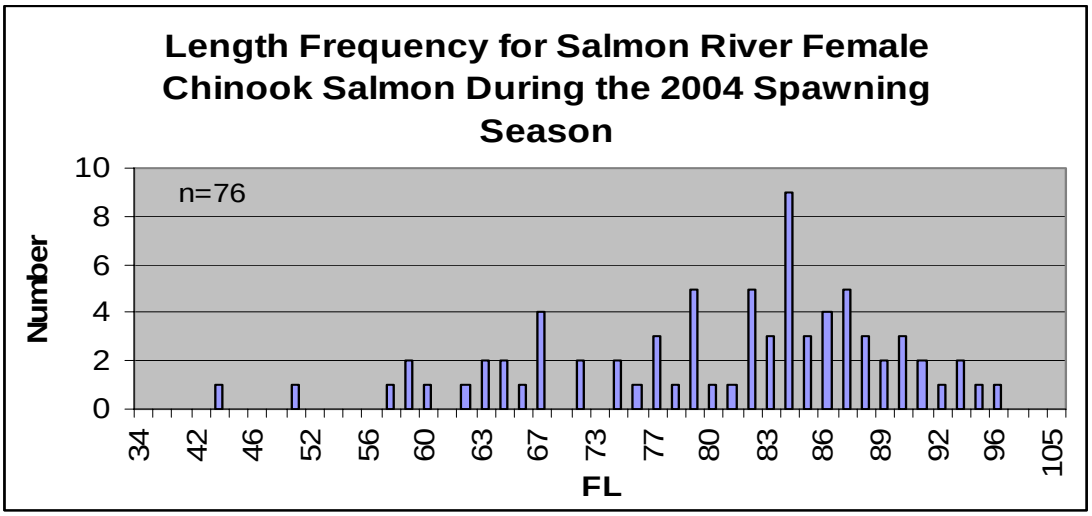

Figure 5. Length frequency distribution of female Chinook salmon carcasses observed in the Salmon River during spawning ground carcass surveys conducted during the 2004 season.

Salmon River Flows

Average daily flows in the Salmon River, as measured at USGS Gauge #11522500 located near Somes Bar, ranged from a low of 155 cfs to high of 931 cfs during the survey period (Figure 6) from October 15th through November 29th. The three storm events during the early part of the season may have contributed to our low recovery rate on the Spawner surveys.

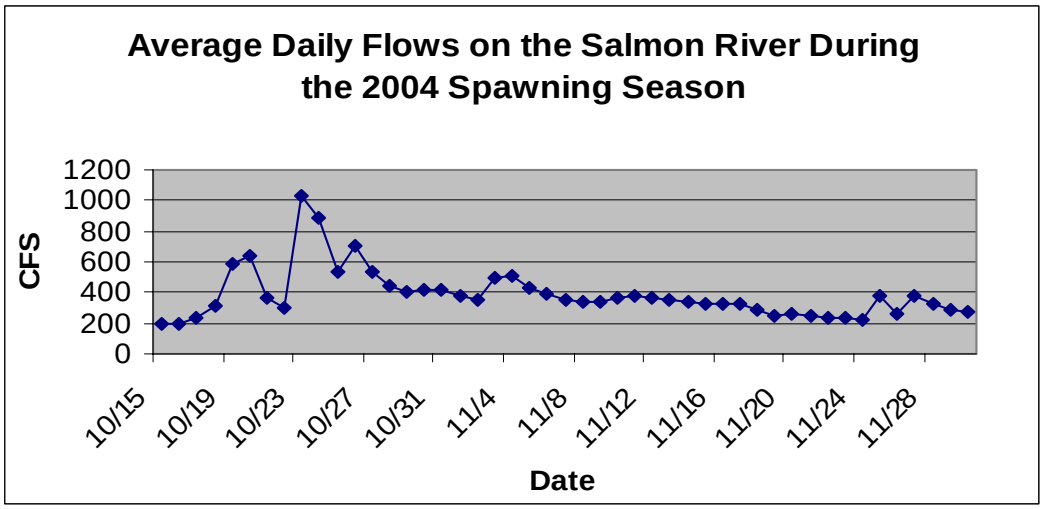

Figure 6. Average daily flows recorded for the Salmon River at the USGS gauge (#11522500) located near Somes Bar from October 15 to November 30, 2004. Data are provisional at this time and may be subject to revision.

Fall Chinook Salmon Spawning Distribution

Fall-run Chinook salmon survey data with results of the carcass survey and redd survey is summarized by reach and survey date is provided in Appendix D. A total of 1,519 redds were observed during the survey. Although Chinook salmon redds were observed in all reaches, the greatest concentration of spawning occurred in the main stem, upstream of Nordheimer Ck (213 redds), and in the lowest reach of the South Fork (232 redds) and in the lowest reach of the North Fork (227 redds).

MISCELLANEOUS KLAMATH TRIBUTARY STREAMS

Fall Chinook salmon spawning ground surveys on the smaller tributary streams began on October 15 and ended on December 18, 2004. Crews handled a total of 81 Chinook salmon carcasses. The sizes of those Chinook salmon carcasses ranged from 34 cm to 103 cm in FL and with an average FL of 82.6 cm.

