

**Shasta River Fish Counting Facility,  
Chinook and Coho Salmon Observations in  
2008-2009  
Siskiyou County, CA**



Prepared by:  
Diana Chesney  
California Department of Fish and Game  
Klamath River Project  
303 South Street  
Yreka, CA 96097  
(530) 841-1176

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

### **ABSTRACT**

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 (Chinook) (*Oncorhynchus tshawytscha*) that return to the Klamath River Basin, excluding the Trinity River Basin, each year. An underwater video camera was operated to record fish passage in the flume of the Shasta River Fish Counting Facility (SRFCF) twenty four hours a day, seven days a week, from September 2, 2008 until December 23, 2008. A total of **6,362** Chinook salmon were estimated to have entered the Shasta River during the 2008 spawning season. The first Chinook was observed on September 4, 2008 and the last Chinook on December 2, 2008. Klamath River Project (KRP) staff processed a total of 187 carcasses during spawning ground surveys, and a total of 767 Chinook salmon carcasses were collected as wash backs against the SRFCF weir during the season. Chinook salmon ranged in fork length (FL) from 35 cm to 103 cm and grilse were determined to be < 60 cm in fork length. The run was comprised of 3,621 grilse (56.9%), and 2,741 adults (43.1%). A total of 3 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 2005 fish released from Iron Gate Hatchery (IGH) as a yearling in 2006. Expansion of this CWT by the production multiplier yielded an estimate of 9 hatchery origin Chinook salmon. The remaining 3 AD Chinook were observed in the video flume but not recovered. 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 47 additional hatchery origin Chinook salmon were estimated to have entered the Shasta River during the 2008 run. This yields a total estimate of 56 hatchery Chinook, or 0.88% of the total run observed in 2008.

A total of 30 coho salmon were estimated to have entered the Shasta River during the 2008-09 season. The first coho salmon of the season was observed passing through the SRFCF on October 20, 2008 and the last two coho salmon were observed swimming downstream through the SRFCF on December 22, 2008. A total of 138 coho salmon were observed passing upstream through the SRFCF and 108 coho salmon were observed passing downstream from October 20, 2008 to December 22, 2008. Since it cannot be assumed that the 108 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 30. No video malfunctions occurred between the first coho observation and the end of the video monitoring season.

### **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 (Chinook) (*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 recreational 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 Chinook populations, data is recorded for other salmonid species observed at the SRFCF during its period of operation as well.

The Department has intensified efforts to document the presence of coho salmon (coho) (*Oncorhynchus kisutch*) 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, 2007). 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 2008.

## 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 is connected to a time lapse video recorder and monitor. As in 2007, a JVC digital color video camera (Model No TK-C92OU) equipped with a 5 – 50mm 1:1.3 Computar lens<sup>1</sup> was used at the SRFCF. However, in 2008 the video cassette recorder was replaced with an Everfocus EDSR 100H digital video recorder (DVR) with a Seagate 250 hard drive in a swappable Everfocus DTLA 250F tray used

---

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

as a recording medium. The weir and video camera were installed during the last week of August and began recording on September 2, 2008. Recording speed was set at 24 hours for the first week, and then at 12 hour mode throughout the remainder of the season.

The use of digital recording equipment eliminates the need for two tape changes 12 hours apart as in the past, so KRP staff visited the SRFCF only once daily in 2008. During each visit staff inspected the video system to insure the system was operational, inspected and cleaned the weir panels as necessary, processed any wash-back carcasses present and conducted routine maintenance of the facility. Twice per week, on Mondays and Thursdays, the hard drive was removed from the DVR and replaced with a blank drive. All equipment was secured in a locked enclosure and access to the site was also controlled through a locked gate located on private property.

Hard drives with stored video data were immediately returned to the office where each was subsequently downloaded onto a Lacie 500 gb or Maxtor One-Touch 500 gb external hard drive for storage and review by staff in the video lab.<sup>2</sup> 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 images. Fish recorded as "unknown" as to species were reviewed by project biologists. All data were then entered into data files on a personal computer and each data file was edited prior to commencement of final data analysis.

A temporary trap was on installed immediately upstream of the SRFCF on October 23, 2008 for the purpose of collecting upstream migrating coho to be used in a radio telemetry investigation. The trap was removed on December 22, 2008.

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 (FL). 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 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. This was done following the protocol provided by the National Oceanic and Atmospheric Administration's (NOAA) Southwest Fisheries Center in Santa Cruz, California, to which the tissue samples were sent at the end of the season.

Every carcass was also examined for the presence of fin clips, marks or tags. Heads were collected from each AD fish for later CWT recovery and analysis. Each carcass

---

<sup>2</sup> Use of trade names in this report does not imply endorsement by the Department of Fish and Game.

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 surveys were conducted on the lower seven miles of the Shasta River, on publicly owned lands and on private lands where permission to access was obtained. In addition, approximately 2.5 miles of the upper Shasta River and 2 miles of Big Springs Creek were made accessible for the first time through cooperative agreements between Department and The Nature Conservancy (TNC). All reaches were surveyed once per week throughout the spawning season. The purpose of the spawning ground surveys was to gather biological data necessary to describe physical characteristics of the run. Surveys were limited to areas historically used, or believed to be 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 wash backs. Forty-two otolith samples were collected, 41 from the spawning ground surveys and one from a weir wash back carcass. These samples were provided to Rebecca Quinones of the U.S. Forest Service and University of California, Davis, for microchemistry analysis. The surveys were conducted once per week throughout the fall Chinook salmon spawning season. The first survey occurred on October 15, 2008 and the last survey occurred on November 19, 2008.

