

**Shasta River Fish Counting Facility,
Chinook and Coho Salmon Observations in 2007-2008
Siskiyou County, CA**



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ABSTRACT

An underwater video camera was operated in the flume of the Shasta River Fish Counting Facility (SRFCF) twenty four hours a day, seven days a week, from September 15, 2007 until January 2, 2008. A total of 2,035 Chinook salmon were estimated to have entered the Shasta River during the 2007-08 spawning season. The first Chinook was observed on September 16, 2007 and the last Chinook on December 30, 2007. Klamath River Project (KRP) staff processed a total of 148 carcasses during spawning ground surveys, and a total of 228 Chinook salmon carcasses were collected as wash backs against the SRFCF weir during the season. Chinook salmon ranged in fork length (FL) from 40 cm to 95 cm and grilse were determined to be < 48 cm in fork length. The run was comprised of 43 grilse (0.02%), and 1,992 adults (97.8%). A total of 4 adipose-clipped (AD) Chinook salmon were observed passing through the SRFCF during the season, indicating that these fish were of hatchery origin. The head from 1 AD Chinook salmon was recovered from a carcass examined in the wash back sample. The analysis of the coded wire tag (CWT) recovered from this head indicated that this was a brood year 2004 fish released from Trinity River Hatchery (TRH) as a fingerling in 2005. Expansion of this CWT by the production multiplier yielded an estimate of 4 hatchery origin Chinook salmon. The remaining 3 AD Chinook recovered were of IGH origin. An estimate of hatchery contribution was derived based on applying the proportion of CWT recoveries observed at Iron Gate Hatchery (IGH) to these 3 ad-clipped fish. Using this method a total of 65 additional hatchery origin Chinook salmon were estimated to have entered the Shasta River during the 2007 run. This yields a total estimate of 69 hatchery Chinook, or 3.4% of the total run observed in 2007.

A total of 249 coho salmon were estimated to have entered the Shasta River during the 2007-2008 season. A total of 433 coho salmon were observed passing upstream through the SRFCF and 185 coho salmon were observed passing downstream from November 4, 2007 to December 30, 2007. Since it cannot be assumed that the 185 coho salmon observed moving downstream through the SRFCF remained in the Shasta River, the net number of coho salmon that are known to have remained in the Shasta River is 248 fish. One additional coho salmon was estimated to have passed through the flume during a period of video equipment malfunction. This was approximated by averaging coho salmon movements during the same time period two days before and two days after the malfunction. Using this method, the number of coho salmon remaining in the Shasta River was adjusted to 249 fish. The first coho salmon of the season was observed passing through the SRFCF on November 4, 2007 and the last two coho salmon were observed swimming downstream through the SRFCF on December 30, 2007.

INTRODUCTION

The Klamath River Project (KRP) of the California Department of Fish and Game (Department) is responsible for estimating the number of fall-run Chinook salmon (*Oncorhynchus tshawytscha*) that return to the Klamath River Basin, excluding the Trinity River Basin, each year. To achieve this task the KRP employs several techniques which include a creel survey of sport fishing effort and harvest, 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, Scott River and Bogus Creek.

Video equipment was first installed at the Shasta River Fish Counting Facility (SRFCF) in 1998 and has been used to describe migration of fall-run Chinook salmon into the Shasta River ever

since. Although the primary responsibility of the KRP is to enumerate and describe fall-run Chinook salmon populations, data is recorded for other salmonid species observed at the SRFCF during its period of operation as well.

The Department of Fish and Game has intensified efforts to document the presence of coho salmon within the Klamath Basin and elsewhere since the August 5, 2004, California Fish and Game Commission's proposal to add coho salmon populations between San Francisco and Punta Gorda (Central California Coast ESU) to the state's list of Endangered Species and those between Punta Gorda and the northern border of California, including the Klamath River, (Southern Oregon/Northern California Coast ESU) to the list of Threatened Species (Walsh and Hampton, 2006). Since 2004, the KRP has elected to continue operating the SRFCF beyond the end of the Chinook salmon run in an effort to document migration of coho salmon into the Shasta River.

This report describes the characteristics of the Chinook and coho salmon runs that entered the Shasta River during the fall of 2007.

METHODS

Monitoring of the salmon run within the Shasta River is accomplished through three primary efforts, operation of a video weir, collection of data from salmon carcasses that become impinged on the weir panels as they float downstream (wash backs), and completion of spawning ground surveys to obtain needed biological data from salmon carcasses.

The SRFCF consists of a video camera, counting flume and an Alaska style weir strategically placed in a diagonal direction across the river channel. Fish immigrating upstream are directed through a narrow flume, which passes in front of an underwater video camera. The camera was connected to a time lapse video recorder and monitor. As in 2006, a JVC digital color video camera (Model No TK-C92OU) equipped with a 5 – 50mm 1:1.3 Computar lens¹ was used at the SRFCF, however, in 2007 during periods of high flow this camera was replaced with an Ocean Systems Delta Vision² black and white waterproof digital video camera. A Panasonic time lapse video cassette recorder, model AG-6740, was used to record flume observations and SVHS 120 minute video tapes were used as the recording medium. The weir and video camera were installed during the first week of September and began recording on September 15, 2007. Recording speeds were set at 24 hour mode from September 15, 2007 until September 18, 2007 and after that date at the 12 hour mode for the duration of the season. The video recorder was set to include both a date and time stamp on every recording to accurately document run timing.

KRP staff visited the SRFCF twice daily, once in the morning and once in the evening. During each visit staff inspected the video system to insure that everything was operating as anticipated, changed the video tape, inspected and cleaned the weir panels, processed any wash-back

¹ Use of trade names in this report does not imply endorsement by the Department of Fish and Game.

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carcasses present and conducted routine maintenance of the facility. All equipment was secured under lock and key and access to the site was also controlled through a locked gate located on private property.

All tapes were immediately returned to the office where each was subsequently reviewed by staff in the video lab. During each review staff recorded the date, time (hour:min:sec), and species of each fish observed. In addition, staff noted the observation of AD fish, and recorded the presence of lampreys or any other distinguishable marks that were visible on the tape. All data were then entered into computer files and each data file was subjected to two independent edits prior to commencement of data analysis.

