

BOGUS CREEK SALMON STUDIES

2004



High Flows on December 8, 2004

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California Department of Fish and Game
Northern California-North Coast Region
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ABSTRACT

The California Department of Fish and Game's (CDFG), Klamath River Project (KRP) operates a video fish counting facility and conducts spawning ground surveys (carcass surveys) on Bogus Creek annually, during the fall-run Chinook salmon (*Oncorhynchus tshawytscha*) spawning season. The purpose of these surveys is to describe the run characteristics of adult fall-run Chinook and coho salmon into Bogus Creek. The total number of Chinook salmon that entered Bogus Creek during the 2004 season is estimated to be 3,788 fish. Based on the proportion of male and female that were randomly sampled during the spawning ground surveys, the run was comprised of approximately 1,629 (43%) males and 2,159 (57%) females. Based on a grilse cut off of ≤ 56 cm, adults comprised approximately 92.1% (3,490 fish) and grilse comprised 7.9% (298 fish) of the run. Male Chinook ranged in fork length from 21 cm (very small grilse) to 108cm and averaged 77cm. Female Chinook ranged in fork length from 45cm to 98cm and averaged 75 cm. A total of 75 adipose fin-clipped Chinook salmon were observed during the spawning ground survey and heads were retrieved from 74 of these fish. Of the 74 heads that were collected, 58 contained readable tags, 1 tag was unreadable, 2 tags were lost while attempting to remove them from the head, 12 tags were shed, and 1 head was lost during the survey after collection. After application of sample expansion rates and hatchery production multipliers KRP staff estimate that 1,019 Chinook (27%) of the Chinook salmon that entered Bogus Creek were of hatchery origin from Iron Gate Hatchery.

A total of 409 coho salmon were observed passing through the BCFCF during the 2004 season. Five additional coho salmon were recovered in spawning ground surveys downstream of the BCFCF. Therefore, the total number of coho salmon that were observed in Bogus Creek during the 2004 season was 414 fish. A total of 176 coho salmon were observed in the spawning ground surveys from November 4 to December 28. Males comprised 49% and females comprised 51% of the run. Males ranged in size from 35 cm to 95 cm and averaged 69 cm. Females ranged in size from 58 cm to 77 cm and averaged 68 cm. Based on examination of fork length frequency distributions, grilse were determined to be ≤ 56 cm and comprised approximately 4.6% of the run. Several of the coho salmon carcasses observed were marked with either a left maxillary (42 fish), right maxillary (1 fish), or adipose fin clip (5 fish). The left maxillary clip corresponds to hatchery origin coho salmon that were released from IGH and a right maxillary clip corresponds to hatchery origin coho salmon that were released from Trinity River Hatchery (TRH). During the 2004 coho spawning season the Department applied a caudal clip and floy tag to 337 unmarked coho salmon that entered Iron Gate Hatchery and were subsequently released providing these fish the opportunity to spawn naturally. A total of 72 coho salmon with a caudal clip and/or Floy tag were observed in Bogus Creek. Therefore, of the 414 coho that were observed at the BCFCF approximately 17% were unmarked fish that had previously entered IGH and were released.

INTRODUCTION

Study Location and Run Timing

Bogus Creek is located on the south east side of the Klamath River just downstream of Iron Gate Hatchery (between river mile 189 and 190) in Siskiyou County, near the Oregon border (Figure 1). Fall-run Chinook salmon return to Bogus Creek to spawn from mid September to early November. The coho salmon spawning run occurs from late October to early January and steelhead run from November to March.

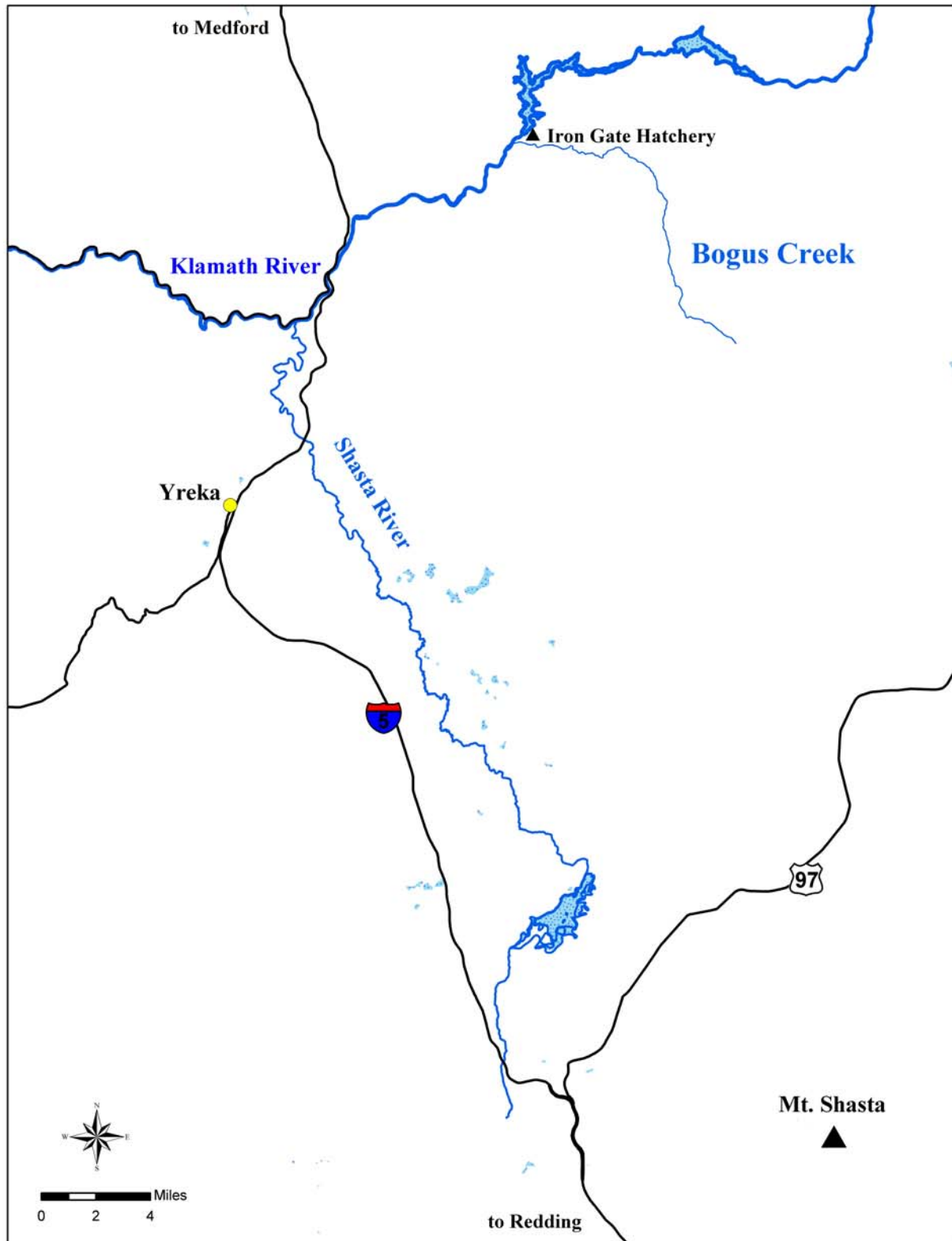


Figure 1. Location of Bogus Creek, tributary to the Klamath River, Siskiyou County.