The population estimates for the smaller tributary streams were derived by multiplying the number or redds observed by a factor of 2, assuming each redd supported 2 adult salmon. The number of live fish observed on the last day of the survey, for each tributary stream, was then added to the redd based expansion to obtain a total population estimate for each stream. Based on these assumptions, the Department conservatively estimates that approximately 477 fall-run Chinook salmon spawned in these smaller tributary streams to the Klamath River above the confluence with the Trinity River (Table 3). Since these tributaries are only surveyed periodically, the estimates presented in Table 3 are considered to be minimum estimates.

Table 3. Summary of the Chinook salmon redd surveys for the miscellaneous tributary streams in the mid-Klamath Basin, 2004.

Stream	Total Redds	Lives Last Survey a/	2004 Estimate	2003 Estimate	2002 Estimate
Aiken Creek	0	0	0	0	14
Beaver Creek	10	14	34	224	98
Bluff Creek	6	0	12	20	36
Boise Creek	0	0	0	0	12
Camp Creek	21	6	48	345	180
China Creek	0	0	0	0	0
Clear Creek	29	68	126	310	298
Dillon Creek	11	34	56	68	33
Elk Creek	18	43	79	321	232
Grider Creek	9	0	18	233	224
Horse Creek	9	4	22	8	29
Independence Creek	0	0	0	0	0
Indian Creek	ns	ns	ns	ns	4
Irving Creek	0	0	0	0	0
Perch Creek	0	0	0	0	0
Red Cap Creek	30	2	62	126	108
Rock Creek	0	0	0	0	0
Slate Creek	1	1	3	0	0
Swillup Creek	0	0	0	0	0
Thompson Creek	8	1	17	106	48
Ti Creek	0	0	0	0	0
Walker Creek	0	0	0	0	0

a/ The number of live chinook salmon observed on the last day of the redd surveys.

DISCUSSION

The Department's Klamath River Project has been conducting run size estimates for the Klamath basin since 1978. As discussed in the Introduction, the methods used to conduct these estimates for the Scott and Salmon Rivers have changed over the years as better survey techniques and cooperation with other stakeholders have matured through time. The cooperative spawning surveys began in 1992 and since that time have remained the most reliable method to estimate Chinook salmon escapement levels in the Scott and Salmon Rivers. Cooperators in the 2004 survey included staff from the U.S. Forest Service, the Yurok, Karuk Natural and Quartz Valley Tribes, Salmon River Restoration Council, the Siskiyou Resource Conservation District, local schools, volunteers and land owners.

SCOTT RIVER

During the 2004 season the Department estimates that 438 Chinook salmon entered the Scott River to spawn. Since 1978 the number of Chinook salmon in the Scott River has ranged from a low of 1,615 fish in 1990 to a high of 14,477 fish in 1995, and has averaged 5,626 fish over the last 27 years. This year's run ranks as the lowest run recorded since 1978 (Table 4).

Table 4. Run size estimates for fall Chinook salmon observed in the Scott River from 1978 to 2004.

Year	Grilse	Adults	Total	Year	Grilse	Adults	Total
1978	1,909	3,423	5,332	1992	965	1,873	2,838
1979	428	3,396	3,824	1993	265	5,035	5,300
1980	2,245	2,032	4,277	1994	505	2,358	2,863
1981	3,409	3,147	6,556	1995	3,279	11,198	14,477
1982	4,350	5,826	10,176	1996	145	11,952	12,097
1983	170	3,398	3,568	1997	277	8,284	8,561
1984	358	1,443	1,801	1998	266	3,061	3,327
1985	1,357	3,051	4,408	1999	563	3,021	3,584
1986	4,865	3,176	8,041	2000	524	5,729	6,253
1987	797	7,769	8,566	2001	744	5,398	6,142
1988	473	4,727	5,200	2002	47	4,261	4,308
1989	1,188	3,000	4,188	2003	66	12,233	12,299
1990	236	1,379	1,615	2004	34	404	438
1991	146	2,019	2,165	AVG	1,096	4,533	5,629

The Klamath River Technical Advisory Team (KRTAT) serves to provide technical assistance to the Klamath Fishery Management Council in providing them with information necessary to make fishery management recommendations annually. To assist in this process, beginning in 1991, the KRTAT began developing age-specific estimates of fall-run Chinook salmon that return to the Basin's hatcheries, spawning grounds, and fisheries (sport and tribal) each year. The Department, and our cooperators, collects scales from carcasses that are sampled during the spawning ground survey to determine the age characteristics of the run. These scales are provided to the Yurok Tribal Fisheries Department during the season for analysis on behalf of the KRTAT. Results of this effort, along with harvest data collected from the fishery, and return data for Trinity and Iron Gate Hatcheries, and population estimates derived throughout the basin from natural spawning areas, such as are presented here for the Salmon and Scott River, are compiled and presented to the KRTAT in January of each year for age composition determinations and cohort reconstruction necessary for harvest management analysis. Because of the short time frame that exists between the end of the Chinook salmon spawning season in December, and the start of the harvest management process in February, the various resource agencies and tribes must prepare preliminary run size estimates and data summaries for the KRTAT by Mid January. Although every effort is made to finalize data results during this short period, it is not uncommon for minor