All salmon carcasses that drifted downstream and became impinged on the weir panels were recovered and processed. Data collected on these wash back carcasses included species, gender, and fork length. Scales were removed from the left side of each carcass at a location posterior to the dorsal fin just above the lateral line whenever possible. Scale samples were then provided to the Yurok Tribal Fisheries Department for analysis. Tissue samples were collected from the caudal fins (or other fins if the caudal fin was not available) of wash-back carcasses for genetic analysis. Every carcass was also examined for the presence of fin clips, marks or tags. Heads were collected from each AD clipped fish for later CWT recovery and analysis. Each carcass was also examined to determine whether successful spawning had occurred. Female salmon with more than 50% of their egg mass still present in their body cavity were identified as pre-spawn mortalities. Carcasses were then cut in half to prevent sample duplication and returned to the river downstream of the weir.

Spawning ground carcass surveys were conducted in the lower seven miles of the Shasta River on publicly owned lands and on private lands where permission to access was obtained. In 2007, additional information was gathered from carcasses found at the Nelson Ranch (River Mile (RM) 28- 32), now being managed by the Nature Conservancy (TNC). The purpose of the spawning ground surveys was to gather additional biological data necessary to describe physical characteristics of the run. Surveys were limited to areas typically used by spawning salmon. During each survey, crews walked along the river bank searching for salmon carcasses. As carcasses were located crews processed each as previously described for weir washbacks. The surveys were conducted once a week throughout the fall Chinook salmon spawning season. The first survey occurred on October 17, 2007 and the last survey occurred on November 28, 2007.

Flow information was obtained from the USGS gauge (# 11517500) located near the mouth of the river a short distance upstream of the SRFCF.

RESULTS

Operation of the SRFCF began the morning of September 15, 2007 at approximately 11:18 hours, Pacific Standard Time. The first Chinook of the season was observed on September 16, 2007 at 22:56. At initial installation, the SRFCF included a trap immediately upstream of the video flume which was to be used later in the season for trapping and radio tagging of coho

salmon (Figure 1). Videotape reviewers noted that beginning on September 21, 2007, Chinook would either enter the video flume and back down, or pass upstream through the flume but later back down. After reviewing tapes, KRP and Shasta/Scott Resource Assessment staff elected to remove the trap on September 26, 2007 since it seemed to be impeding the successful upstream movement of Chinook. Following the removal of the trap, Chinook were observed to pass through the flume without backing down.



Figure 1. Coho trap attached to upstream end of video flume at SRFCE, 2007.

On September 16, 2007 the camera box was observed to be leaking and was removed for repair at approximately 18:22 hours. During the ensuing evening and night hours, an underwater video camera was mounted on the entrance to the flume without a camera box and was used to record fish passage. Without the box to guide fish through a narrow opening, visibility was poor. The camera box was re-installed on September 17, 2007 and did not leak for the remainder of the season. The weir and recording equipment were removed on January 2, 2008 in anticipation of high flows.

Chinook Salmon

A net total of 1,994 Chinook salmon were counted passing upstream through the SRFCF during the 2007 season. This number was derived by subtracting the number of downstream observations (133) from the number of upstream observations (2,127). Recording was disrupted on ten occasions lasting from nine minutes to twelve hours, but on two of those occasions, October 19, 2007 and November 19, 2007, the flume was blocked off to prevent fish passage during camera changes. For those lapses in recording where the flume was not blocked, the number of Chinook salmon that may have passed through the SRFCF during equipment malfunctions was estimated by averaging Chinook salmon movements during the same time period two days prior and two days after each video malfunction. Using this method, a total of 41 additional Chinook salmon was estimated to have entered the Shasta River. Therefore, the total run size of Chinook salmon in the Shasta River during the 2007 season was estimated to be 2,035 fish.

The first Chinook salmon movement was observed on September 16, 2007 and the last Chinook salmon was observed on December 30, 2007 (Figure 2).

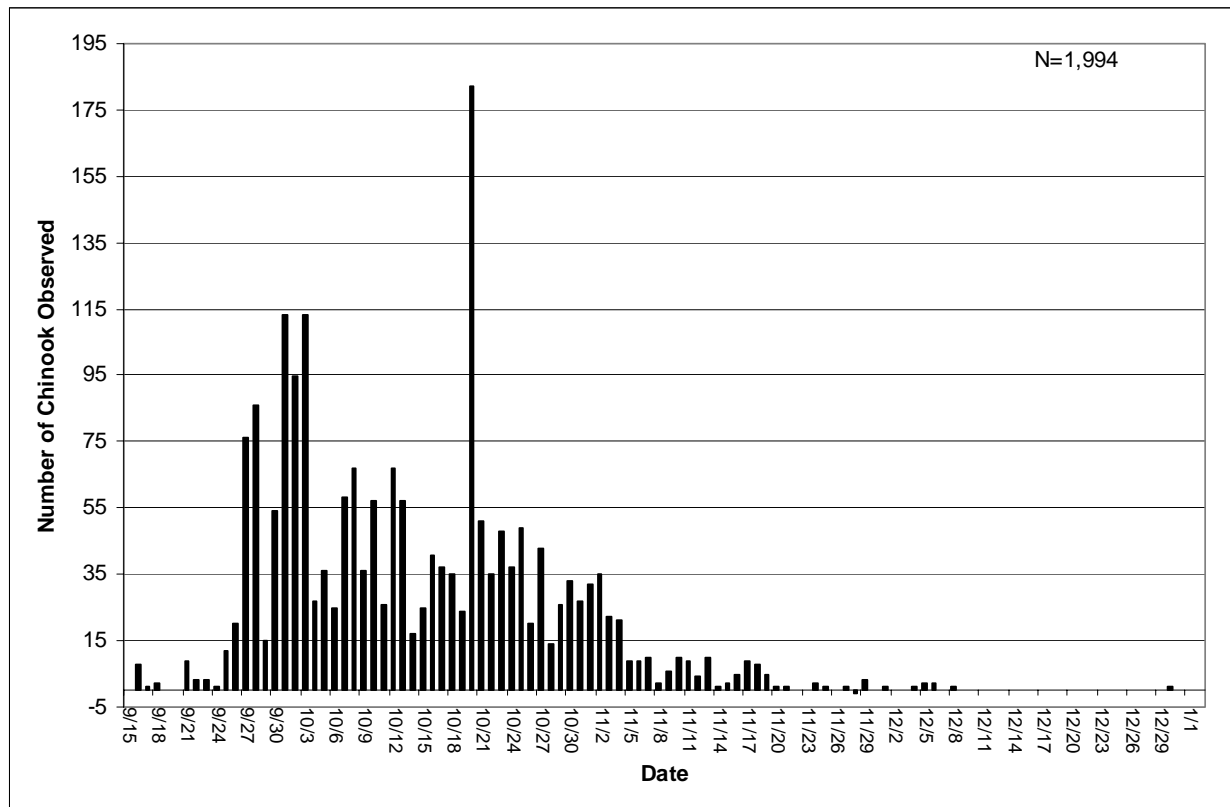


Figure 2. Run timing of fall Chinook salmon observed at the Shasta River Fish Counting Facility in 2007.