Bogus Creek Fish Counting Facility

The purpose of the Bogus Creek Fish Counting Facility (BCFCF) is to count the number of adult Chinook salmon that enter Bogus Creek each year. Prior to the 2003 spawning run, a fish marking weir was operated on Bogus Creek to collect biological data, recover heads from adipose fin clipped adults, and mark Chinook with an opercle punch, which was then used for the Petersen mark and recapture population estimate from recaptures obtained during carcass surveys upstream. Incorporation of a video counting station in 2003 has greatly improved the accuracy of run size estimate and has eliminated the need to handle migrating salmon during the season. Biological data collection occurs during spawning ground surveys which includes collection of fork lengths, sex information, pre-spawn mortality, and recovery of CWTs from marked salmon encountered during the survey. The CDFG received funds from the Klamath River Basin Fisheries Task Force (Task Force) to aid in the operation of the weir and conduct spawning ground surveys on Bogus Creek during the 2004 Chinook spawning season.

Klamath Restoration Program

The Klamath River Basin Conservation Area Restoration Program was established in 1986 by the Klamath Act (Public Law 99-552). The purpose of this 20-year program is to restore anadromous fish in the Klamath River basin, primarily salmon and steelhead. The Klamath Act established two federal advisory committees: the Klamath River Basin Fisheries Task Force and the Klamath Fishery Management Council (KFMC). The KFMC and the Task Force consist of members from various interest groups including commercial and recreational fishermen, Native American tribes, as well as state and federal agencies. The goal of the KFMC and the Task Force is to ensure continued viable populations of anadromous fish in the Klamath Basin by managing in-river and ocean harvest of Klamath Basin anadromous fish and providing funding for restoration projects.

Klamath River Project and Bogus Creek Study

The Bogus Creek study is one component of the KRP (initiated in 1978). The goals of the KRP include obtaining information on species composition, spawning distribution, fork length frequency and sex ratios for salmonids (primarily Chinook) in various tributaries to the Klamath River including the Salmon, Scott, and Shasta rivers, as well as Bogus Creek and a dozen other small tributaries. Bogus Creek is particularly important because it is a major salmon spawning tributary, despite its small size. For example, during the 1996-98 spawning seasons, an average of 30.6% (8,914) of the total number of natural adult spawners above the Trinity River confluence were estimated to have entered Bogus Creek to spawn. Therefore, a significant portion of natural escapement to the Klamath Basin would be unaccounted for if the Bogus Creek studies were not conducted. In addition to providing valuable escapement estimates to the KFMC and the Pacific Fisheries Management Council for the effective management of fall-run Chinook salmon in the Klamath Basin, the Bogus Creek studies provide an additional opportunity to recover CWTs and collect scale samples (which are used in the final determination of age composition).

Bogus Creek Study Objectives Summarized:

- A) Determine the in-river run size (escapement) of fall Chinook salmon returning to Bogus Creek.

- B) Determine run timing, spawning distribution, length frequency distribution, and sex ratio for fall Chinook in Bogus Creek.
- C) Collect scale samples and recover heads (containing coded wire tags) from adipose fin-clipped Chinook in order to determine age composition of the run.
- D) Collect biological data for all coho salmon and steelhead observed during the Chinook spawning season.

METHODS

Operation of the Bogus Creek Fish Counting Facility

The video fish counting system was installed at the Bogus Creek Fish Counting Facility (BCFCF) on September 14th, 2004. A temporary Alaskan style weir was installed to direct migrating fish into a concrete flume where they pass in front of the camera. The underwater video system includes a water proof camera housing, viewing window, and counting flume which allowed for unimpeded passage through the facility. The facility was operated 24 hours a day, seven days a week throughout the Chinook salmon migration period. A Sony Hyper HAD digital color video camera (Model No SSC-DC50)¹ and Tokina 4mm F1.2 lens was used to collect the photo image and a Sony Time Lapse 168 Video Cassette Recorder (Model SVT-S3100) was used to record the image to SVHS 120 min video tapes. The time lapse VCR was set to record over a 12 hour period and tape changes were made at 0700 hours and 1900 hours daily. Operation of the video weir began on September 14th, and ended on December 8th, 2004.

All tapes were immediately returned to the office where each was subsequently reviewed by seasonal and scientific aides in the video lab. During each review staff recorded the date, time (hour:min:sec), and species of each fish observed on each video tape. If the species could not be determined because of poor visibility on picture quality, staff recorded that observation as fish unknown. Staff also noted any adipose fin clips (ad-clips) observed, and recorded the presence of lampreys or any other distinguishable marks that were visible on the tape. All video data was then entered into computer files and each data file was subjected to one independent edit prior to commencement of data analysis.

Spawning Ground Surveys

Spawning ground surveys were conducted twice a week, every Monday and Thursday throughout the Chinook salmon spawning season and then additional surveys were conducted once a week through December 28th to recover additional information for spawning coho salmon. The first survey was conducted on October 18th and the last survey was conducted on December 28th. A total of nine surveys were performed twice a week during the Chinook salmon spawning season and 5 additional surveys were conducted once a week during the coho salmon spawning season. For the purpose of the spawning ground surveys, Bogus Creek was divided into 4 reaches (Figure. 2). Reach 1 includes the area from the mouth of Bogus Creek upstream to the BCFCF, a distance of approximately 0.3 miles. Reach 2 extends from the BCFCF upstream to a small waterfall approximately 0.6 miles. Reach 3 begins at the small waterfall and continues upstream to a larger waterfall for approximately 2.0 additional miles and Reach 4 continues upstream to a larger waterfall (about 20' high) and fish ladder for a distance of 0.5 miles.

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

Each survey was conducted by three crews (one crew per reach), consisting of a minimum of two people for each crew. Fork length measurements (cm), and sex determinations were recorded from every fish encountered during the survey and when possible. Scale samples were taken from each carcass to assist in determining the age composition of the run. All scale samples were provided to the Yurok Tribal Fisheries Department for reading each week. All female carcasses were examined internally to determine spawning success. Females with greater than 50% of their eggs still remaining in their body cavity were identified as a pre-spawn mortality. Heads and scale samples were also collected for all ad-clipped fish (as well as fork length and sex) in order to recover the coded wire tag for subsequent age determination. Once examined, all carcasses were cut in half to prevent potential recounting during later surveys.