changes to occur to the preliminary run size estimates after final data editing and analysis are completed. A summary of the age composition results developed by the KRTAT for Chinook salmon returns to the Scott River for the period from 1991 through 2004 is presented in Table 5. The age composition estimate for the 2003 run has been updated to reflect the final run size numbers for the Scott River as presented in this report. Final update to the KRTAT for the 2004 run will occur in their next reporting cycle in March of 2005.

Table 5. Age composition results for Scott River fall Chinook salmon as determined by the Klamath River Technical Advisory Team, 1991 through 2004.

Return Year	Age Composition				Total Adults	Total Run
	2	3	4	5		
1991	146	539	1,418	62	2,019	2,165
1992	965	234	1,621	18	1,873	2,838
1993	265	4,283	673	79	5,035	5,300
1994	505	985	1,338	35	2,358	2,863
1995	3,279	9,653	1,329	217	11,198	14,477
1996	145	3,331	8,597	23	11,952	12,097
1997	277	3,091	4,811	382	8,284	8,561
1998	266	1,933	995	133	3,061	3,327
1999	563	2,178	806	37	3,021	3,584
2000	524	4,701	1,028	-	5,729	6,253
2001	744	3,083	2,293	23	5,398	6,142
2002	47	2,479	1,656	127	4,261	4,308
2003	66	4,489	7,713	31 234	12,333	12,299
2004	21	39	144	234	417	438

The number and proportion of grilse that return to the river each year can sometimes provide insight into the strength of future runs, particularly the 3 year old age class that is anticipated to return in the following year. The KRP estimated that only 47 grilse, or 1.1% of the total run, returned to the Scott River during the 2002 spawning season. Based on this small grilse return, KRP staff anticipated that the strength of the 2003 run might be lower than was observed in 2002. In reality, the final run size estimate for the 2003 spawning run was the second largest on record. However, the run was dominated by 4 year old fish which comprised 62.7% of the run. Three year old fish comprised 36.5% of the run.

The percentage of grilse (age 2 fish) that returned to the Scott River during the 2003 season was extremely low (0.54%) when compared to the period or record dating back to 1978 (Figure 7). Grilse that returned to the Scott River in 2003 were progeny from the

2001 brood year which would have reared in the Scott River and Klamath River during the spring of 2002. The distribution of spawning Chinook salmon during the fall of 2001 was limited to the lower 6.9 river miles (CDFG, 2002). Low flow conditions and migration barriers prevented migration of adult Chinook salmon to much of their historic spawning grounds located further upstream with in the canyon and Scott Valley. Progeny from the 2001 brood year (BY) were therefore, limited to rearing habitats available in the lower 6.9 miles of the Scott River and main stem Klamath River. The low number of grilse observed in the 2003 spawning run may indicate of poor survival of the 2001 BY. If true, the number of 3 year old fish that return to the Scott River in 2004 should also exhibit a corresponding reduction in numbers relative to historic runs. Unfortunately, these predictions turned out to be fairly accurate during the 2004 spawning season. The three year old age class only comprised 9.0% of the run, while the four and five year old age class comprised 33.0% and 53.3% of the run, respectively. Grilse, age 2 fish, comprised 4.7% of the run.