Consistent with previous years, the majority of Chinook salmon (88%) passed through the SRFCF during day light hours between 06:00 and 17:00 hours (Figure 3).

The video camera is positioned on the right side of the flume, facing downstream, and therefore, the left side of each fish is visible to the camera as salmon migrate upstream. As staff reviewed each video tape, information was recorded on the presence of lamprey, fin clips, scars or other abnormalities that are may be present on each fish. A total of 356 Chinook salmon, 17.8% of the net number of Chinook salmon observed at the SRFCF, had live lamprey attached to their bodies. Since the right side of each fish cannot be seen during review of video tapes, any of these abnormalities that may be present on the right side cannot be observed. In many cases, lamprey attached to the right side of fish can be seen dangling below, above, or behind, these fish as they pass through the flume. As a result, the estimated number of fish observed with lamprey attached likely underestimates the actual occurrence of lamprey attachments by a small portion.

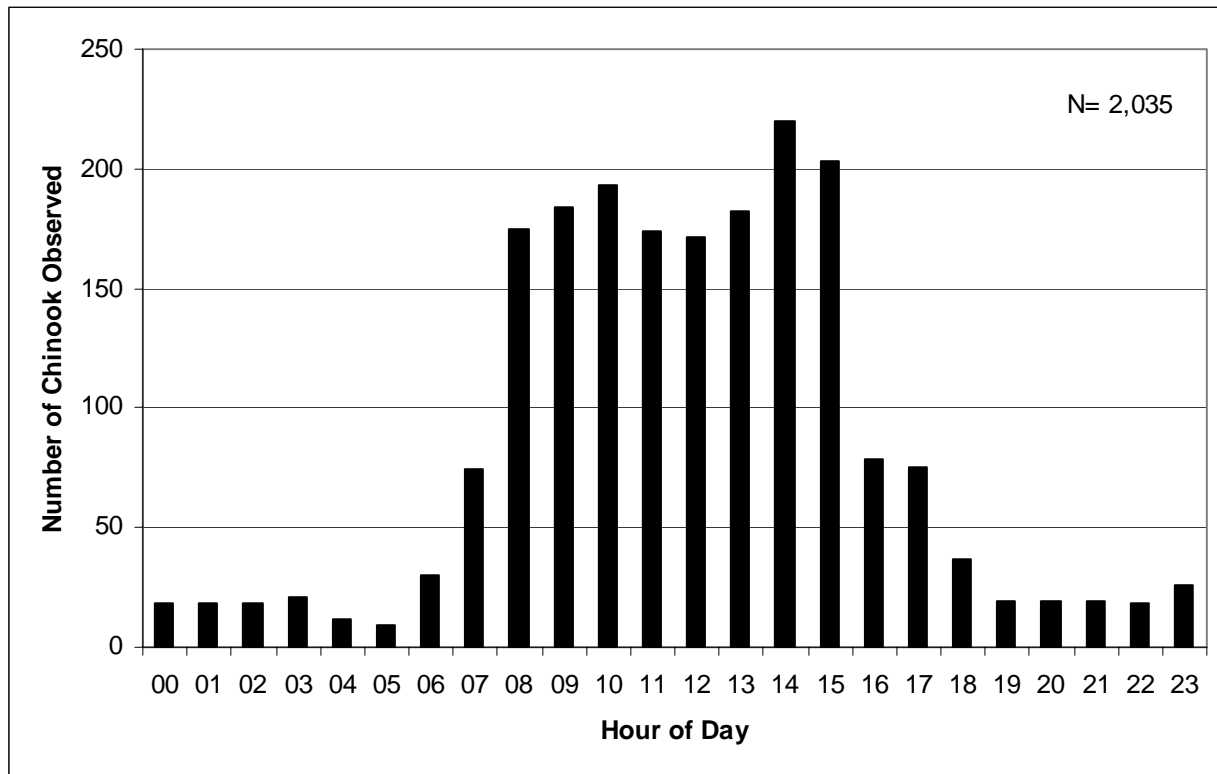


Figure 3. Diel run timing of Chinook salmon movement through the Shasta River Fish Counting Facility during the 2007 season.

A total of 148 Chinook salmon carcasses were sampled during spawning ground surveys, which were conducted in the lower 7 miles of the Shasta River on publicly owned lands or on private lands where permission to access was obtained, and at the upper Shasta River property owned by TNC between river miles 28 and 32. Of the 146 carcasses for which fork lengths were obtained, 99 (68%) were female and 47 (32%) were male. The lower reaches of the Shasta River typically present challenges to survey crews which include access limitations, high flow conditions, poor visibility, rugged terrain, thick riparian vegetation and otter predation on carcasses.

A total of 228 Chinook carcasses were recovered and sampled as wash backs on the weir. Of these, 67 (29%) were female and 161 (71%) were male. It appears that in 2007 the wash back sample was biased toward males and the spawning ground survey sample toward females. To reduce bias associated with the sex composition observed in both samples, KRP staff elected to pool the samples. It does not appear that size selection is biased within the male portion of either sample, based on examination of the male length frequency distributions. Therefore, the grilse cut-off and subsequent grilse/adult proportions were derived from the Chinook length frequency distribution provided by combining the spawning ground survey and wash back samples (Figure 4). KRP staff determined that grilse salmon were < 48 cm in FL. Based on this determination, the Department estimates that the Chinook salmon run in the Shasta River during 2007 was comprised of 43 (2.1%) grilse and 1, 993 (97.9%) adults. .