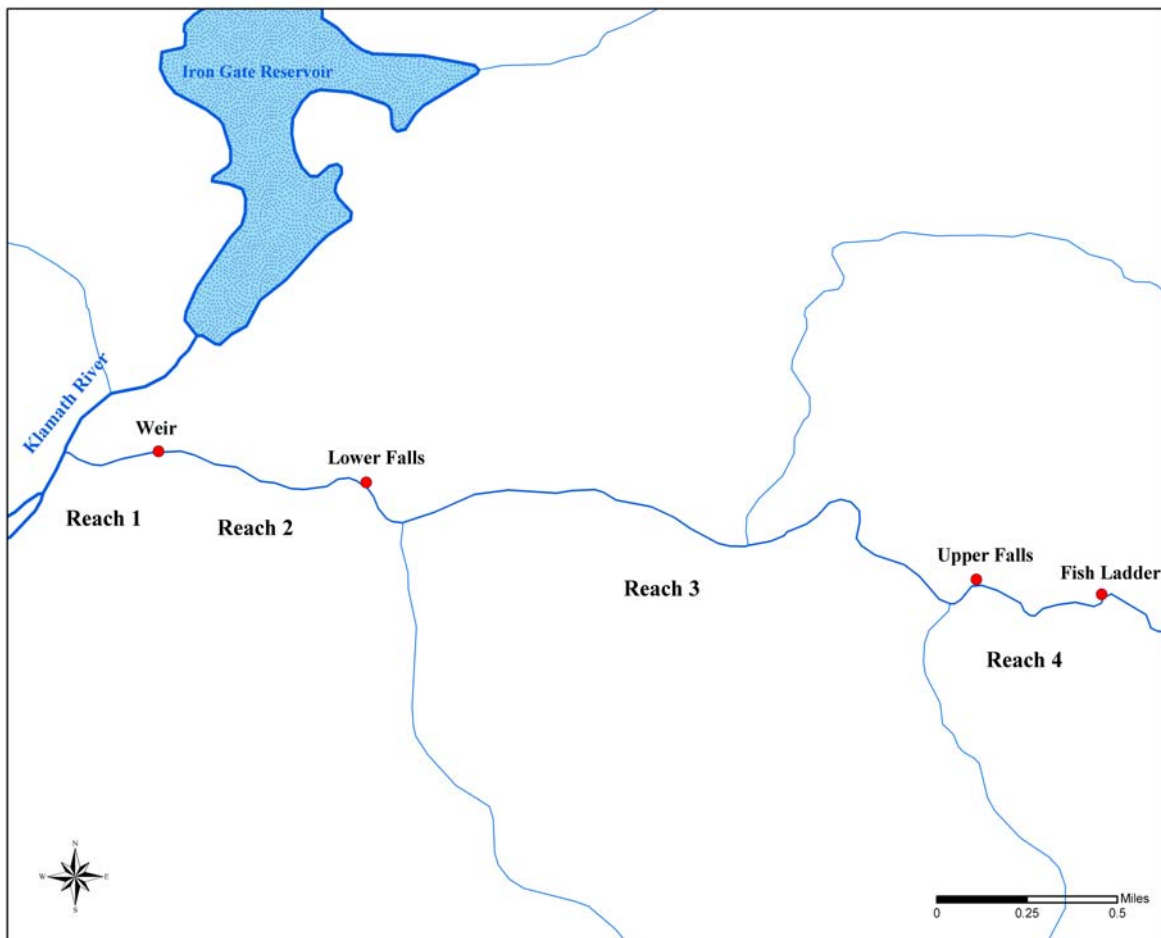


Figure 2. Map of spawning ground survey reaches on Bogus Creek used during the 2003 field season. The weir denotes the location of the Bogus Creek Fish Counting Facility (BCFCF).

Population Estimate

The Chinook salmon spawner escapement for the area of Bogus Creek upstream of the BCFCF was derived from a direct count of all Chinook salmon observed on the video tapes that recorded fish as they passed through the video counting facility. To estimate the total escapement to Bogus Creek, the number of Chinook salmon carcasses observed downstream of the weir (a direct count for Reach 1) was added to the count of all Chinook salmon that were observed passing through the video counting facility.

Hatchery contribution of Chinook was derived by multiplying the number of CWTs observed for each CWT group by its production multiplier value (the inverse of the proportion of each group of juveniles that were tagged). For Reaches 2, 3, and 4, an additional expansion (the inverse of the number of fish handled during spawning ground surveys divided by the direct count observed at the video counting facility) is applied. Therefore, the sum of each tag group observed in Reaches 2, 3, and 4, is multiplied by the sample expansion value.

RESULTS

Bogus Creek Fish Counting Facility

A total of 3,021 Chinook salmon were counted as they passed through the BCFCF between September 16 and November 11. The run peaked on October 13 when 256 Chinook salmon were observed passing through the flume (Figure 3). The majority of Chinook salmon entered Bogus Creek during the morning and afternoon hours. Movement of Chinook decreased dramatically during the night (Figure 4). An additional, 767 Chinook salmon carcasses were counted in the lower 0.25 mile of Bogus Creek located downstream of the BCFCF. Therefore, the total number of Chinook salmon that entered Bogus Creek during the 2004 season is estimated to be 3,788 fish. Based on the proportion of male and female Chinook salmon that were sampled during the spawning ground surveys, the run was comprised of approximately 1,629 (43%) males and 2,159 (57%) females. Based on a grilse cut off of $\leq 56\text{cm}$, adults comprised approximately 92.1% (3,490 fish) and grilse comprised 7.9% (298 fish) of the run.

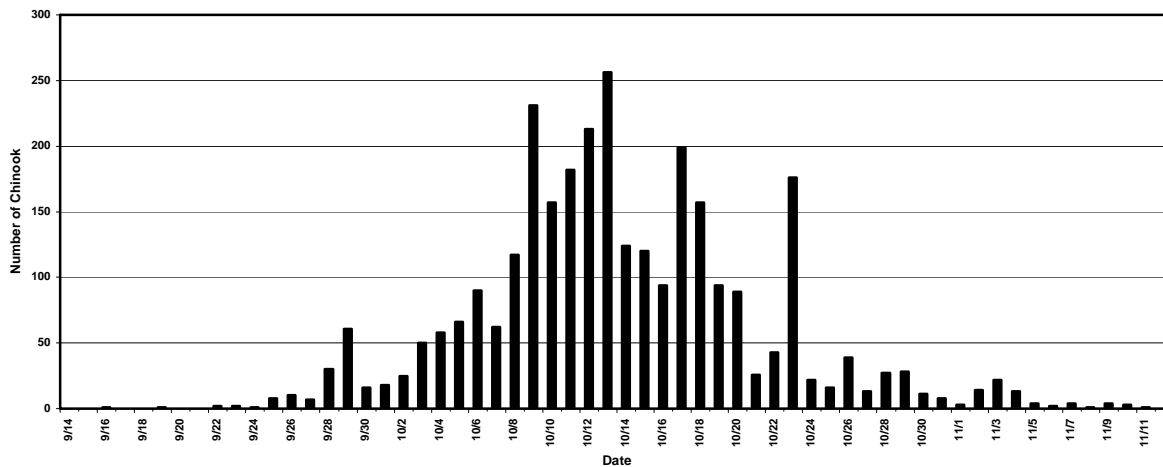


Figure 3. Run timing of Chinook salmon through the Bogus Creek Fish Counting Facility in 2004 (n = 3,021).

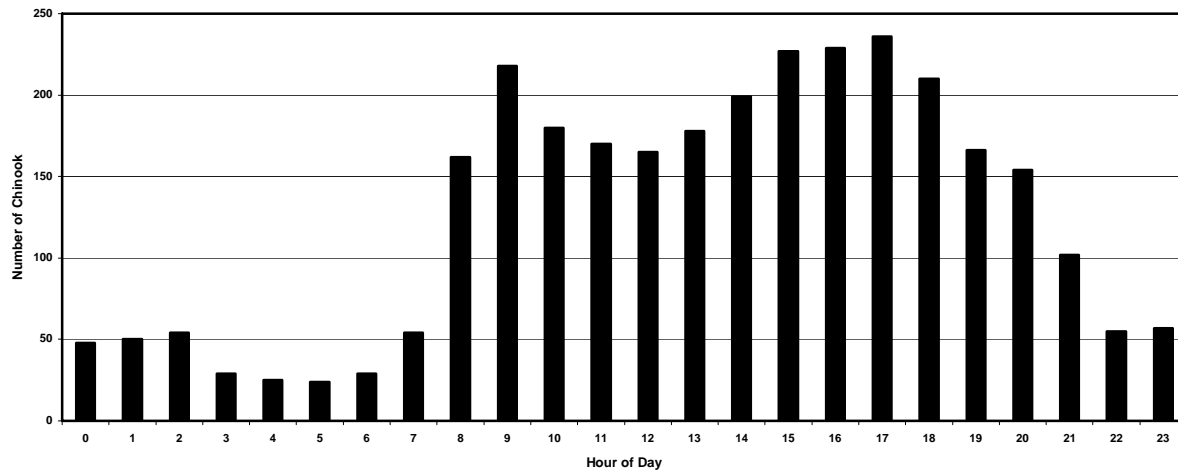


Figure 4. Summary of daily run timing of Chinook salmon through the Bogus Creek Fish Counting Facility during 2004 (n = 3,021).