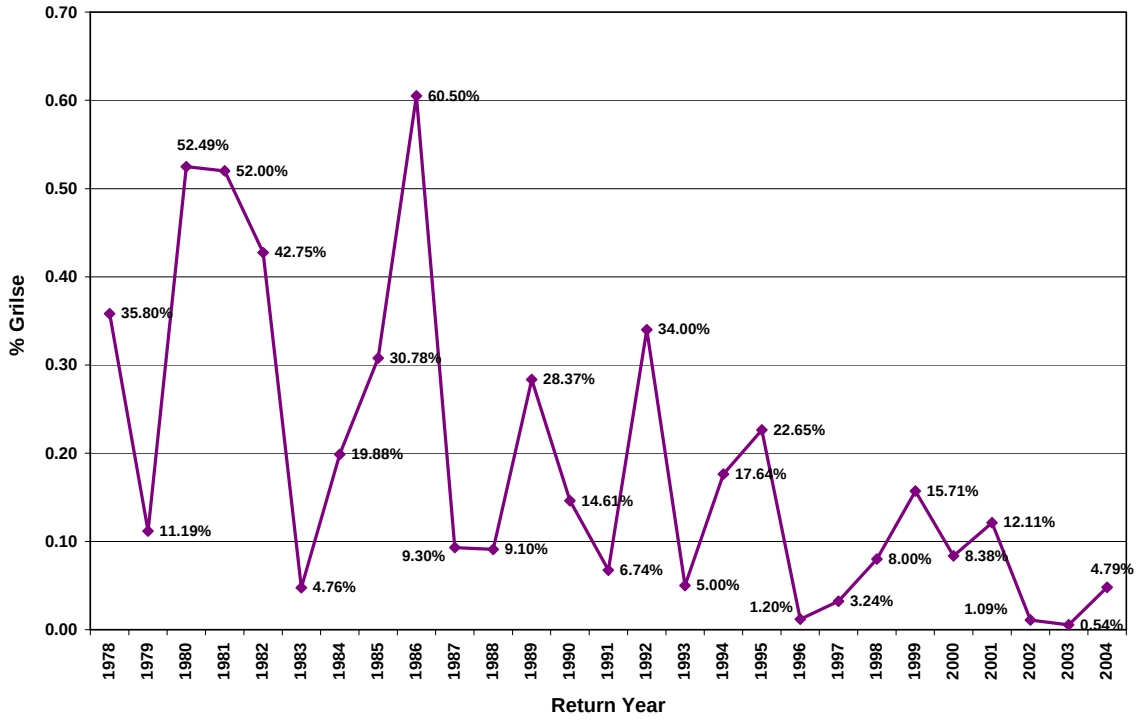

Figure 7. Percent grilse (age 2 fish) observed in the fall Chinook salmon run with in the Scott River from 1978 to 2004.

The Department's Anadromous Fish Research and Monitoring Program (AFRAMP) has been monitoring emigration of juvenile salmonids from the Scott River since the spring of 2000. This effort is conducted in cooperation with the Scott River Ranger District of the Klamath National Forest. The numbers of emigrating juvenile Chinook salmon observed in rotary trapping efforts during the spring of 2002 (2001 BY) was estimated to be 11,000 fish, 22,000 fish less than was observed in the previous year (Chesney & Yokel, 2003). Reduced juvenile Chinook trap catches observed during the 2002 rotary trapping effort are likely related to the spawner distribution and may not be truly

reflective of reduced survival. In 2001 a large proportion of Chinook salmon spawned downstream of the rotary trapping site and progeny from those adults would not have been sampled by the trap. Regardless, progeny from the 2001 BY year did not have as much river length available to them for rearing and it is reasonable to speculate that reduced rearing habitat and poor emigration conditions associated with dry water year conditions throughout the basin may have negatively impacted survival of this brood year. The low number of grilse observed in 2003 combined with the very low return of age 3 Chinook salmon observed this year appears to confirm fears that survival of 2001 BY was indeed very poor.

SALMON RIVER

The Department estimates that 333 fall Chinook salmon entered the Salmon River during the 2004 spawning season. Since 1978 the number of fall Chinook salmon entering the Salmon River has ranged from a high of 6,000 fish in 1997, to a low of 780 fish in 1999 (Table 6). The 2004 fall Chinook salmon run ranks as the lowest run size that has been observed thus far.

Table 6. Run size estimates for fall Chinook salmon observed in the Salmon River from 1978 to 2004.

Year	Grilse	Adults	Total	Year	Grilse	Adults	Total
1978	1,400	2,600	4,000	1992	547	778	1,325
1979	150	1,000	1,150	1993	456	3,077	3,533
1980	200	800	1,000	1994	277	3,216	3,493
1981	450	750	1,200	1995	1,335	4,140	5,475
1982	300	1,000	1,300	1996	274	5,189	5,463
1983	75	1,200	1,275	1997	217	5,783	6,000
1984	216	1,226	1,442	1998	116	1,337	1,453
1985	905	2,259	3,164	1999	110	670	780
1986	949	2,716	3,665	2000	228	1,544	1,772
1987	118	3,832	3,950	2001	743	2,607	3,350
1988	327	3,273	3,600	2002	78	2,669	2,747
1989	695	2,915	3,610	2003	73	3,302	3,375
1990	596	4,071	4,667	2004	33	300	333
1991	143	1,337	1,480	AVG	407	2355	2763

As was discussed earlier, the KRTAT develops age composition data for each run within the Klamath River Basin. This process began during the 1991 season and has continued every year since then. Age structure is typically developed from results of scale analysis conducted by the Yurok Tribe from scale samples provided by the various cooperators with in the Basin. Scale samples collected from carcasses examined in the Salmon River were provided, and the results of the age composition analysis for the 2004 return year, and previous years since 1991, are provided in Table 7.

Table 7. Age composition results for Salmon River fall Chinook salmon as determined by the Klamath River Technical Advisory Team, 1991 through 2004.

Return Year	Age Composition 2	3	4	5	Total Adults	Total Run
1991	143	201	1,086	50	1,337	1,480
1992	547	203	570	5	778	1,325
1993	456	2,772	297	8	3,077	3,533
1994	277	1,883	1,301	32	3,216	3,493
1995	1,335	2,891	1,120	129	4,140	5,475
1996	274	1,740	3,439	10	5,189	5,463
1997	217	2,450	3,115	218	5,783	6,000
1998	116	706	584	46	1,337	1,453
1999	110	392	272	6	670	780
2000	228	1,102	421	21	1,544	1,772
2001	743	1,433	1,174	-	2,607	3,350
2002	72	1,206	1,279	-	1,486	2,558
2003	73	1,245	2,039	17	3,302	3,375
2004	51	55	214	14	300	333

The number of grilse that have returned to the Salmon River over the last three years (2002, 2003, and 2004) has been the lowest recorded since 1991 when the KRTAT began age composition analysis for the Klamath basin. The percentage of grilse in the total run in 2002 and 2003 was also the lowest on record (Figure 8).