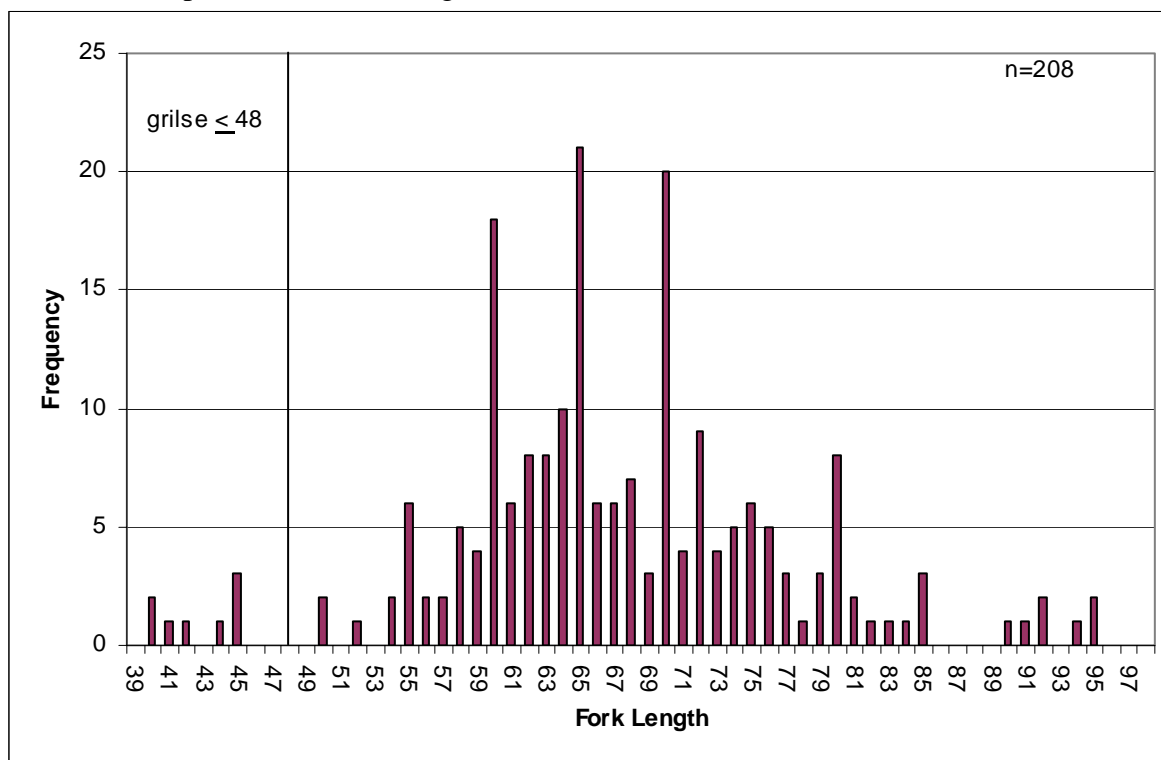


Figure 4. Length frequency distribution of male Chinook salmon recovered during spawning ground surveys or as wash backs impinged on weir panels of the SRFCF during the 2007 season.

A total of four (4) Chinook salmon observed passing through the SRFCF appeared to have been AD indicating that these fish may be of hatchery origin. A head from one AD Chinook salmon was recovered from a carcass examined in the wash back sample. The CWT (#065323) recovered was from the 2004 Chinook salmon brood year released from Trinity River Hatchery (TRH) as a fingerling in 2005. Expansion of this recovery by the hatchery production multiplier (4.06) yields an estimate of 4 fish. Heads from the other three ad-clipped fish observed at the SRFCF were not recovered. Therefore, the origin and production multiplier could not be derived

for these fish. However, if we assume that each of these ad-clipped fish did in fact carry a CWT, an estimate of the potential hatchery contribution to the Shasta River could be derived based on the proportion of CWTs that were observed at IGH during 2007 (Table 1). This assumes that the proportion of hatchery strays into the Shasta River is equivalent to the proportion of CWT recoveries observed at IGH. Based on these assumptions, an estimated 65 hatchery origin Chinook were estimated to have entered the Shasta River. Accounting for the 3 ad-clipped Chinook salmon that were not recovered, a total of 69 hatchery origin Chinook are estimated to have entered the Shasta River during the 2007 season.

Table 1. Estimated contributions of 4 ad-clipped Chinook salmon observed at the SRFCF based on the number of CWT fish actually observed at IGH and expanded based on the production multiplier for each CWT release code.

Coded Wire Tag	Brood Year	Age	Release Type	Number of CWT's observed at IGH	IGH CWT Proportion	Estimated Number of CWT's	Production Multiplier	Estimated Hatchery Contribution
66358	2002	5	Fy	2	0.0028	0.0084	10.52	0
66359	2002	5	Fy	1	0.0014	0.0042	10.00	0
66360	2002	5	Fy	1	0.0014	0.0042	7.99	0
601020407	2002	4	Ff	1	0.0014	0.0042	29.47	0
601020408	2003	4	Ff	5	0.0070	0.0211	19.20	0
601020409	2003	4	Ff	2	0.0028	0.0084	19.28	0
601020500	2003	4	Ff	4	0.0056	0.0169	18.81	0
601020501	2003	4	Ff	1	0.0014	0.0042	20.34	0
601020502	2003	4	Fy	29	0.0407	0.1222	14.11	2
601020503	2003	4	Ff	3	0.0042	0.0126	21.42	0
601020504	2004	3	Ff	117	0.1643	0.4930	17.12	8
601020505	2004	3	Ff	153	0.2149	0.6447	16.61	11
601020506	2004	3	Ff	159	0.2233	0.6699	34.04	23
601020507	2004	3	Ff	89	0.1250	0.3750	37.4	14
601020508	2004	3	Fy	75	0.1053	0.3160	9.095	3
601020509	2004	3	Fy	57	0.0801	0.2402	8.007	2
601020604	2005	2	Ff	3	0.0042	0.0126	37.01	0
601020606	2005	2	Fy	2	0.0028	0.0084	9.24	0
601020607	2005	2	Fy	8	0.0112	0.0337	9.22	0
			Subtotal	712		3		65
Hatchery contribution of 3 unknown ad-clipped Chinook Salmon=								65
Expansions of one known CWT (65323)=								4
Total estimated contribution of hatchery origin Chinook =								69

Coho Salmon

A total of 433 coho salmon were observed passing upstream and 185 coho salmon were observed passing downstream through the SRFCF from November 4, 2007 to December 30, 2007 (Fig 5). After subtracting the 185 coho observed moving downstream through the SRFCF, the total

number of coho salmon that are known to have remained in the Shasta River is 248 fish. To estimate the number of coho salmon which may have passed through the flume undetected during periods of video malfunction when the flume was not blocked, coho salmon movements during the same time period two days prior and two days after each video malfunction were averaged. Using this method, a total of one additional coho salmon was estimated to have entered the Shasta River. Therefore, the total coho salmon run size in the Shasta River during the 2007 season was estimated to be 249 fish.