A total of 2,485 Chinook salmon carcasses were sampled in the spawning ground survey. Sex determinations and fork length measurements could be determined for 2,478 of the Chinook salmon sampled. The remaining 7 Chinook were either partially eaten by predators or scavengers, or had decomposed to the point where accurate measurements could not be made. Of the 2,478 Chinook measured, 1,414 were females and 1,064 were males. Males ranged in fork length from 21cm (very small grilse) to 108cm and averaged 77cm (Figure 5). Females ranged in fork length from 45cm to 98cm and averaged 75 cm (Figure 6). Based on the length frequency distribution of male Chinook salmon grilse were determined to be ≤ 56 cm.

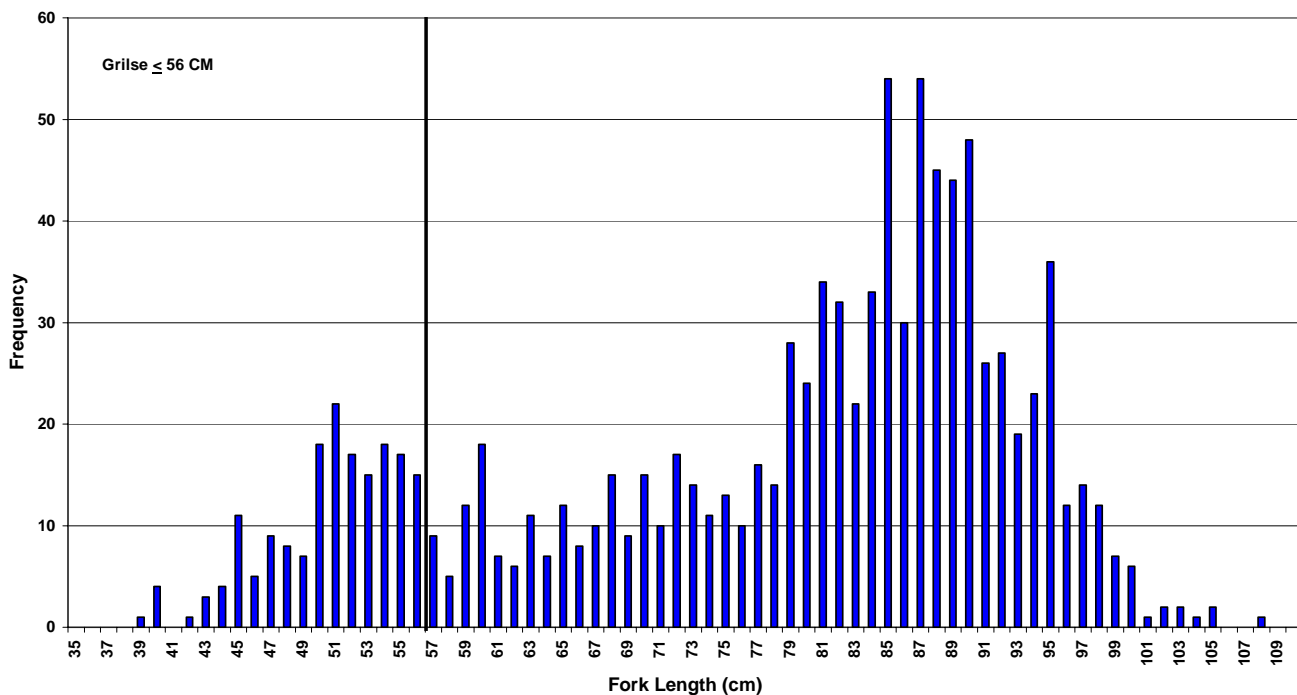


Figure 5. Length Frequency distribution of male Chinook salmon observed during spawning ground surveys in Bogus Creek, 2004 (n = 1,064).

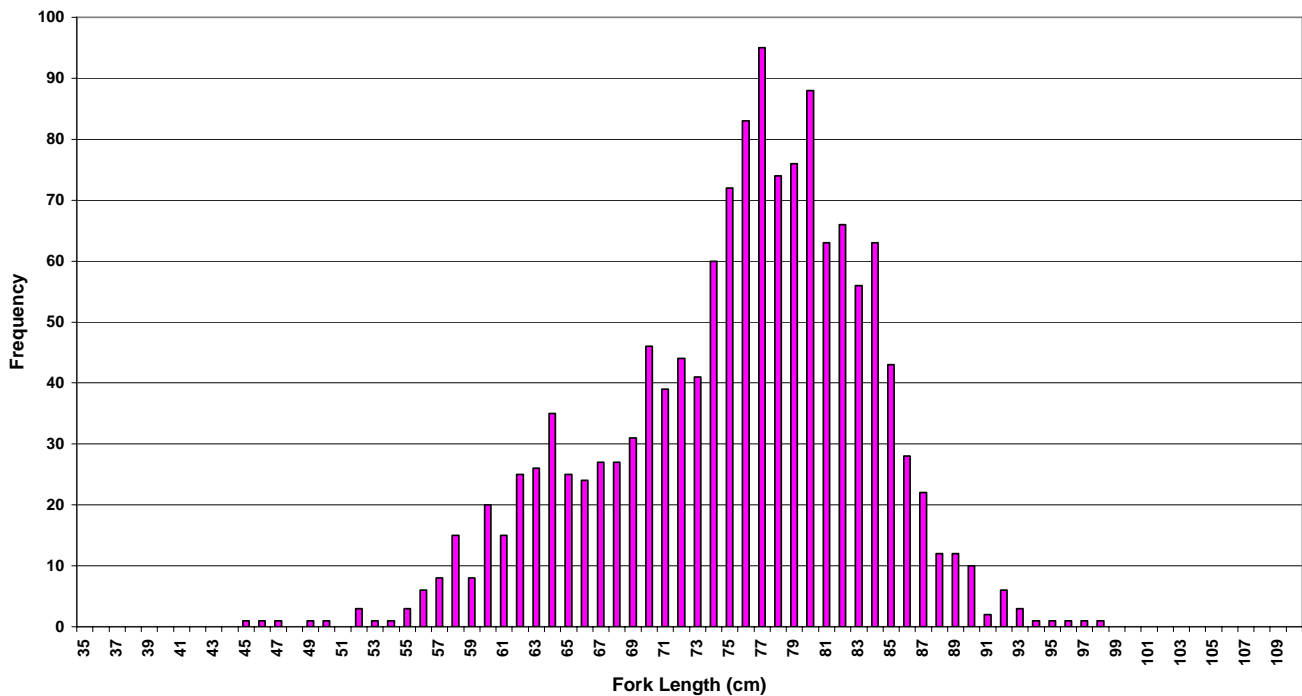


Figure 6. Length frequency distribution of female Chinook salmon observed during spawning ground surveys in Bogus Creek, 2004 (n = 1,414).