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

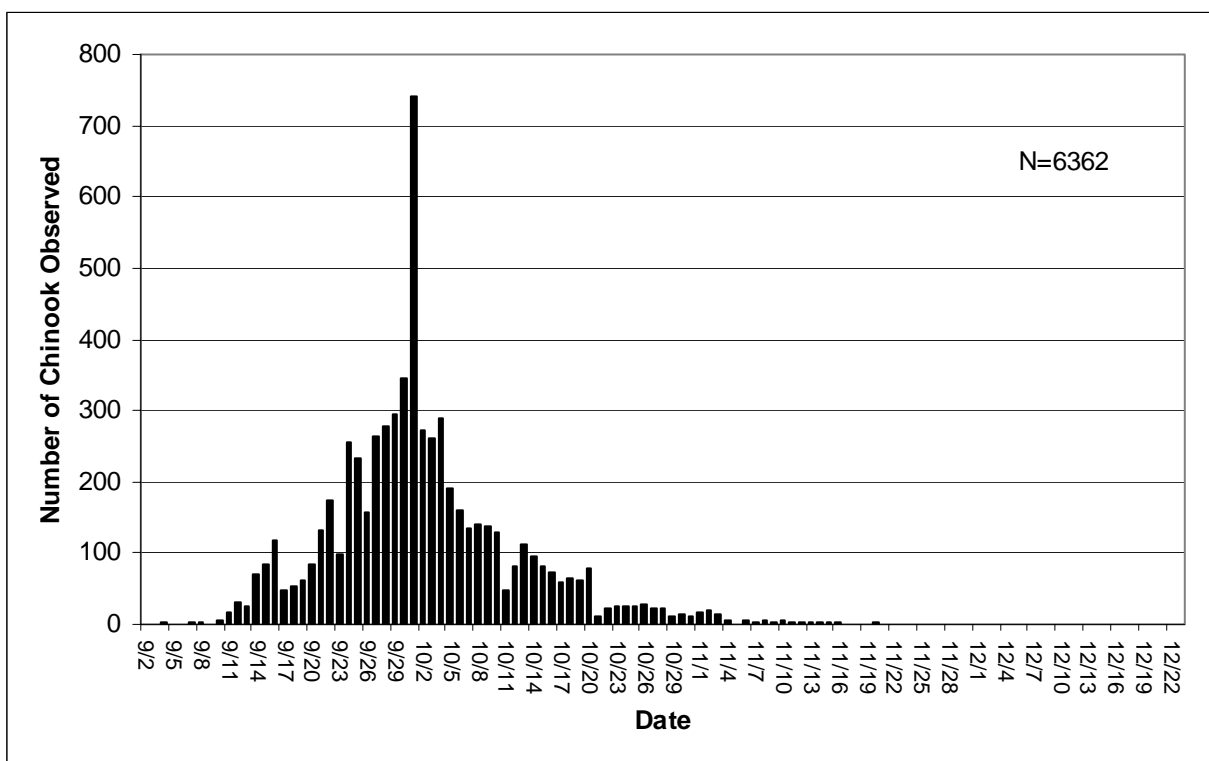
## **RESULTS**

Operation of the SRFCF began the afternoon of September 2, 2008 at approximately 14:45 hours, Pacific Standard Time (P.S.T.). The first Chinook of the season was observed on September 4, 2008 at 02:20 and the last Chinook was observed on December 2, 2008 at 19:24 hours, P.S.T. The weir and recording equipment were removed on December 23, 2008 due to anticipated high flows

Recording was disrupted on three occasions: the first two on September 30 and October 1, 2008 when the video flume lights malfunctioned and darkness prevented review between midnight and six a.m, or six (6) hours each, and 43.5 hours between 1200 on October 7, 2008 and 0730 on October 9, 2008 when the DVR failed to record due to operator error.

## Chinook Salmon

A net total of 6,103 Chinook salmon were counted passing upstream through the SRFCF during the 2008 season. This number was derived by subtracting the number of downstream observations (594) from the number of upstream observations (6,697). An additional 259 Chinook were estimated to have entered the Shasta River during periods of equipment malfunctions, for a total estimate of **6,362** Chinook. The number of Chinook salmon which may have passed through the SRFCF during periods of video malfunctions was estimated by averaging Chinook salmon movements during the same time period two days prior and two days after each video malfunction. The first Chinook salmon movement was observed on September 4, 2008 and the last Chinook salmon was observed on December 2, 2008 (Figure 1).