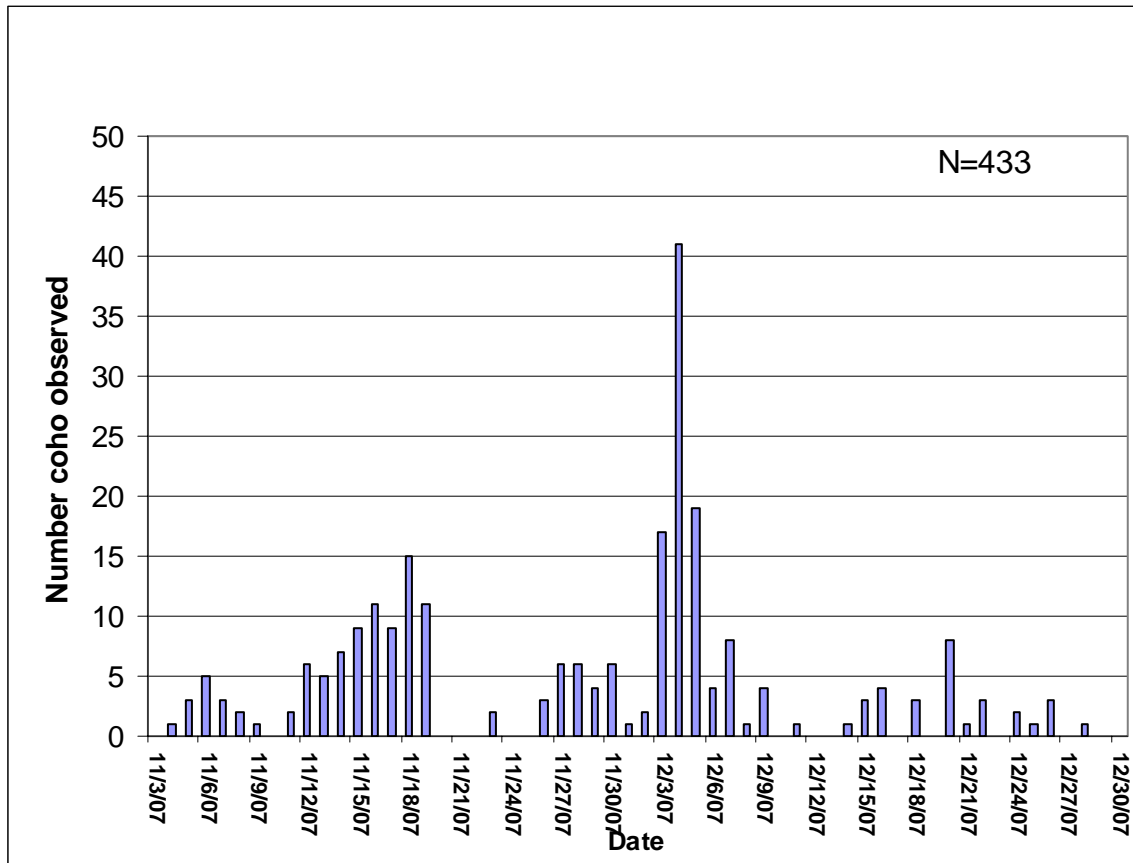


Figure 5. Run timing of coho salmon observed at the Shasta River Fish Counting Facility in 2007.

Beginning in 1996, all coho salmon released from IGH (75,000 yearlings) receive a left maxillary clip and all coho salmon released from TRH (500,000 yearlings) receive a right maxillary clip. Unfortunately, the picture quality of the video tapes does not allow for accurate determination of the presence of a maxillary clip. Therefore, the potential contribution of hatchery origin coho salmon cannot be determined from video tape review.

In the fall of 2004, the Department, in collaboration with NOAA Fisheries, initiated a program intended to reduce potential take of unmarked coho salmon that enter IGH. Under this program all unmarked coho, with the exception of a small number of fish (10) that were incorporated into

the spawn with marked coho, were released back to the river providing them the opportunity to spawn naturally. Prior to release, each unmarked coho salmon was given an upper caudal clip and a serially numbered Floy tag. These marks were applied to allow the Department and others to track the movements of these fish after release from the hatchery. The caudal clip provided a means to easily identify these fish should they pass through one of the video fish counting facilities which are operated by the Department on Bogus Creek and the Shasta River.

In 2007, floy-tagged and caudal fin-clipped coho salmon were observed passing through the SRFCF on five occasions, four upstream and one downstream. The dates of the observations were 11/18, 11/23, 11/30, 12/1 and 12/22. Although no coho salmon carcasses were recovered during the spawning ground surveys in 2007, fifteen (15) coho salmon carcasses were recovered as wash backs on the SRFCF, five (5) of which were floy-tagged and caudal clipped, indicating they had been tagged and released from IGH as unmarked coho salmon (Table 2).

Table 2. Recovery locations and lapsed time for coho salmon tagged at Iron Gate Hatchery, 2007

Floy Tag #	Sex	FL (cm)	Date Tagged at IGH	Date Recovered at SRFCF	Days Elapsed
1610	F	61	11/9/07	12/2/07	23
1685	F	62	11/21/07	12/3/07	12
1723	M	61	11/30/07	12/7/07	7
2109	M	71	11/19/07	12/5/07	16
2113	F	68	11/19/07	11/26/07	7

Forty-three (43) coho salmon were observed with lamprey attachments as they passed through the SRFCF, and ten (10) of these were observed with at least two lamprey attachments. Since any lamprey attached to the fishes right side may not be visible on the video the number of coho salmon with lamprey attachments may actually be slightly greater. At least 10% of the coho salmon run had lamprey attached to them as they entered the SRFCF.