Hatchery Contribution

A total of 75 adipose fin-clipped Chinook salmon were observed during the spawning ground survey and heads were retrieved from 74 of these fish. One ad-clipped fish did not have a head as it was eaten by scavengers. Of the 74 heads that were collected, 58 contained readable tags, 1 tag was unreadable, 2 tags were lost while attempting to remove them from the head, 12 tags were shed, and 1 head was lost during the survey after collection. In order to estimate the probable origin of the 5 ad-clipped fish for which the tag was unreadable, or lost, staff assigned a cwt code to these based on the proportional distribution of the 58 tags that were readable. The estimated contribution of hatchery origin Chinook salmon in Bogus Creek is presented in Table 1. All of the CWTs that were retrieved were from Iron Gate Hatchery and these fish accounted for 27% (1,019 fish) of the total fall Chinook salmon run observed in Bogus Creek. The remaining 73% (2,769 fish) of the run is therefore assumed to be of natural origin.

Table 1. Estimated contribution of hatchery origin fall Chinook salmon in Bogus Creek. The estimate is based on coded-wire tags (CWT) recovered from ad-clipped fall run Chinook salmon collected in Bogus Creek during spawning ground surveys in 2004.									
CWT	Release Location	Brood Year	Age	Release Type	Number Recovered	Production Multiplier	Expanded	Sample Expansion	Total Estimate
Spawning Ground Surveys, Reach 1									
66353	IGH	2000	4	Y	6	9.6434	58	1	58
66354	IGH	2000	4	Y	8	8.5096	68	1	68
601020308	IGH	2000	4	F	1	32.4353	32	1	32
601020403	IGH	2000	4	F	1	30.6631	31	1	31
66355	IGH	2001	3	Y	4	9.3246	37	1	37
66357	IGH	2001	3	Y	1	9.8064	10	1	10
601020305	IGH	2001	3	F	1	17.6863	18	1	18
601020407	IGH	2002	2	F	1	28.4657	28	1	28
Subtotal =					23	Subtotal =			282
Spawning Ground Surveys, Reach 2, 3, and 4									
66353	IGH	2000	4	Y	5	9.6434	48	1.75844005	85
66354	IGH	2000	4	Y	8	8.5096	68	1.75844005	120
601020305	IGH	2000	4	F	1	17.6863	18	1.75844005	31
601020308	IGH	2000	4	F	1	32.4353	32	1.75844005	57
66355	IGH	2001	3	Y	6	9.3246	56	1.75844005	98
66356	IGH	2001	3	Y	5	10.5505	53	1.75844005	93
66357	IGH	2001	3	Y	8	9.8064	78	1.75844005	138
601020404	IGH	2002	2	F	1	16.3173	16	1.75844005	29
Subtotal =					35	Subtotal =			650
Estimated contribution of lost and unreadable CWTs					5	Subtotal =			86
Total Estimate Hatchery Contribution = 1,019									
Release Type: Y = Yearling; F = Fingerling									
Unknown CWTs: 200000 = CWT lost during removal from head, 300000 = head lost, 400000 = CWT unreadable.									
The production multiplier value is the inverse of the proportion effectively tagged and released from IGH.									
Sample expansion equals the inverse of the number sampled during carcass surveys divided by the video estimate.									

Coho Salmon

A total of 409 coho salmon were observed passing through the BCFCF during the 2004 season. Five additional coho salmon were recovered in spawning ground surveys downstream of the BCFCF. Therefore, the total number of coho salmon that were observed in Bogus Creek during the 2004 season was 414 fish. The first coho salmon was observed on October 19 and the last coho was observed in the early morning hours of December 8, the last day of video weir operations for the season (Figure 7). Several coho salmon (28) were observed passing through the video weir on December 7 in response to increasing flows related to a storm front that passed through the region at that time. Additional coho salmon likely entered Bogus Creek during and after the high flow event that overtopped the video weir and forced an end to its operation.

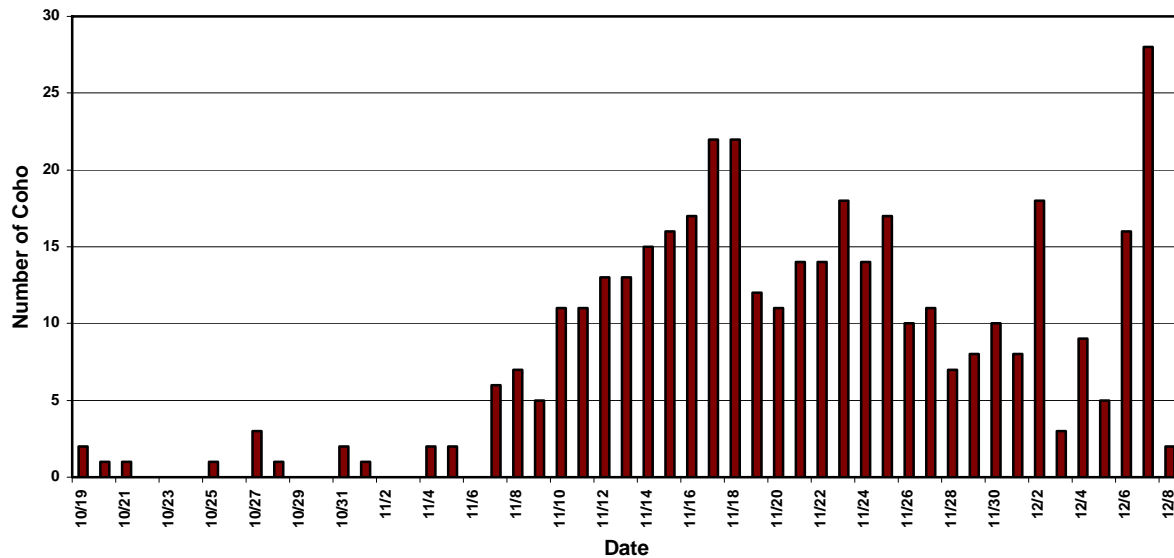


Figure 7. Run timing of coho salmon observed passing through the Bogus Creek Fish Counting Facility during the 2004 season (n = 409).

Diel movements of coho salmon through the BCFCF tended to increase in the late afternoon and evening hours (Figure 8) and peaked between 19:00 and 20:00 hours. Coho migration behavior differs substantial from the diel movements of Chinook salmon that have consistently been observed over the last several years at the Shasta River Fish Counting Facility and last year at Bogus Creek.