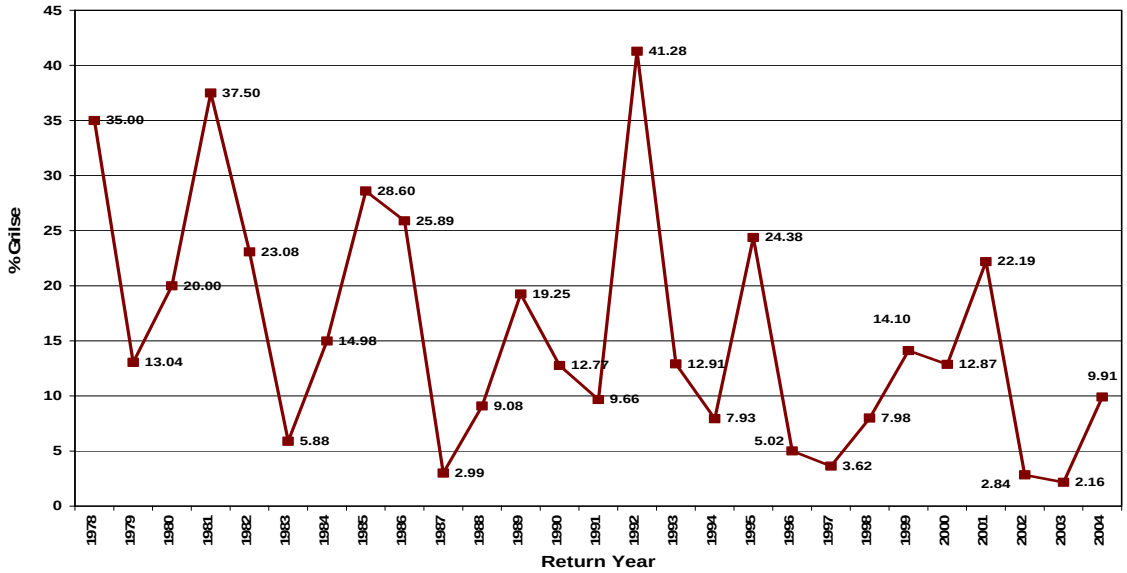

Figure 8. Percent grilse (age 2 fish) observed in the total fall Chinook salmon run in the Salmon River from 1978 to 2004.

Only 72 grilse returned to the Salmon River in 2002 which tends to indicate that the 3 year old return the following year would also be down in numbers. In 2003 a total of 3,375 fall Chinook were estimated in the Salmon River, exceeding the average return that has been observed since 1978 by 612 fish. However, age 4 fish comprised the majority of the run (60%) in that year, while age 3 fish only comprised 37% of the run. The grilse return in 2003 only included 73 grilse, and in 2004 age 3 Chinook only accounted for 17% of the entire run.

CONCLUSION

Progeny (ocean type) from both the Scott and Salmon River must pass through the Klamath River during their emigration in late spring. The Scott River enters the Klamath River at river mile 143 and the Salmon River enters the Klamath River at river mile 66. Therefore, conditions in the Klamath River also play a major role in the over all survival and health of Chinook salmon progeny from the Scott and Salmon Rivers.

In recent years high incidence of disease infections have been documented in both natural and hatchery origin Chinook salmon juveniles within the main stem Klamath River (Foott et al 2002). The primary pathogens believed responsible for the disease outbreaks include two myxozoan parasites *Ceratomxya shasta* (C. Shasta) and *Parvicapsula minibicornix* (Parvicapsula) and the bacterial disease *Columnaris*. C. Shasta is endemic to the Klamath River and has a complex life cycle using both salmonids and a polychaete worm, *Manaynukia speciosa*, as host species. The polychaete worm is often associated with aquatic macrophytes and algae including attached periphyton species such as Cladophora which is commonly found in the Klamath River (Stocking and Bartholomew 2004). Stocking and Bartholomew hypothesize that the high incidence of C. Shasta in the Klamath River is related to increased populations of the polychaete worm in response to an increase in available habitat for the worm which is provided by Cladophora. Nutrient rich water, stable flow releases and lack of scouring flows in recent years have created favorable conditions for establishment and production of algae species which are used by the polychaete worm. Dry year conditions have prevailed in the Klamath River since the 2000 water year, and peak daily flows at Iron Gate have ranged from 5,060 cfs in 2000 to 2,120 cfs in 2001. The lack of scouring flows in recent years have likely benefited establishment of macrophytes and periphyton and may have resulted in an increase in polychaete worm populations. The low flow conditions that existed in the spring of 2002, combined with the lack of any scouring flows since 1999, probably created ideal conditions for the myxozoan parasite populations to flourish. This disease, combined with poor emigration conditions in the Klamath River, are likely responsible for the poor survival of the 2001 Chinook brood year.