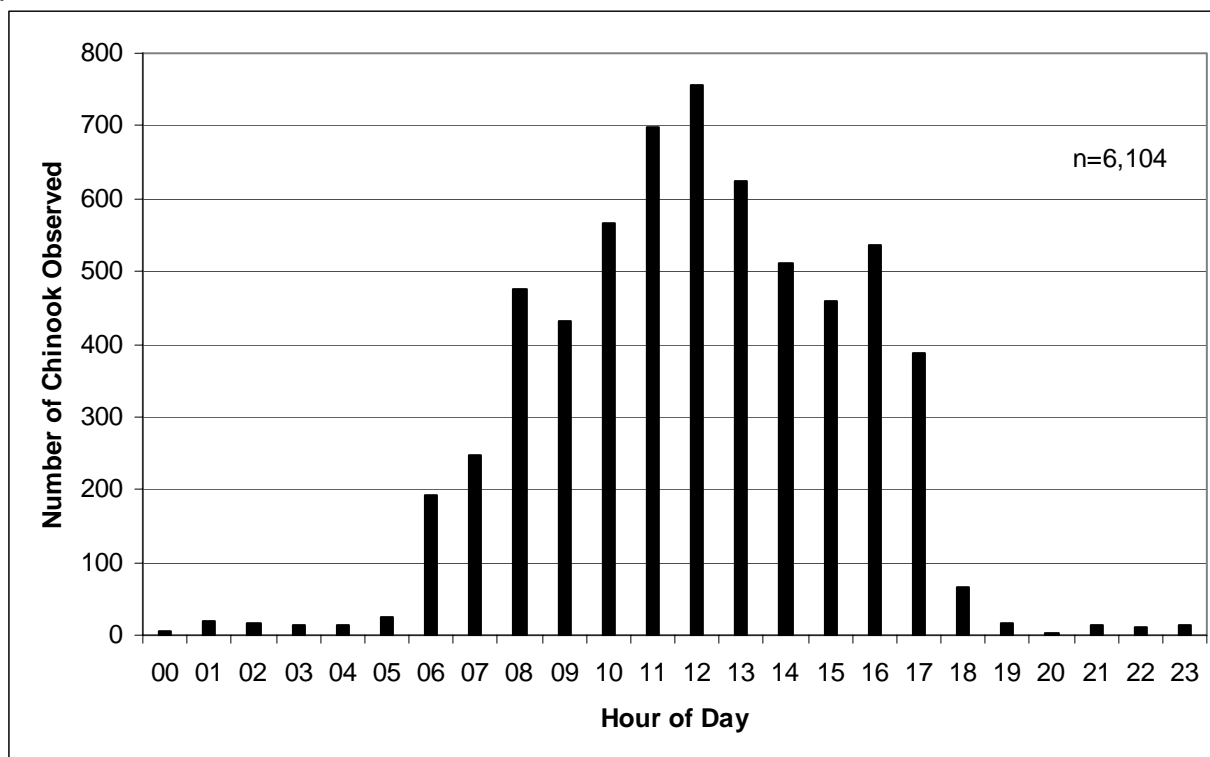


**Figure 1. Run timing of fall Chinook salmon observed at the Shasta River Fish Counting Facility in 2008.**

Consistent with previous years, the majority of Chinook salmon (96%) passed through the SRFCF during day light hours between 06:00 and 17:00 hours (Figure 2).

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 600 Chinook salmon, 9.4% 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 2. Diel run timing of Chinook salmon movement through the Shasta River Fish Counting Facility during the 2008 season.**

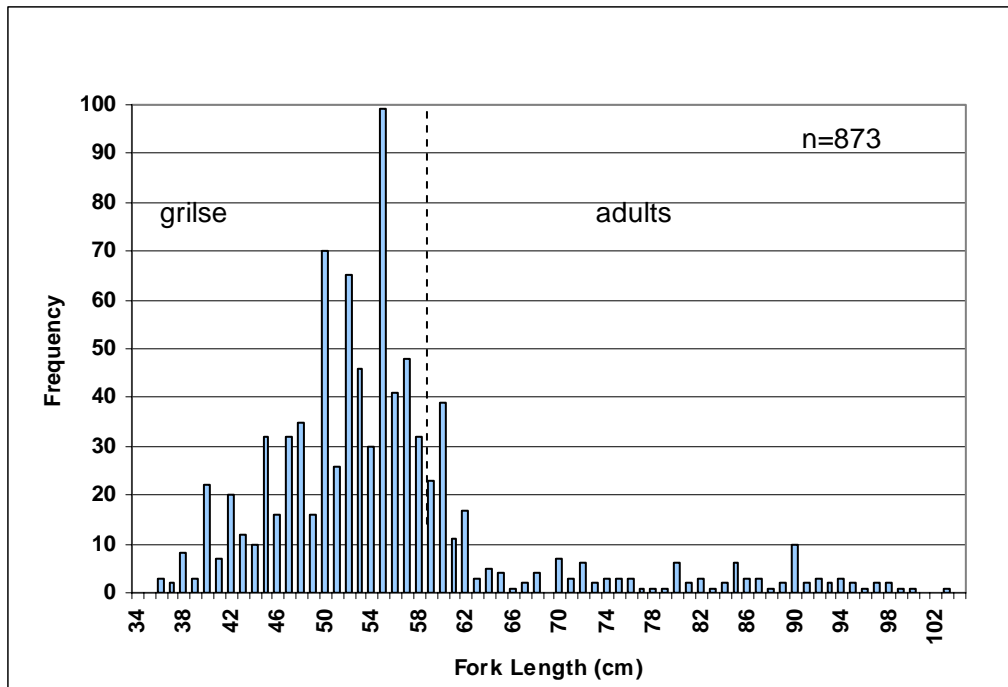
A total of 187 Chinook salmon carcasses were sampled during spawning ground surveys, which were conducted on publicly owned lands or on private lands where permission to access was obtained. Of the 186 carcasses for which sex determinations were made (one was measured but sex was marked as “unknown”), 46 (24.7%) were female and 140 (75.3%) were male.

A total of 767 Chinook carcasses were recovered and sampled as wash backs on the weir. Of these, 34 (4%) were female and 733 (96%) were male. Since 2004, the wash back samples at the SRFCF have shown a heavy bias toward males (Table 1). Therefore, the grilse cut-off and subsequent grilse/adult proportions were derived from

the Chinook length frequency distribution provided by the spawning ground survey. KRP staff determined that grilse salmon were those < 60 cm in FL. Based on this determination, the Department estimates that the Chinook salmon run in the Shasta River during 2008 was comprised of 3,621 (56.9%) grilse and 2,741 (43.1%) adults.