A total of 176 coho salmon were observed in the spawning ground surveys from November 4 to December 28. Males comprised 49% (87 fish) and females comprised 51% (89 fish) of the run. Fork length measurements could be conducted for 174 of the 176 coho salmon observed. Two of the coho observed were partially eaten and accurate fork length measurements could not be conducted. Males ranged in size from 35 cm to 95 cm and averaged 69 cm (Figure 9). Females ranged in size from 58 cm to 77 cm and averaged 68 cm (Figure 10). Based on examination of fork length frequency distributions, grilse were determined to be ≤ 56 cm and comprised approximately 4.6% of the run. Several of the coho salmon carcasses observed were marked with either a left maxillary (42 fish), right maxillary (1 fish), or adipose fin clip (5 fish). The left maxillary clip corresponds to hatchery origin coho salmon that were released from IGH and a right maxillary clip corresponds to hatchery origin coho salmon that were released from Trinity River Hatchery (TRH). Those coho salmon with an adipose fin clip are most likely hatchery fish released from Cole Rivers Hatchery operated by the Oregon Department of Fish and Wildlife on the Rogue River. Cole Rivers Hatchery releases 200,000 coho salmon smolts annually, which include, 150,000 fish with an ad-clip only, 25,000 fish with an ad-clip and CWT, and 25,000 fish that are tagged with a CWT and are not ad-clipped.

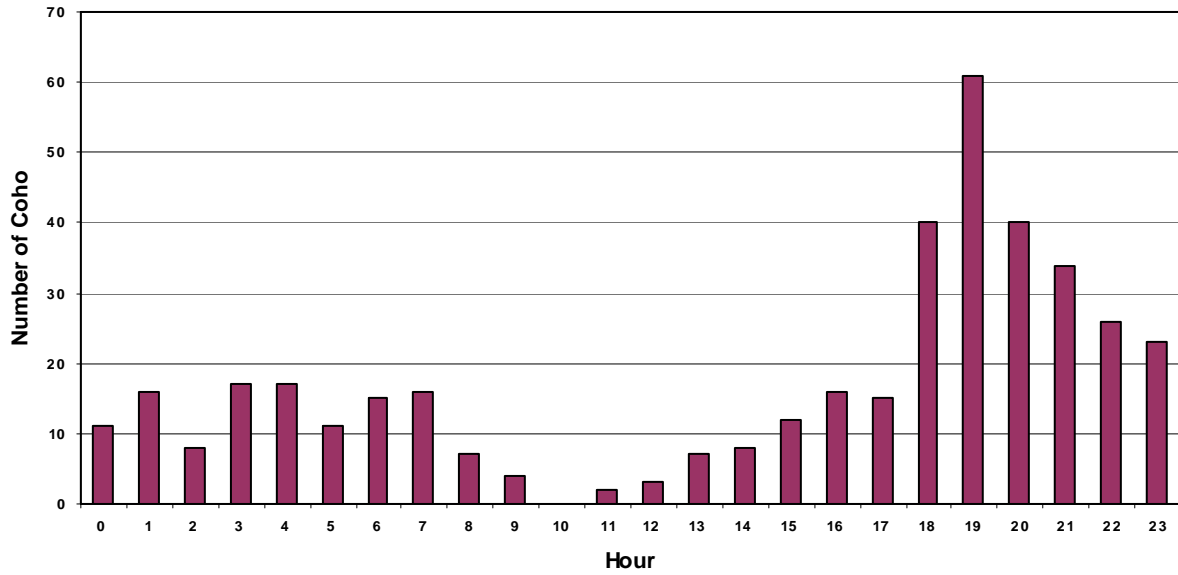


Figure 8. Diel migration patterns of coho salmon observed moving through the Bogus Creek Fish Counting Facility in 2004.

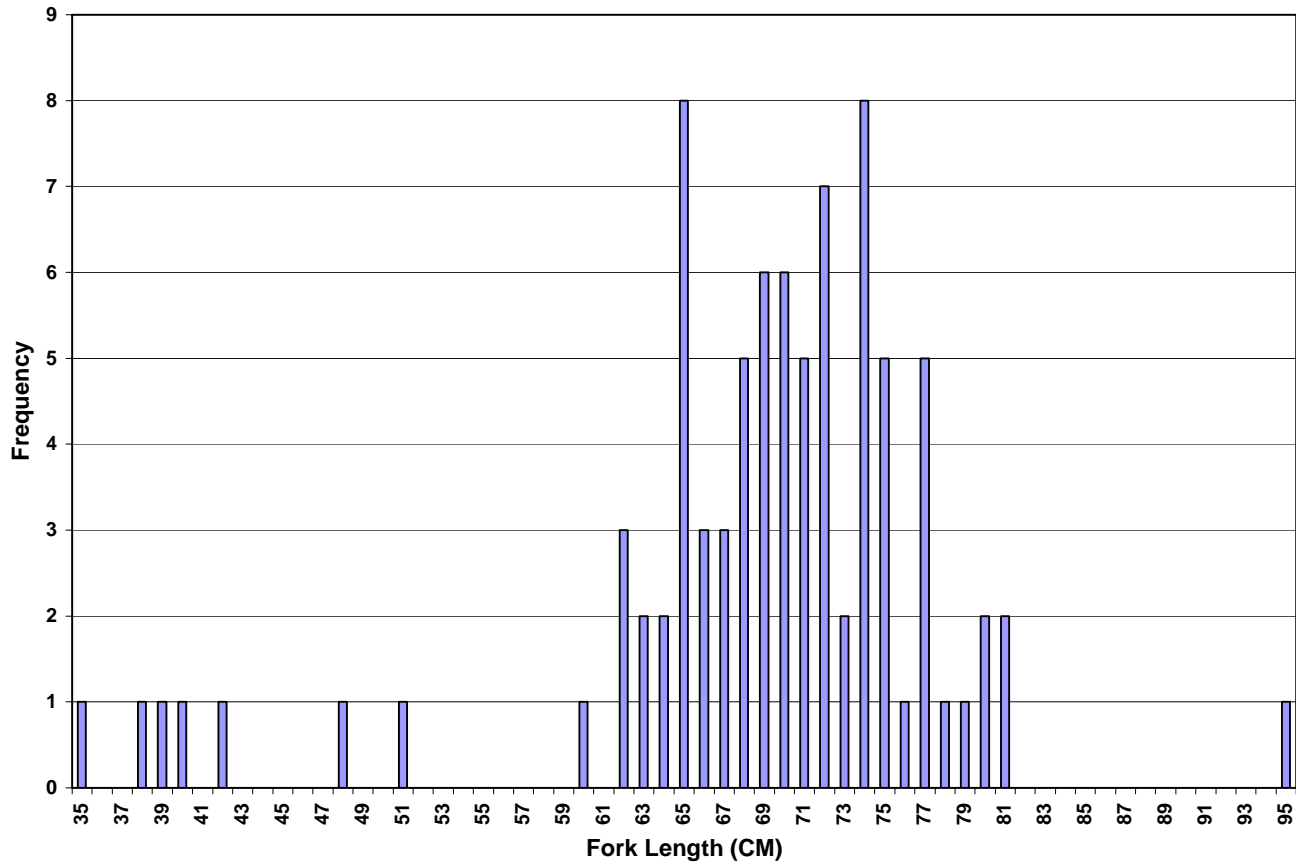


Figure 9. Fork length frequency distribution of male coho salmon observed in the Bogus Creek spawning ground surveys, 2004 (n = 86).