ACKNOWLEDGEMENTS

The fall Chinook spawning ground surveys require an enormous amount of effort and collaboration among all of the cooperators who participate each year. Staff from the Klamath River Project would like to thank all of our cooperators for their contributions towards this effort. These include biological and technical staff from the Klamath National Forest, Six Rivers National Forest, Yurok Tribal Fisheries Department, Karuk Tribe's Natural Resource Department, Salmon River Restoration Council, and the Siskiyou Resource Conservation District. Staff would also like to thank Tara Palmer (Junction Elementary School), Jim Morris (Etna High School), and Danielle Quigley (Siskiyou RCD) for their continued support in encouraging local student participation in the survey.

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APPENDIX A

PETERSEN MARK AND RECAPTURE ESTIMATE FOR THE SCOTT AND SALMON RIVERS, 2004

$$\text{Petersen Estimate} = \frac{(M+1)(C+1)}{(R+1)}$$

Where: M = The number of salmon carcasses tagged (Path 1).
C = The total number of salmon carcasses examined.
R = The number of tagged salmon carcasses recovered (Path 3).

Scott River

M = 10, C = 171, R = 40

Petersen Estimate = ((100+1)(171+1))/(40+1)
= 424

Total Run Size Estimate = 424 + 25 (live Chinook observed on last surveys)
= 448 Fish

Salmon River

M = 71, C = 140, R = 11

Petersen Estimate = ((71+1)(140+1))/(11+1)
= 846

Total Estimate = 846 – 238 (Spring Run) +15 (Lives) +54 (Wooly Creek)
= 677 Fish

APPENDIX B

SUMMARY OF SCHAEFER MARK AND RECAPTURE ESTIMATES FOR THE SCOTT AND SALMON RIVERS, 2004

The Schaefer equation was used to estimate the final Chinook salmon run size as follows:

$$\text{Escapement} = \sum((R_{ij})(M_i/R_i)(C_j/R_j)$$

Where:
M_i = The number of fish marked in period i,
R_i = The number of marked fish recaptured in period i,
R_j = The number of marked fish recaptured in period j,
C_j = The total number of fish recaptured in period j.

APPENDIX B (Continued)

Summary of tagged fish recovery effort during the 2004 Chinook Salmon Survey on the Scott River															
		Week of Tagging (i)											Rj Total Tagged fish Recovered	Cj Total Fish Recovered	Rj/Cj
Week of Recovery (j)		19Oct	22 Oct	16 Oct	29 Oct	2 Nov	5 Nov	9 Nov	12 Nov	16 Nov	19 Nov	23 Nov			
		1	2	3	4	5	6	7	8	9	10	11			
19 Oct	1												0	1	0.00
22 Oct	2	1											1	3	3.00
26 Oct	3												0	6	0.00
29 Oct	4			3									3	12.58	4.19
2 Nov	5				3								3	22.51	7.51
5 Nov	6					5.22							5.22	15.42	2.95
9 Nov	7					3.29	4.68						7.97	41.82	5.25
12 Nov	8				1.14			5.68					6.82	26.18	3.84
16 Nov	9							1.22	8.36				9.58	37.55	3.92
19 Nov	10								1	6.90			7.90	14.36	1.82
23 Nov	11								1.22				1.22	8.9	7.26
Recovered Ri		1	0	3	4.14	8.51	4.68	6.90	10.58	6.90	0	0	45.74	189.36	39.73
Total Fish Tagged Mi		1	2	4	9.58	16.51	10.19	26.80	17.32	22.20	0	0			
Mi / Ri		1.00	0.00	1.33	2.31	1.94	2.18	3.88	1.64	3.21	0.00	0.00			

Computed Schafer Estimate Table for Scott River 2004													
		Week of Tagging (i)											Total
		19 Oct	22 Oct	16 Oct	29 Oct	2 Nov	5 Nov	9 Nov	12 Nov	16 Nov	19 Nov	23 Nov	
Week of Recovery (j)		1	2	3	4	5	6	7	8	9	10	11	
19 Oct	1												0.00
22 Oct	2	3											3.00
26 Oct	3												0.00
29 Oct	4			16.77									16.77
2 Nov	5				52.04								52.04
5 Nov	6					29.91							29.91
9 Nov	7					33.47	53.51						86.99
12 Nov	8				10.15			84.56					94.72
16 Nov	9							18.64	53.70				72.35
19 Nov	10								2.97	40.33			43.31
23 Nov	11								14.60				14.61
Total		3.00	0.00	16.77	62.19	63.39	53.51	103.21	71.29	40.33	0.00	0.00	413.70
												Plus last day live fish (25) =	438

APPENDIX B (Continued)