**Table 1. Sex composition of wash back carcasses sampled at Shasta River Fish Counting Facility, 2005-2008.**

Year	Sample Number	% Males	% Females
2005	395	76	24
2006	457	94	6
2007	228	71	29
2008	767	96	4



**Figure 3. Length frequency distribution of male Chinook salmon recovered during spawning ground surveys or as wash backs impinged on weir panels of the SRF CF during the 2008 season. Grilse were determined to be <60 cm fork length.**



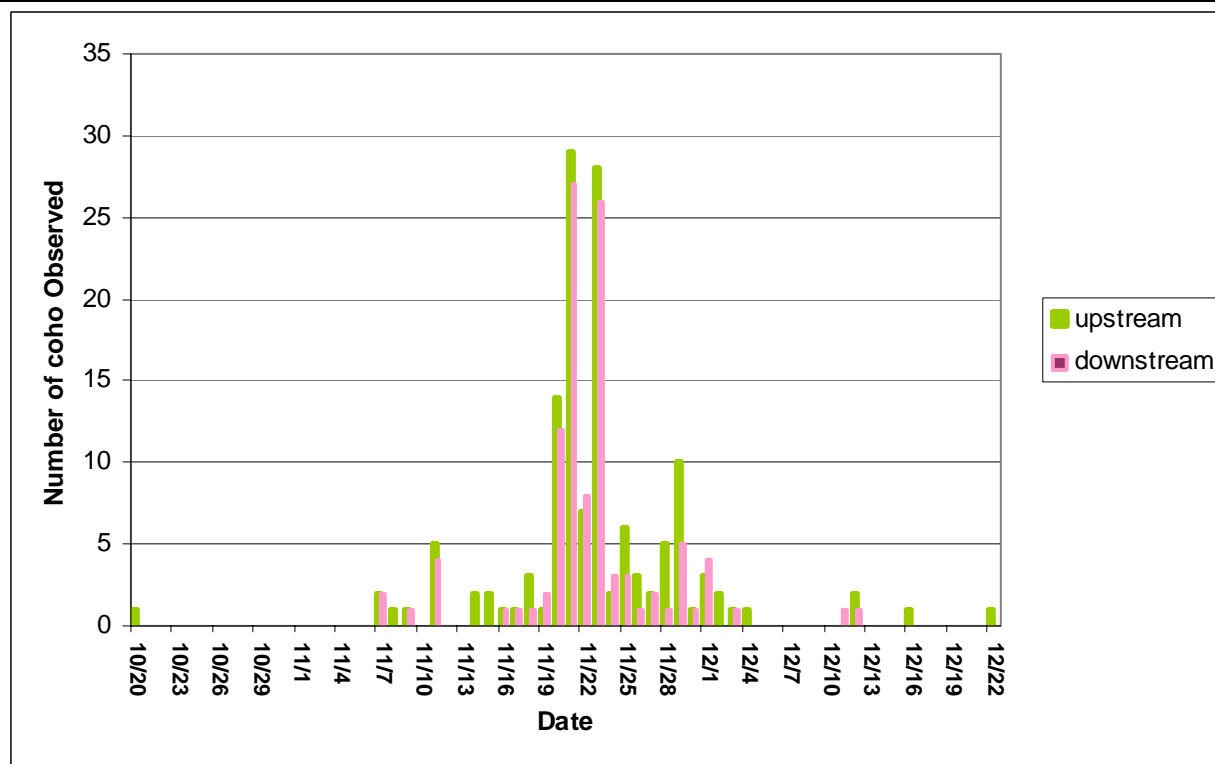
A total of 9 Chinook salmon observed passing through the SRFCF appeared to have been AD, indicating that these fish may be of hatchery origin. Eight of the observed AD Chinook were swimming upstream and 5 were swimming downstream. Because it cannot be assumed that those downstream migrating fish remained in the Shasta River to spawn, the net total of AD Chinook estimated to have spawned in the Shasta River in 2008 is 3. The head from 1 AD Chinook salmon was recovered from a carcass examined in the wash back sample. The CWT recovered was from an IGH produced Chinook spawned in brood year 2005 and released from IGH as a yearling in 2006. Expansion of this recovery by the hatchery production multiplier (9.24) yields an estimate of 9 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 2008 (Table 2). 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 47 additional 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 56 hatchery origin Chinook are estimated to have entered the Shasta River during the 2008 season.

**Table 2. Estimated contribution of 4 AD clipped Chinook salmon observed at the SRFCF in 2008 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
601020503	2003	5	F	1	0.0015	0.0044	21.42	0
601020504	2004	4	F	13	0.0190	0.0570	17.12	1
601020505	2004	4	F	19	0.0278	0.0833	16.61	1
601020506	2004	4	F	31	0.0453	0.1360	34.04	5
601020507	2004	4	F	37	0.0541	0.1623	37.42	6
601020508	2004	4	Y	30	0.0439	0.1316	9.09	1
601020509	2004	4	Y	47	0.0687	0.2061	8.01	2
601020602	2005	3	F	56	0.0819	0.2456	18.01	4
601020603	2005	3	F	44	0.0643	0.1930	18.67	4
601020604	2005	3	F	25	0.0365	0.1096	37.01	4
601020606	2005	3	Y	75	0.1096	0.3289	9.24	3
601020607	2005	3	Y	187	0.2734	0.8202	9.22	8
601020608	2006	2	F	20	0.0292	0.0877	20.82	2
601020609	2006	2	F	35	0.0512	0.1535	15.93	2
601020700	2006	2	F	14	0.0205	0.0614	16.61	1
601020701	2006	2	F	13	0.0190	0.0570	16.54	1
601020702	2006	2	F	11	0.0161	0.0482	16.65	1
601020703	2006	2	F	13	0.0190	0.0570	18.11	1
601020704	2006	2	Y	13	0.0190	0.0570	9.57	1
			<b>Subtotal</b>	<b>684</b>		<b>3</b>		<b>47</b>
<b>Hatchery contribution of 3 unknown ad-clipped Chinook Salmon=</b>								<b>47</b>
<b>Expansions of one known CWT=</b>								<b>9</b>
<b>Total estimated contribution of hatchery origin Chinook =</b>								<b>56</b>