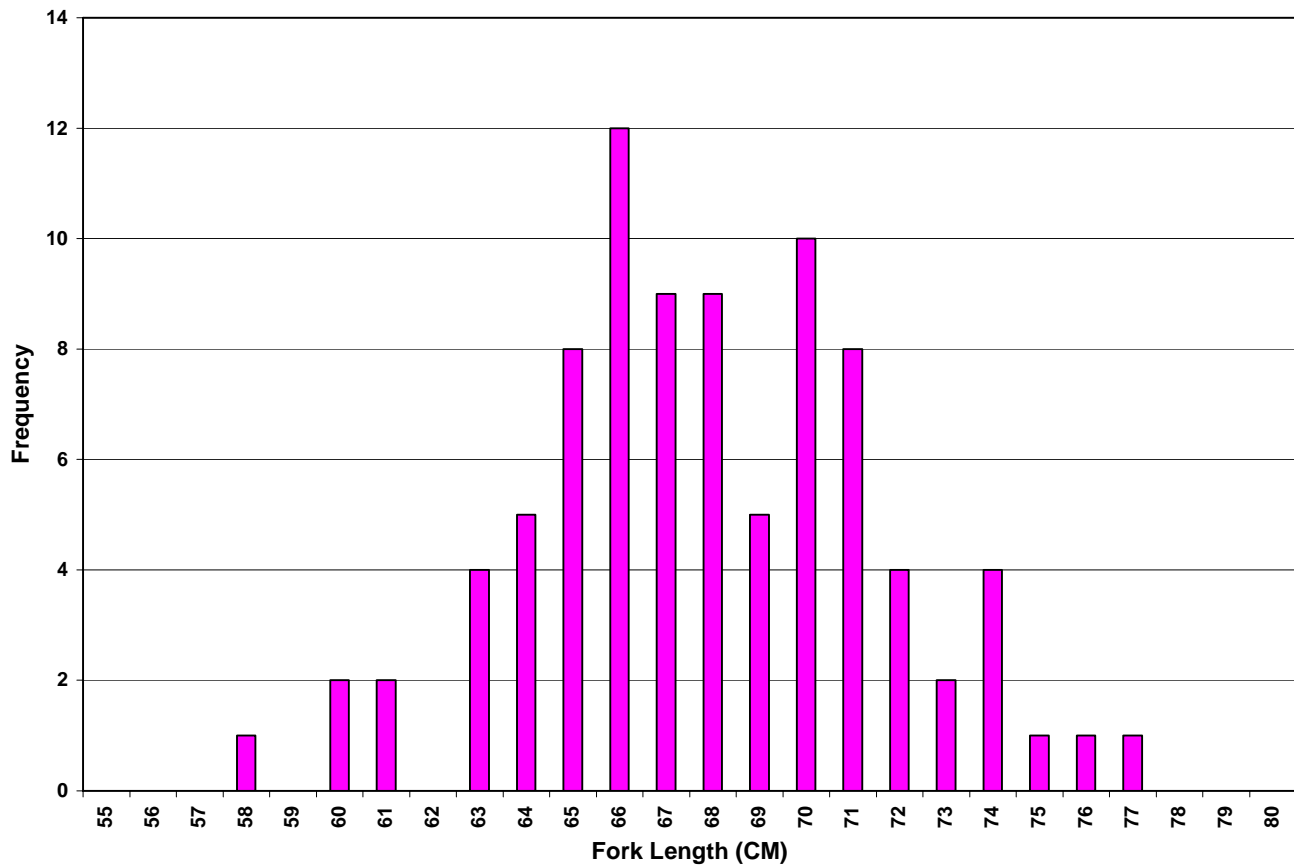


Figure 10. Fork length frequency distribution of female coho salmon observed in the Bogus Creek spawning ground surveys, 2004 (n = 88).

Based on the fork length information and the number of males and females observed in the spawning ground survey, the Department estimates that of the 414 coho salmon estimated in Bogus Creek in 2004, approximately 19 fish (4.6%) were grilse, 186 (44.8%) were adult males and 209 (50.6%) were adult females. Based on the number marked coho salmon that were observed, the Department estimates that about 27.7% (48 coho) of the coho salmon in Bogus Creek were of hatchery origin and 72.3% (125 coho) were of natural origin. Of the 125 unmarked coho salmon that were observed in Bogus Creek during spawning ground surveys, 33 coho (26.4%) had a caudal clip and floy tag indicating that they were unmarked coho released from IGH.

In the fall of 2004, the Department, in collaboration with NOAA Fisheries, initiated a new program intended to reduce potential take of unmarked coho salmon that enter Iron Gate Hatchery. 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 an individually 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 addition, the U.S. Fish and Wildlife Service inserted radio tags to 40 adult unmarked coho salmon at the hatchery which were then released back to

the river. A total of 337 unmarked coho salmon were floy tagged and 40 coho were radio tagged by USFWS and released from IGH during the 2004 season.

Because of the proximity of Bogus Creek to IGH, several of the unmarked coho salmon that were released from IGH subsequently swam up Bogus Creek. A total of 71 coho salmon with a caudal clip and/or Floy tag were observed passing through the BCFCF and one was recovered in the spawning ground survey downstream of the BCFCF, bringing the total number of unmarked coho to 72. Therefore, of the 414 coho that were observed at the BCFCF approximately 17% were unmarked fish that had previously entered IGH and were released. As mentioned earlier in this report, a total of 176 coho salmon were observed in the spawning ground surveys, and of these fish 31 fish (18%) were caudal clipped and Floy tagged at IGH. The percentage of unmarked fish released from IGH, those with a caudal clip and floy tag, that were observed at the BCFCF (17%) and in the spawning ground survey (18%) correspond closely, indicating the proportions observed in the spawning ground survey are likely representative the entire coho salmon run.

DISCUSSION

Historic Chinook Runs

Since 1978 the Chinook salmon run in Bogus Creek has ranged from 46,432 fish (1995) to 785 fish (1990) and has averaged 9,491 fish (Figure 11). The 2004 Chinook salmon run in Bogus Creek ranks as the nineteenth largest (3,788 fish) recorded since the beginning of the Klamath River Project in 1978. The largest run of fall Chinook salmon within the entire Klamath River basin occurred during the 1995 season when a total of 245,543 Chinook salmon were estimated. In that same year the ladder gates to IGH were shut after the hatchery met its egg production goal. Therefore, a significant portion of the IGH Chinook salmon that would otherwise have entered IGH either spawned in the main stem or entered Bogus Creek. This probably accounts for the large return of Chinook salmon that were observed in Bogus during the 1995 season. As a result, the run size estimates for IGH and Bogus Creek during the 1995 season do not accurately describe the run size that would most certainly have occurred if the ladder gates at IGH were left open during that year. Subsequent to 1995, the hatchery policy was modified to allow all Chinook to enter the hatchery irregardless of the numbers of fish that may return. This policy change allows for better monitoring of natural and hatchery components within the Chinook salmon run at IGH annually, and also reduces the potential for hatchery stocks spawn naturally and should reduce potential interactions between hatchery and natural Chinook salmon populations within the basin.

A comparison between the annual Chinook salmon runs estimated in entire basin (total in river run), Bogus Creek, IGH, and the total natural escapement to the Klamath River basin excluding the Trinity River is presented in Figure 12. The contribution of Bogus Creek Chinook salmon escapement to the total in-river run has ranged from a low of 1.9% in 1990 to a high of 18.9% in 1995. In 2004 the Bogus Creek Chinook salmon run accounted for approximately 4.3% of the total run of Chinook salmon in the basin and contributed 13% of the total natural spawning population within the Klamath River basin, excluding the Trinity River basin. Since 1996 the contribution of Bogus Creek has ranged from 5.8% to 15.4% of the total in river run within the Klamath basin. In terms of the total natural escapement of Chinook salmon in the Klamath basin, excluding the Trinity River, Bogus Creek has contributed a substantial number of spawning Chinook and its contribution has ranged from 8.7% in 1990, to 56.3% in 2000, and has averaged 25.8% since 1978.