During the 2007-2008 season, the Department's Shasta/Scott Resource Assessment program conducted a radio telemetry investigation in which thirty-five (35) coho salmon were trapped and tagged at the SRFCF between November 8, 2007 and December 5, 2007. Subsequent detections of tagged coho showed that 26% remained in the canyon and 74% moved upstream into the Big Springs complex. A stationary receiver located at the Nelson Ranch (RM32) detected eleven tagged coho swimming up and down at various times throughout the spawning season (Olswang, 2008).

Steelhead Trout

A total of 298 observations of steelhead were recorded by SRFCF video reviewers during 2007, most of which were juveniles (262). Throughout the 2007 season fork length calculations were not attempted, however, steelhead were separated into two categories: juveniles and half pounders/adults.

Flow

Flow data for the Shasta River was downloaded from the U.S. Geological Survey (USGS) gauge no. 11517500 located near the mouth of the Shasta River north of Yreka. Complete flow records are available for this gauge for water years 1934 through 1941 and 1946 to the present. Flow data for the 2007-2008 water year are provisional at this time and may be subject to revision once these records have been finalized by the USGS. Annual discharge volumes in the Shasta River have ranged from a low of 56,299 acre feet (AF) in 1934 to a high of 263,128 AF in 1974.

Flow data for the SRFCF 2007-08 season are shown in Figure 6. The irrigation season on the Shasta River officially ends on October 1st of each year, after which time flows in the Shasta River typically increase. The flows increased from 92 cfs on September 30, 2007 to 133 cfs twenty-four hours later and 153 cfs forty-eight hours later. A storm on October 19, 2007 increased flows to 382 cfs (Fig. 6). KRP staff continually cleared debris off the weir panels on that date, and continued filming with a Delta Vision underwater camera. KRP staff pulled the weir and camera housing from the SRFCF on January 3, 2008 in response to a forecasted storm event, ending monitoring efforts for the season.

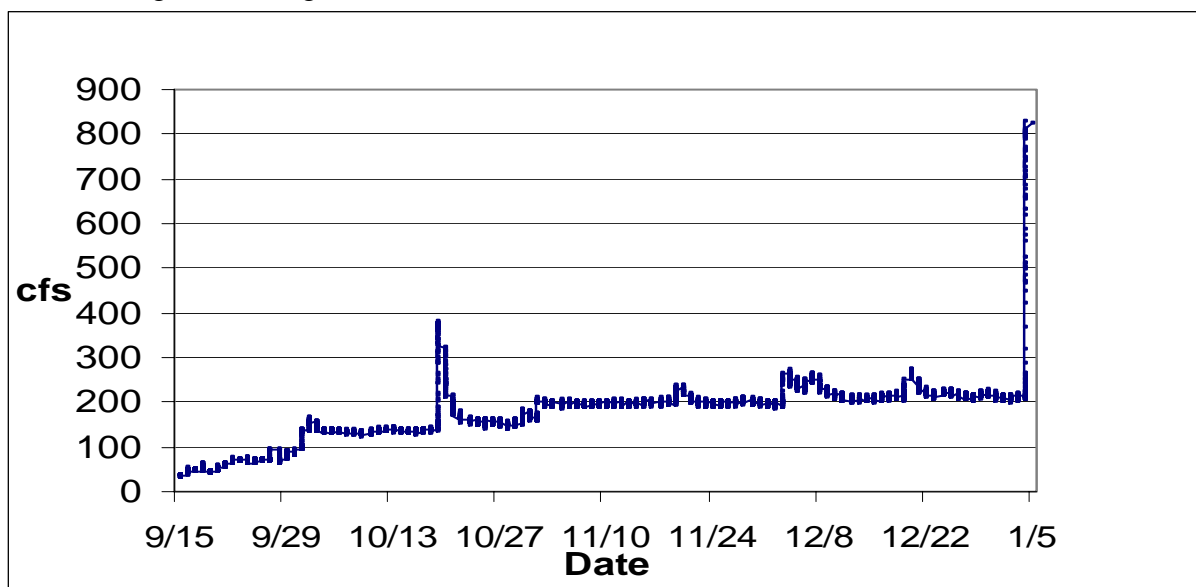


Figure 6. Average daily flows (cfs) in the Shasta River at USGS Gauge No. 11517500 from September 15, 2007 to January 5, 2008.

DISCUSSION

Chinook Salmon

Since 1978 the run size of fall Chinook salmon in the Shasta River has averaged 5,221 fish, and has ranged from a low of 533 fish in 1990 to a high of 18,731 fish in 1978.

The 2007 fall Chinook salmon run totaled 2,035 fish, and ranks as the 8th lowest run recorded since 1978 (Figure 9).