## Coho Salmon

A total of 138 coho were observed passing upstream and 108 coho were observed passing downstream through the SRFCF from October 20, 2008 to December 22, 2008 (Fig 4). After subtracting the 109 coho observed moving downstream through the SRFCF, the total number of coho salmon that are known to have remained and presumably spawned in the Shasta River is 30 fish.



**Figure 4. Run timing of coho salmon observed at the Shasta River Fish Counting Facility in 2008.**

Beginning in 1996, all coho released from IGH (75,000 yearlings) receive a left maxillary clip and all coho 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 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, the Scott River and the Shasta River.

In 2008, no Floy-tagged coho salmon were observed passing through the video flume at the SRFCF, and no coho salmon carcasses were recovered during the spawning ground surveys. One unmarked coho carcass was recovered as a wash back on the SRFCF.

Forty-four observations were made of upstream migrating coho with lamprey attachments as they passed through the SRFCF; 14 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 with lamprey attachments may actually be slightly greater. At least 32% of the coho salmon run had lamprey attached to them as they entered the SRFCF. In addition, moderate to severe wounds associated with lamprey attachments were observed on 9 of the coho as they passed through the SRFCF.

During the 2008 season, the Department's Shasta/Scott Resource Assessment program conducted a radio telemetry investigation in which twelve (12) coho salmon were trapped and tagged at the SRFCF between November 5, 2008 and December 22, 2008. In addition to the radio tags, pink dorsal tags were applied to female coho and green dorsal tags to male coho. Prior radio tagging investigations in 2004 and 2006 included only unmarked coho, but due to low numbers of returning coho in 2008, the decision was made to include three (3) left maxillary clipped male coho and two (2) left maxillary clipped female coho of IGH origin in the radio telemetry investigation.

Subsequent detections of tagged coho showed that all five (5) of the IGH fish and three (3) of the unmarked fish remained in the canyon. Of the remaining four wild coho, three had detections in Parks Creek (RM 34.8) and one above the stationary receiver located at TNC (RM 33). One tagged male was detected to have traveled from RM 1, where it was tagged, past the TNC property, back to the canyon, past the stationary receiver again and, finally, recovered as a tagged carcass at Parks Creek, a tributary of the Shasta River (RM 35). This totaled approximately 64 miles of back and forth migration in the period between November 5, 2008 and November 26, 2008. (Olswang, 2009).

Installation of the coho trap on October 23, 2008 appears to have increased the incidence of both coho and Chinook salmon swimming downstream through the video flume. Prior to the installation of the trap, 3% of the Chinook observed were going downstream, as opposed to 36.7% of the Chinook observations made during the period from October 23, 2008 to December 22, 2008 when the trap was in place. Forty-four percent of coho observations were downstream. No coho were observed prior to the installation of the trap. Modifications to the trap configuration and design should improve this situation in future seasons.

## **Steelhead Trout**

A total of 1,130 observations of steelhead trout were recorded by SRFCF video reviewers during the 2008 season, of which 902 were the net number that remained upstream of the SRFCF. Of these, 817 (72%) were classified as juveniles by the reviewers. Since fork length calculations were not attempted, these determinations of life stage may vary among observers. The SRFCF video season does not include the entire migration period for steelhead trout, however, it is interesting to note that the 2008 observations were over three times the number observed in 2007 (298).

### **Flow Measurements**

Daily in-stream flow data for the Shasta River was downloaded from the U.S. Geological Survey 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 2008-2009 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.

In-stream flow data for the SRFCF 2008 season are shown in Figure 5. The agricultural irrigation season on the Shasta River officially ends on October 1 of each year, after which time flows in the Shasta River typically increase. Immediately following the end of the irrigation season and following storm events, KRP staff increased efforts to clear debris off the weir panels thereby preventing the creation of a temporary dam, in-stream flow conditions allowed continuous operation of the SRFCF until the weir was pulled on December 23, 2008 due to a forecasted storm event.