Summary of tagged fish recovery effort during the 2004 Chinook Salmon Survey on the Salmon River															
		Week of Tagging (i)											Rj Total Tagged fish Recovered	Cj Total Fish Recovered	Rj/Cj
Week of Recovery (j)		18 Oct	21 Oct	25 Oct	28 Oct	1 Nov	4 Nov	8 Nov	11 Nov	15 Nov	18 Nov	22 Nov			
		1	2	3	4	5	6	7	8	9	10	11	0	1	0.00
18 Oct	1												0	5	0.00
21 Oct	2												0	10	0.00
25 Oct	3												1	6	6.00
28 Oct	4			1									3	21	7.00
1 Nov	5			2	1								1	12	12.00
4 Nov	6					1							1	8	8.00
8 Nov	7					1							0	12	0.00
11 Nov	8												1	20	20.00
15 Nov	9								1				3	14	4.67
18 Nov	10									1	2		1	12	12.00
23 Nov	11										1		0	0	0.00
Recovered Ri		0	0	3	1	2	0	0	1	1	3	0	11	121	69.67
Total Fish Tagged Mi		0	3	9	2	15	7	6	8	13	8	0			
Mi / Ri		0.00	0.00	3.00	2.00	7.50	0.00	0.00	8.00	13.00	2.67	0.00			

Computed Schafer Estimate Table for Salmon River 2004													
		Week of Tagging (i)											Total
		18 Oct	21 Oct	25 Oct	28 Oct	1 Nov	4 Nov	8 Nov	11 Nov	15 Nov	18 Nov	22 Nov	
Week of Recovery (j)		1	2	3	4	5	6	7	8	9	10	11	
18 Oct	1												0.00
21 Oct	2												0.00
25 Oct	3												0.00
28 Oct	4			18.00									18.00
1 Nov	5			42.00	14.00								56.00
4 Nov	6					90.00							90.00
8 Nov	7					60.00							60.00
11 Nov	8								160.00				0.00
15 Nov	9									60.67	24.89		160.00
18 Nov	10										32.00		85.56
23 Nov	11												32.00
Total		0.00	0.00	60.00	14.00	150.00	0.00	0.00	160.00	60.67	56.89	0.00	501.53
Minus Spring Chinook (238), Plus last day live fish (15), Plus Wooley Creek (54) =													333

APPENDIX C: Summary of Chinook Carcass Recoveries by Path, Live Chinook Observed, and Redd Observations that were collected during the spawning ground surveys on the Scott River, 2004

Reach	Survey date											
	10/19	10/22	10/26	10/29	11/2	11/5	11/9	11/12	11/16	11/19	11/23	Total
1	1 0 0 0 52 26	1 1 0 0 106 0	4 0 1 0 29 0	5 3 0 0 50 0	9 3 0 0 32 20	2 4 0 0 16 17	4 1 0 0 13 17	1 2 0 0 6 0	2 0 0 0 4 0		0 0 0 0 0 0	29 14 1 0 308 80
2	0 0 0 0 6 5	0 0 0 0 77 0	0 0 0 0 27 0	4 0 0 0 118 0	2 0 0 0 51 0	2 0 0 0 22 3	2 2 2 0 12 0	0 1 0 0 3 4	0 0 0 0 3 8			10 3 2 0 319 20
3	0 0 0 0 27 0	1 0 0 0 113 0	0 0 0 0 48 0	0 0 0 0 94 0	3 0 1 0 135 0	1 0 0 0 15 6	4 1 1 0 100 0	3 1 0 0 21 0	2 0 0 1 0 0		0 0 1 0 4 0	14 2 3 1 557 6
4	0 0 0 0 0 0	0 0 0 0 14 5	0 0 1 0 12 0		1 0 2 0 30 0	0 0 0 0 0 0	3 0 0 0 0 0		2 0 1 0 9 0	0 1 0 0 5 0	0 0 1 0 2 0	6 1 5 0 72 5
5	0 0 0 0 1 0	0 0 0 0 42 0		0 0 0 0 32 0		0 0 0 0 0 0	1 0 0 0 13 0			0 0 4 0 1 0		1 0 4 0 89 0
6	0 0 0 0 0 0			0 0 0 0 32 0	0 0 0 0 37 0		2 0 1 0 11 0		2 0 1 0 0 0		0 0 0 0 0 0	4 0 2 0 80 0
7	0 0 0 0 0 0		0 0 0 0 2 0		0 0 0 0 21 5			6 0 1 0 0 0	5 1 1 0 3 0	0 2 0 0 0 0	0 0 2 0 0 0	11 3 4 0 27 5
8A			0 0 0 0 30 19	0 0 0 0 22 20	1 0 0 0 33 0		7 3 2 0 25 0		7 6 3 0 5 0	0 4 2 0 8 0	0 1 3 0 2 0	15 14 10 0 125 39
8B						4 1 0 0 35 22		6 3 0 0 6 0				10 4 0 0 41 22
10					0 0 0 0 8 7	0 0 0 0 4 8	1 0 0 0 0 0					1 0 0 0 12 15
13						0 0 0 0 3 6						0 0 0 0 3 6
14			0 0 0 0 2 1		0 0 0 0 2 1		0 0 0 0 0 0		0 0 0 0 2 8		0 0 0 0 2 9	0 0 0 0 8 19
Total	1 0 0 0 87 31	2 1 0 0 352 5	4 0 2 0 150 20	9 3 0 0 348 20	16 3 3 0 349 33	9 5 0 0 95 62	24 7 6 0 174 17	16 7 1 0 36 4	20 7 6 1 26 16	0 7 6 0 14 0	0 1 7 0 10 9	101 41 31 1 1641 217