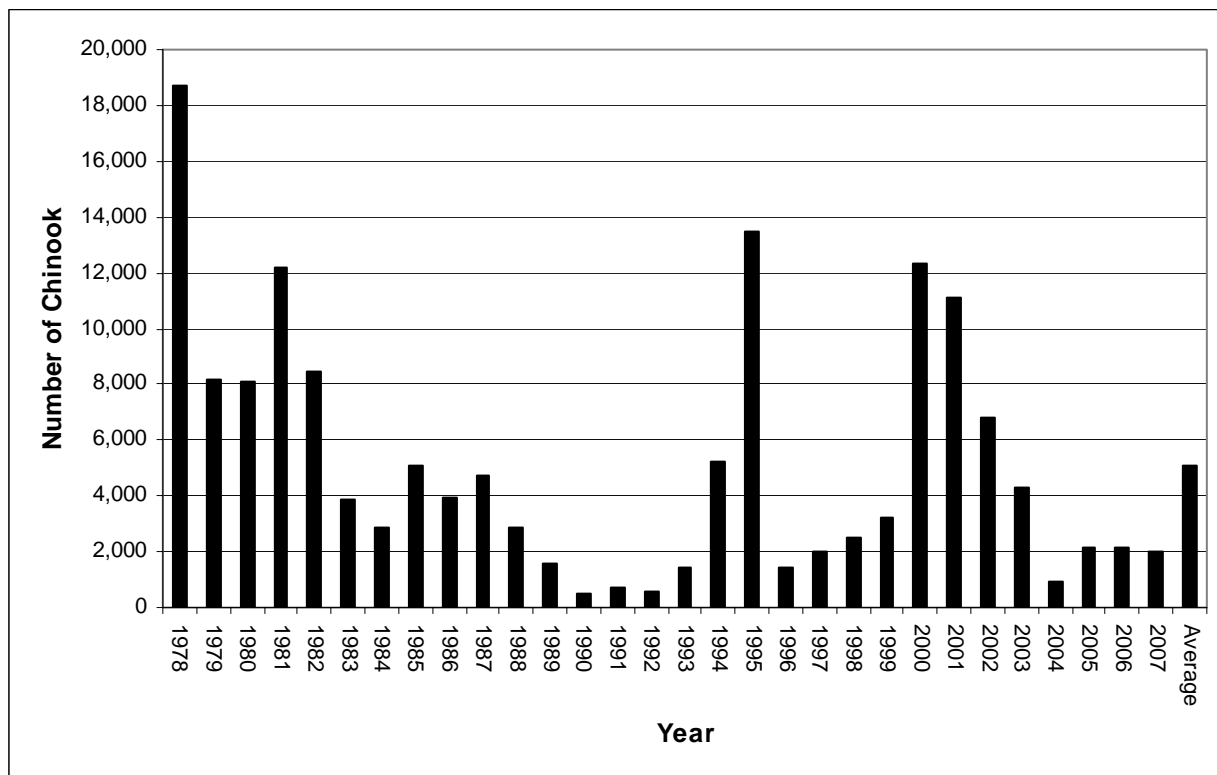


Figure 9. Chinook salmon run size estimates for the Shasta River from 1978 through 2007.

Since 2002, the KRP has estimated the number of hatchery origin fall Chinook salmon that may have strayed into the Shasta River. These estimates have been based on sample expansions from tag recoveries obtained from the Shasta River, or have been based on the proportional distribution of CWT recoveries observed at IGH and applied to the number of ad-clipped Chinook salmon that were observed passing through the SRFCF during the season. This later method was used to estimate the number of hatchery strays in the Shasta River during the 2002 through 2007 seasons. Since 2001 the percent estimated contribution of hatchery strays to the Shasta River has ranged from a low of 1.2% in 2002 to a high of 38.7% in 2004 (Table 2). The percentage of hatchery strays into the Shasta River was 3.4% in 2007 (Table 3).

Table 3. Estimates of hatchery strays as percentage of Chinook entering the Shasta River, 2002-2007.

Year	Total Number of Chinook	Hatchery Stray Estimate	Percent Hatchery
2002	6,820	79	1.2%
2003	4,195	436	10.4%
2004	962	372	38.7%
2005	2,129	469	22.0%
2006	2,184	106	4.9%
2007	2,035	69	3.4%

Each year the Klamath River Technical Advisory Team determines the age composition for fall Chinook salmon populations that return to the Klamath River and its tributary streams. These analyses are based on both length frequency distributions and results of scale age analysis conducted for each sub-basin within the Klamath River watershed. The data are used in an ocean harvest model to estimate age specific ocean abundance and develop harvest management recommendations for the following season. A summary of the age composition determinations for Shasta River fall Chinook salmon are provided in Table 4.

Table 4: Age Composition of Shasta River fall Chinook salmon from 2002 through 2007						
Year	Age 2	Age 3	Age 4	Age 5	Total Adults	Total Run
2002	386	4,286	2,088	58	6,432	6,818
2003	155	2,798	1,325	11	4,134	4,289
2004	129	184	484	166	833	962
2005	38	1,409	600	82	2,091	2,129
2006	863	253	1,042	27	1,321	2,184
2007	27	1,855	146	8	2,008	2,035

The grilse (2005 Brood Year (BY)) component of the 2007 run was one of the lowest in KRP history, in the Shasta River and basin-wide (Figure 10). High flows during the winter of 2005/2006 may have negatively impacted Chinook salmon fry production from the 2005 spawning run. Rotary migrant trapping conducted in the Shasta River in the spring of 2006 by the Anadromous Fish Research and Monitoring Program (AFRAMP) found that fry survival was significantly reduced compared to prior years which leads to speculation that flood flows likely scoured incubating eggs deposited by the adult spawners in the fall of 2005. However, low returns of two year olds to Iron Gate and Trinity River Hatcheries in 2007 suggest that in-river conditions affecting fry production were not the only factor affecting the survival of this age class.

As expected, the strong grilse component of 2006 (2004 BY) was followed by a strong age 3 component of the 2007 run, and the poor return of age 3 (2003 BY) fish in 2006 preceded a poor return of age 4 fish in 2007. The 2002 BY which returned as grilse in 2004, age 3 in 2005 and age 4 in 2006 has provided the foundation for the adult spawners that returned during those years. The 2004 BY may also turn out to be the dominant age class for the adult return in 2007 and 2008. Survival of the offspring from the 2004 BY will be important to ensure future production of Shasta River fall-run Chinook salmon.