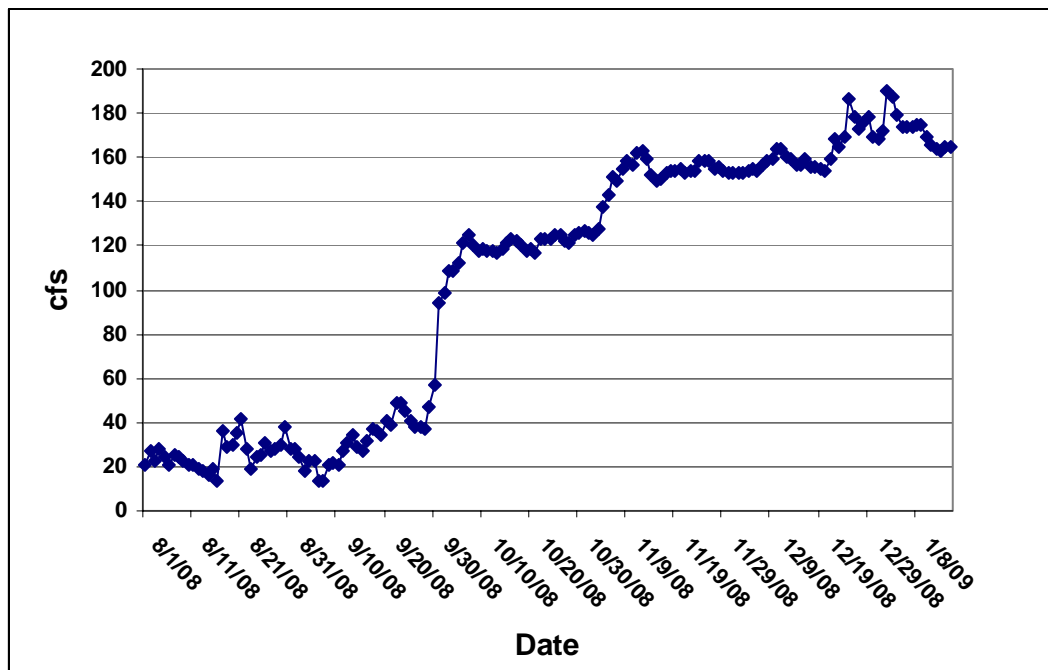


Figure 5. Average daily flows (cfs) in the Shasta River at USGS Gauge No. 11517500 from August 1, 2008 to January 15, 2009.

## DISCUSSION

### Chinook Salmon

Since 1978 the run size of fall Chinook in the Shasta River has averaged 7,215 fish, and has ranged from a low of 533 fish in 1990 to a high of 18,731 fish in 1978. The 2008 fall Chinook run totaled 6,362 fish, and ranks as the 10<sup>th</sup> highest run recorded since 1978 (Figure 6).

Since 2002, the KRP has estimated the number of hatchery origin fall Chinook 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 Chinook that were observed passing through the SRFCF during the season. This latter method was used to estimate the number of hatchery strays in the Shasta River during the 2002 through 2008 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 estimated at 1.0% in 2008 (Table 3).

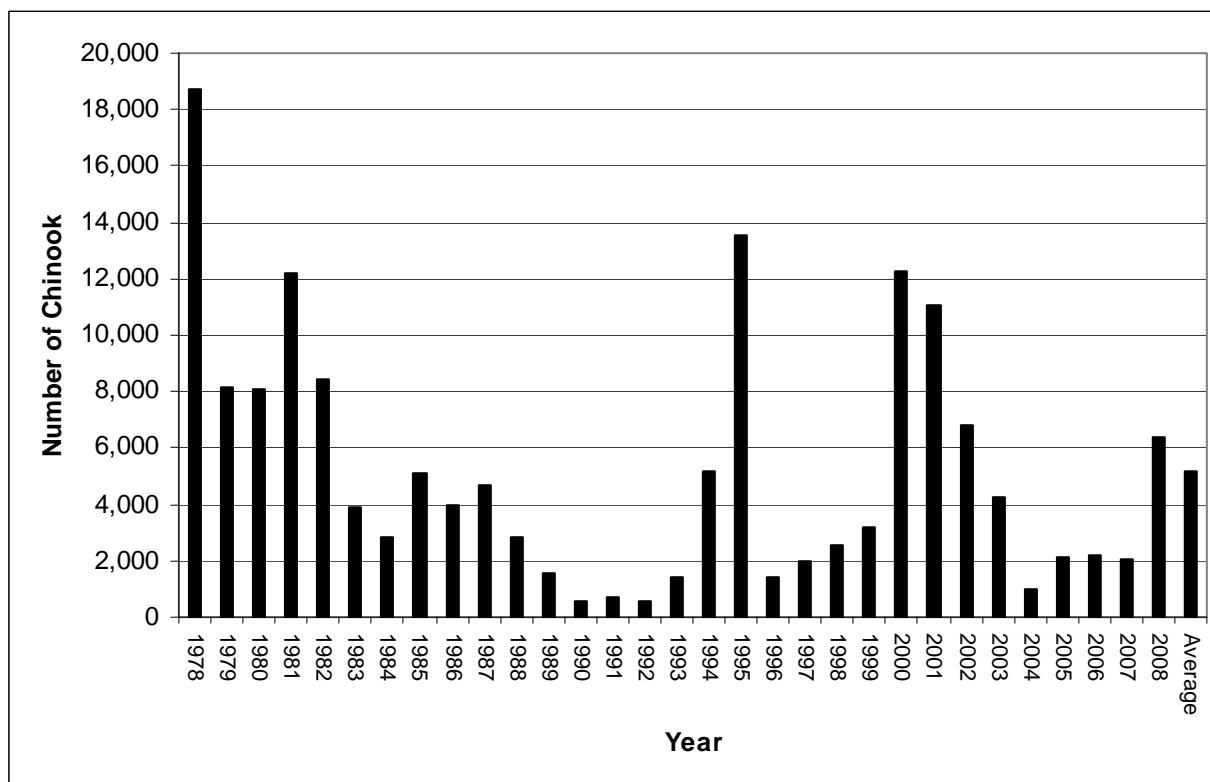


Figure 6. Chinook salmon run size estimates for the Shasta River from 1978 through 2008.

Table 3. Estimates of hatchery strays as percentage of Chinook entering the Shasta River, 2002-2008.