Table Key =

1 3	1 = Path 1, 3 = Path 3
2 4	2 = Path 2, 4 = Path 4
L R	L = Live Chinook, R = Number of Redds

APPENDIX D: Summary of Chinook Carcass Recoveries by Path, Live Chinook Observed, and Redd Observations that were collected during the spawning ground surveys on the Salmon River, 2004.

Reach	Survey Date														
	10/5	10/14	10/18	10/21	10/25	10/28	11/1	11/4	11/8	11/11	11/15	11/18	11/22	11/29	Total
1	0 0 0 0 263 0	0 0 0 0 76 0		0 0 0 0 6 1		0 0 0 0 12 4	0 0 0 0 29 3			0 0 0 0 11 6		0 0 0 0 14 3		0 0 0 0 10 0	0 0 3 0 421 17
2	0 0 0 0 4 0	0 0 0 0 10 0		0 0 0 0 0 3		0 0 0 0 5 5	0 0 0 0 7 5			0 0 0 0 3 2		0 0 0 0 4 5		0 0 0 0 5 3	0 0 4 0 38 20
3	0 0 0 0 13 2	0 0 0 0 67 0		0 0 0 0 8 0		0 0 0 0 64 2	0 0 0 0 59 3			0 0 0 0 5 2		0 0 0 0 1 10		0 0 0 0 0 1	0 0 0 0 217 20
4			0 0 0 0 19 4	0 0 0 0 40 19			3 0 2 0 15 9	3 0 2 0 19 6	0 0 0 0 9 2		2 0 0 0 2 2	0 0 0 0 3 1	0 0 0 0 0 47		8 1 4 0 107 90
5A			0 0 0 0 11 3	1 0 2 0 32 8	1 0 0 0 12 2	0 0 1 0 21 1	8 1 0 0 11 7	0 0 0 0 17 8	1 0 1 2 6 0	2 0 1 0 11 1	2 0 0 1 6 28	2 1 1 0 2 0	0 0 5 0 3 28		17 2 11 3 132 86
5B			0 0 1 0 57 16	1 0 0 0 17 2	2 0 1 0 29 1	0 0 0 0 7 8	0 0 0 0 11 2	2 1 1 0 4 0	0 0 1 0 5 4	1 0 1 0 17 0	1 1 2 0 10 29	1 2 0 0 18 1	0 0 3 0 2 0		8 4 9 0 177 63
6A			0 0 0 0 3 3	0 0 0 0 5 2	0 0 0 0 33 5	1 0 1 0 42 5	0 1 0 0 38 11	1 0 0 0 22 1	3 0 0 0 6 0	1 0 1 0 26 5	3 0 3 0 20 12	1 0 1 0 12 0	0 0 1 0 8 3		10 1 6 0 215 47
6B			0 0 1 0 18 10	1 0 0 0 10 2	1 0 0 0 5 0		2 1 0 1 12 3	0 0 1 0 13 7	1 0 0 0 5 2		1 0 0 0 2 2	2 1 1 0 3 2	0 1 1 0 1 28		8 2 4 1 69 56
7						0 0 0 0 4 4									0 0 0 0 4 4
9			0 0 0 0 21 3	0 0 0 0 31 10	3 0 0 0 27 8	1 1 2 0 40 10	3 1 0 0 41 4		0 0 0 0 21 0	2 0 2 0 11 2	4 0 0 0 7 13	2 0 0 0 0 3	0 0 0 1 1 1		15 1 5 1 200 54
10			0 0 0 0 13 8	0 0 0 0 14 8	2 0 0 0 19 8	0 0 0 0 8 2	0 0 0 0 7 1		1 0 0 0 15 3	2 0 0 0 8 2	0 0 0 0 3 24				5 0 0 0 87 51
11			0 0 0 0 6 0					0 0 0 0 1 3			0 0 0 0 0 0		0 0 0 0 0 11		0 0 0 0 7 14
total	0 0 0 0 280 2	0 0 0 0 153 0	0 0 2 0 148 47	3 0 2 0 163 50	9 0 1 0 125 24	2 1 3 0 203 41	16 3 4 1 230 48	6 1 4 0 76 25	6 1 2 2 67 11	8 0 8 0 92 20	13 1 5 1 50 110	8 3 7 0 55 22	0 1 10 1 15 118	0 0 4 0 15 4	71 11 53 5 1672 522

Table Key =

1 3	1 = Path 1, 3 = Path 3
2 4	2 = Path 2, 4 = Path 4
L R	L = Live Chinook, R = Number of Redds