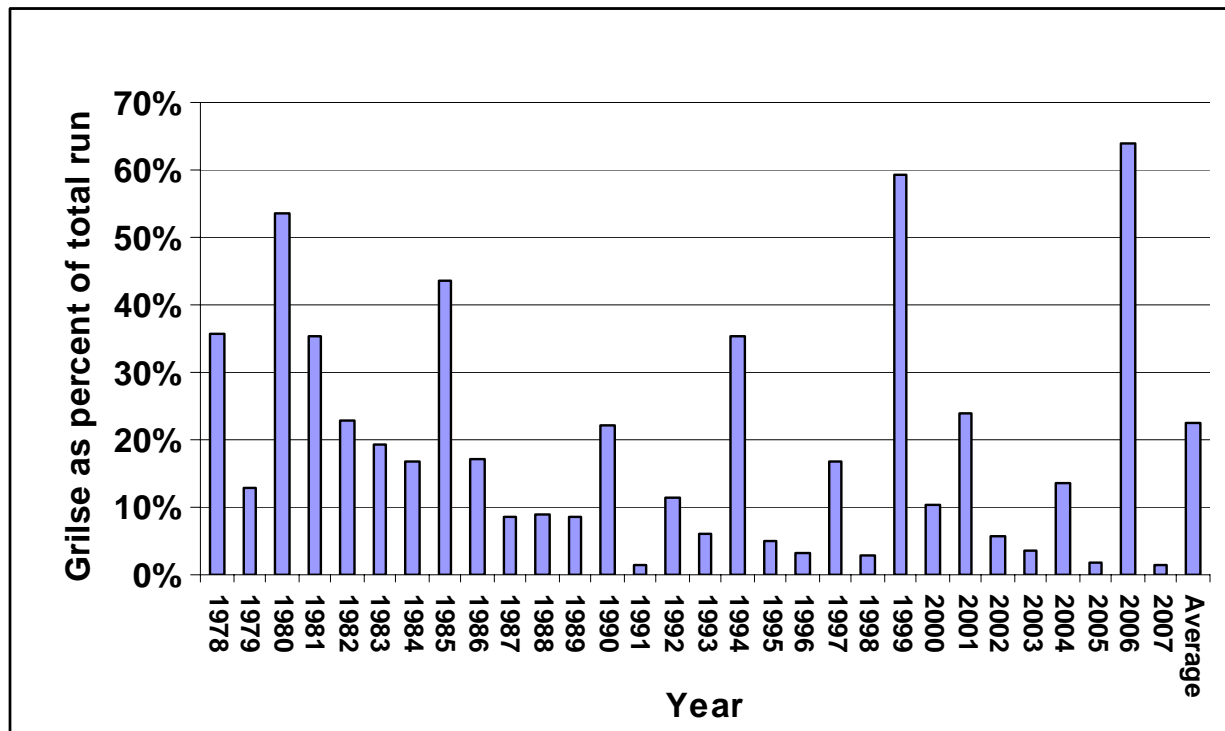


Figure 10. Grilse percentage of fall Chinook salmon escapement to the Shasta River, 1978-2007.

In April of 2008, the Pacific Fishery Management Council adopted an unprecedented closure of ocean commercial and sport Chinook fisheries off California and most of Oregon in response to a severe decline in the return of Sacramento River fall Chinook salmon. Reasons for the failure of the Sacramento run are not known, but are speculated to include a combination of poor ocean conditions and continuing adverse in-river conditions. The closure of ocean salmon fisheries to protect Sacramento River stocks will likely have a positive effect on the spawning escapement of Klamath River stocks. In-river sport and tribal fisheries in the Klamath River will take place in 2008.

Since the onset of video operations in the Shasta River in 1998 the Department's ability to accurately monitor salmon escapement into the river has greatly improved. As a result, mark and recapture carcass surveys are no longer needed to estimate run sizes in the Shasta River. However, since extensive spawning ground surveys are not conducted on the Shasta River, information describing the spawning distribution of the run throughout the river is limited. In addition, the collection of biological data from carcasses in the Shasta River is limited by turbidity, flow and thick riparian vegetation.

Lack of access to some private lands above the canyon reach has limited the KRP's ability to conduct spawning ground surveys. However, recent changes in land ownership along the river have improved the Department's potential for future studies. In 2006 the Nelson Ranch, RMs 28-32 was purchased and subsequently managed by the Nature Conservancy (TNC). The Department has entered into agreements with TNC to conduct fisheries studies including the operation of a rotary screw traps and snorkel surveys to monitor rearing habitat for juvenile salmonids. In 2007, TNC initiated the potential purchase of additional property in the Big Springs area, which includes Big Springs Creek and over two miles of Shasta River frontage. If the land purchase is completed, potential future work by the Department in the Shasta River includes expanded spawning ground surveys and possibly operation of a video weir to monitor Chinook and coho salmon escapement into the upper reaches.

With additional access and funding, collection of information on spawning distribution will likely improve and could help target restoration efforts and enhance our knowledge of habitat use in the Shasta River. Determination of run age structure, the collection of genetic tissue samples, and the estimation of hatchery straying rates would benefit from the collection of additional carcasses. This type of information would further our knowledge on run characteristics for both Chinook and coho salmon populations in the Shasta River.

Coho Salmon

Since 2001, the KRP has operated the SRFCF beyond the Chinook salmon migration period in an effort to better document coho salmon returns in the Shasta River. Increased efforts in recent years have been impacted by high flows that have prevented the SRFCF from operating beyond December (Table 5). However, in 2007 monitoring efforts continued until January 2, 2008, one of the longest seasons in KRP history. The acquisition and operation of a waterproof digital camera has enabled staff to continue recording during periods of high flows when there is a potential of flooding the camera box. The use of a flooded camera box with filtered water during future seasons is being considered to further improve operations during high flow events typical during the coho salmon migration.

Annual variability in sampling through the end of the coho salmon migration exists and direct comparisons of coho salmon numbers between years must acknowledge this issue. Although sampling difficulties occur, the data collected is extremely important given the current status of coho salmon under the federal Endangered Species Act and California Endangered Species Act.

Table 5. Summary of Coho Salmon Observations in the Shasta River at the SRFCF.

Year	Number	Last Day of Operation	Comments
1979	355	Ukn	No date information provided in report.
1981	418	1/6/1982	
1982	263	2/28/1983	Weir opened for 2 days Dec 29-30 to flush gravel from upstream.
1983	36	1/19/1984	high water made weir inoperable from Nov 12 to Jan 10.
1984	69	11/19/1984	
1985	3	Early December	High water forced removal of weir in early December, no date given.
1986	0	11/3/86	
1987	0	10/12/87	
1988	3	11/2/88	Three coho salmon sampled in spawning ground surveys.
1989	6	10/21/89	High flows made weir inoperable from Sept 18-20.
1990	2	10/28/90	
1991	9	11/11/91	
1992	3	11/11/92	
1993	6	11/12/93	
1994	17	11/6/94	
1995	12	11/11/95	
1996	1	11/4/96	
1997	0	10/28/97	
1998	0	11/4/98	
1999	27	11/10/99	
2000	1	11/7/00	
2001	291	12/14/01	Weir operations extended beyond November 11 to monitor Coho Salmon.
2002	86	12/17/02	
2003	187	12/28/2003	
2004	373	12/8/2004	
2005	69	12/1/2005	Missed 7 days from 11/7 to 11/14 due to high flows.
2006	47	12/13/2006	Weir operations ended 12/13/06 due to high flows.
2007	249	1/2/2008	Weir operations ended 1/2/08 due to high flows.

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