Year	Total Number of Chinook	Hatchery Stray Estimate	Percent Hatchery
2002	6,820	79	1.2%
2003	4,289	436	10.2%
2004	962	372	38.7%
2005	2,129	469	22.0%
2006	2,184	106	4.9%
2007	2,035	69	3.4%
2008	6,362	66	1.0%

Each year the Klamath River Technical Advisory Team determines the age composition for fall Chinook 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. These data are used in an ocean harvest model to estimate age specific ocean abundance and develop harvest management recommendations for the following fishing season. A summary of the age composition determinations for Shasta River Chinook are provided in Table 4.

**Table 4. Age composition of Shasta River fall Chinook salmon from 2002 through 2008.**

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
2008	3,621	1,222	1,456	63	2,741	6,362

The grilse component from brood year (BY) 2006 of the 2008 Shasta River Chinook run was the third highest recorded in KRP history at 56.9 percent (Figure 7). Basin-wide, the grilse component of the natural Chinook spawner escapement was 35.9%. This suggests that if in-river and ocean conditions are favorable, the fall 2009 Chinook run should see a strong age-3 component.

The 3 year old component of natural spawning escapement was estimated at 15.6%. However, 3 year olds constituted 42.6 percent of hatchery returns to IGH and TRH. High flows in the spring of 2006, suspected of scouring redds, may have negatively impacted the naturally produced BY 2005 fish but not hatchery fish. The 2004 BY was the dominant age class for the adult return in 2008.

In April of 2008, the Pacific Fishery Management Council adopted an unprecedented closure of ocean commercial and recreational Chinook fisheries from the California-Mexico border to Cape Falcon, Oregon in response to a severe decline in the return of Sacramento River fall Chinook salmon. In 2009, it appears that the ocean harvest will again be closed in California. 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

During the 2008 fall season, the TNC was in the process of negotiating to purchase over 4,000 acres of what was formerly known as the Busk Ranch in the Big Springs area of the Shasta River basin. The TNC took ownership of this property, now known as the Shasta Big Springs Ranch, in March of 2009. During the fall of 2008, a cooperative agreement between CDFG and the TNC made it possible for Department personnel to conduct spawning ground surveys in 3 miles of the upper Shasta River and just over 2 miles of Big Springs Creek. These reaches were surveyed once per week from October 10, 2009 to November 14, 2009.

With the TNC's recent acquisition of properties in the Big Springs area, collection of information on the spawning distribution of Chinook salmon will likely improve. This information will 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 will benefit from the collection of additional carcasses. This type of information will further our knowledge of run characteristics for both Chinook and coho salmon populations in the Shasta River.

As in the lower (canyon ) reaches of the Shasta River, predation by river otter and other predators and scavengers makes the recovery of intact Chinook carcasses very difficult in the upper Shasta River. However, a mark and recapture survey, as well as extensive redd surveys, were conducted on the main stem reaches and Big Springs Creek.

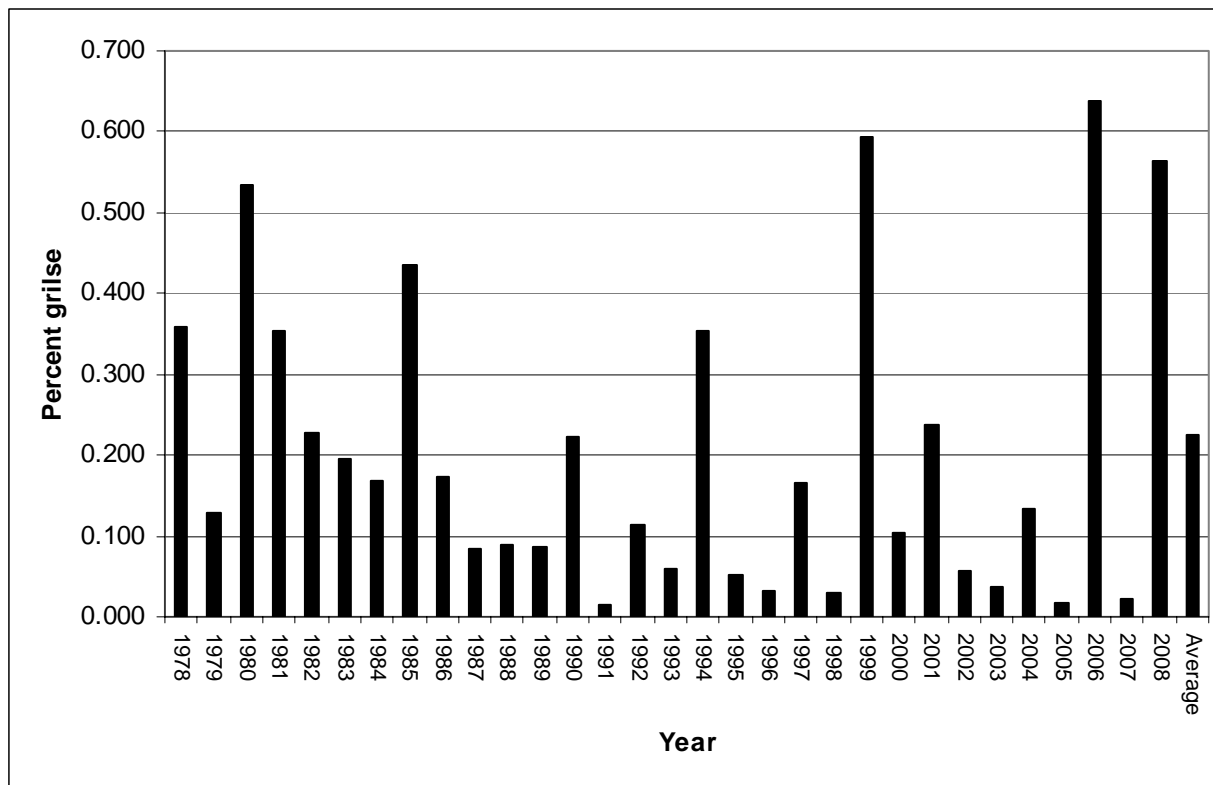


Figure 7. Grilse percentage of fall Chinook salmon escapement to the Shasta River, 1978-2008.

## Coho Salmon

Since 2001, the KRP has operated the SRFCF beyond the Chinook 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 in-stream flows that have prevented the SRFCF from operating beyond early December. However, in 2007 monitoring efforts continued until January 2, 2008, and in 2008 the facility was operated until December 23, 2008. 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 migration.

Figure 8 shows returns of coho to the Shasta River from 1979 to 2008. Annual variability in sampling through the end of the coho migration exists and direct

comparisons of coho 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.

Returns of wild coho to the Shasta River and throughout the Klamath Basin were very poor in 2008. The Department's ongoing radio telemetry and pit tagging investigations, as well as newly acquired access to coho spawning and rearing areas in the upper Shasta River now managed by the TNC, take on even greater importance given the tenuous status of the ESU. By identifying specific areas of coho habitat use, protection and restoration efforts can be targeted at these areas of critical habitat.

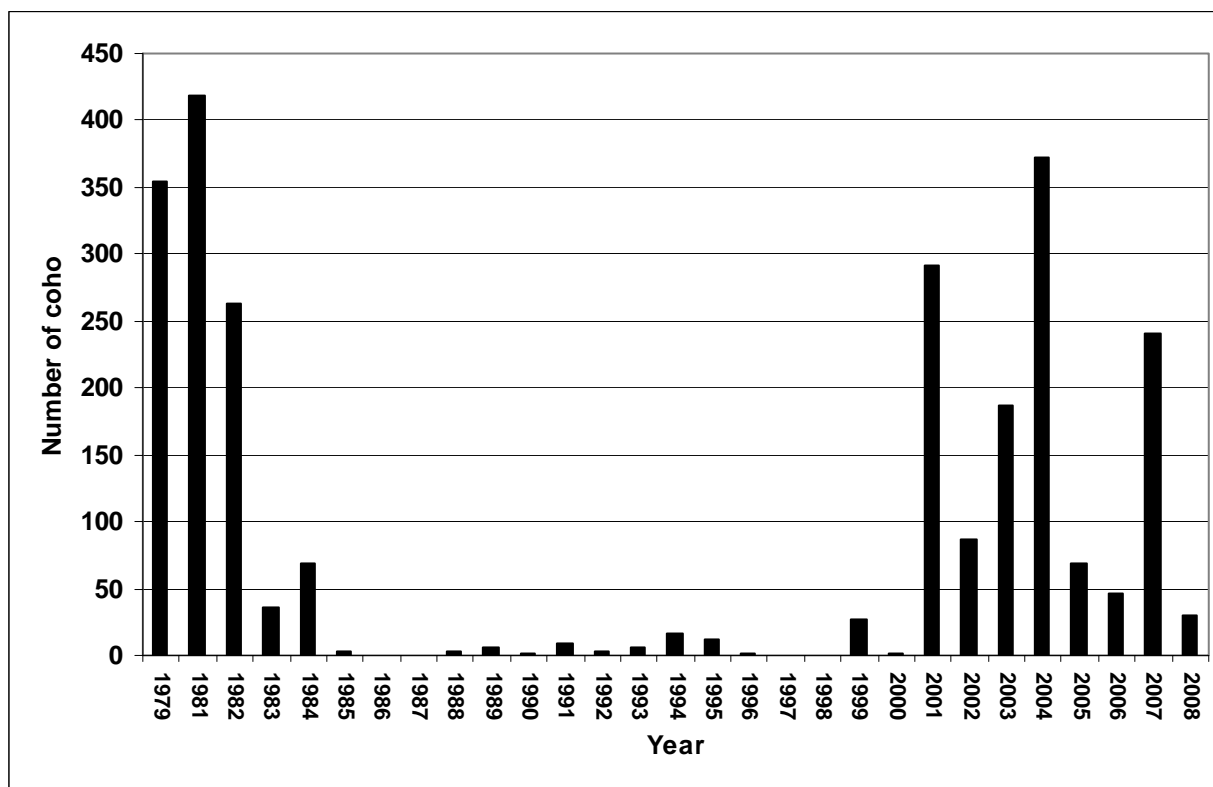


Figure 8. Returns of coho salmon to the Shasta River, 1979-2008.

### LITERATURE CITED

KRTAT (Klamath River Technical Advisory Team). 2009. Klamath River Fall Chinook Age-Specific Escapement, 2008 Run. Available from U.S. Fish and Wildlife Service, 1829 South Oregon Street, Yreka, CA, 96097.

Olswang, Mary. 2009. Shasta River Coho Salmon Radio Telemetry Investigation, 2008. Brief Preliminary Summary. California Department of Fish and Game.

Walsh, Brannon and Mark Hampton, 2007. Shasta River Fish Counting Facility, Chinook and Coho Salmon Observations, Siskiyou County, CA. Available from California Department of Fish and Game, 303 South Street, Yreka, CA. 96097