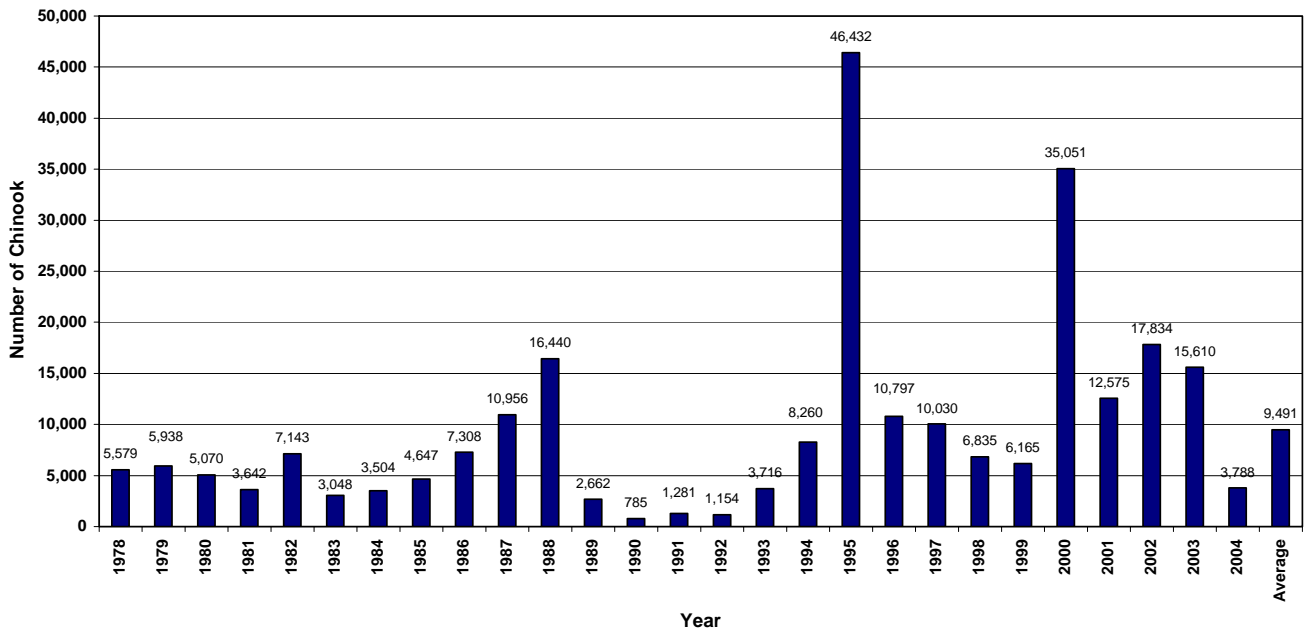


Figure 11. Total Chinook salmon escapement levels estimated to have returned to Bogus Creek from 1978 to 2004.

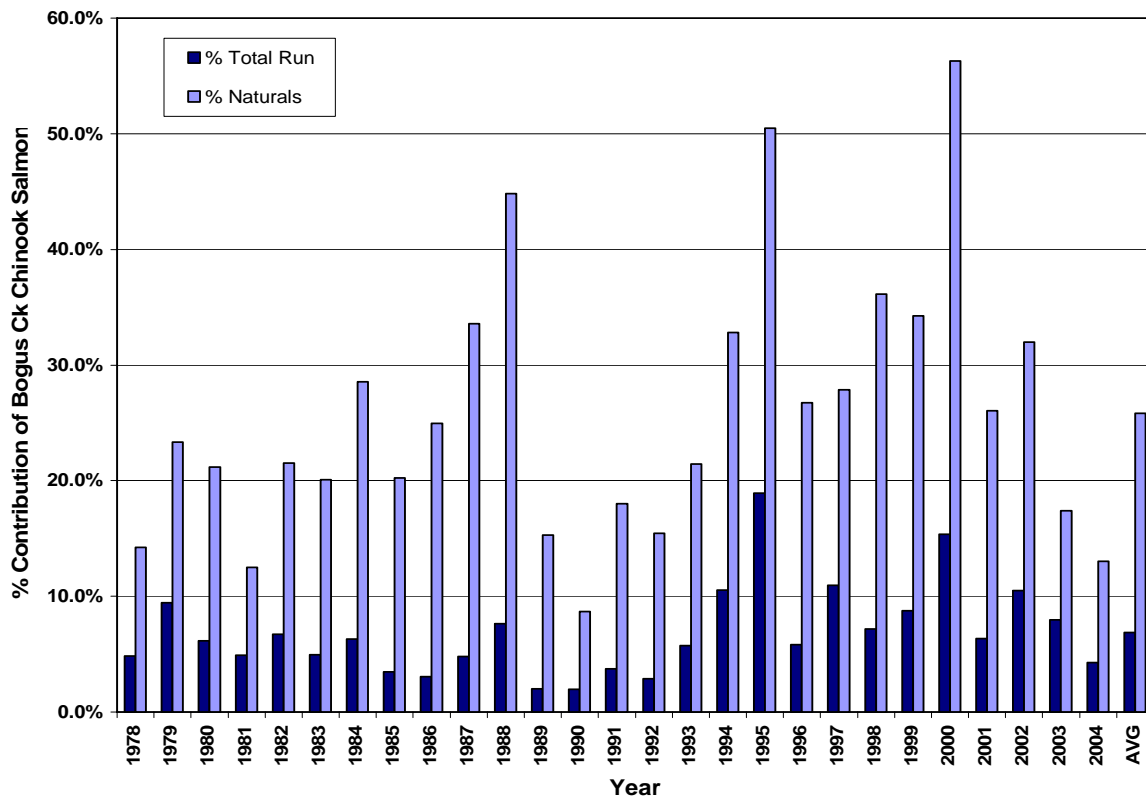


Figure 12. Percent contribution of Bogus Creek Chinook salmon to the total fall Chinook run size estimate for the entire Klamath basin and total natural spawner escapement in the Klamath basin, excluding the Trinity River, from 1978 to 2004.

Hatchery Chinook Salmon Contributions

The KRP has estimated the contribution of hatchery origin Chinook salmon in Bogus Creek since 1999. Over that period of time the contribution of hatchery Chinook to the total Chinook salmon run in Bogus Creek has fluctuated greatly, ranging between 61.6% and 7.5% (Figure 11). Yearling Chinook salmon released from IGH in 1998 (Brood Year 1997) and 1999 (Brood Year 1998) were not tagged prior to release because of budgetary constraints. Without tags on these yearling releases it is impossible to determine their contribution rates, and therefore the hatchery estimates presented for Bogus Creek do not account for potential hatchery returns from these two yearling releases. Three year old returns from these two yearling brood years would have occurred during the 2000 and 2001 seasons. The 2002 return would have been the last year that untagged yearlings from the 1998 brood year would have returned as four year old fish. As a result, the hatchery contribution estimates for Bogus Creek from 1999 to 2002 likely under estimate the total hatchery contribution to Bogus Creek by an unknown number. Even without an accounting of these untagged yearling releases, a large proportion of the 2000 (37.2%) and 2001 (61.6%) Chinook salmon run that returned to Bogus Creek originated from IGH.

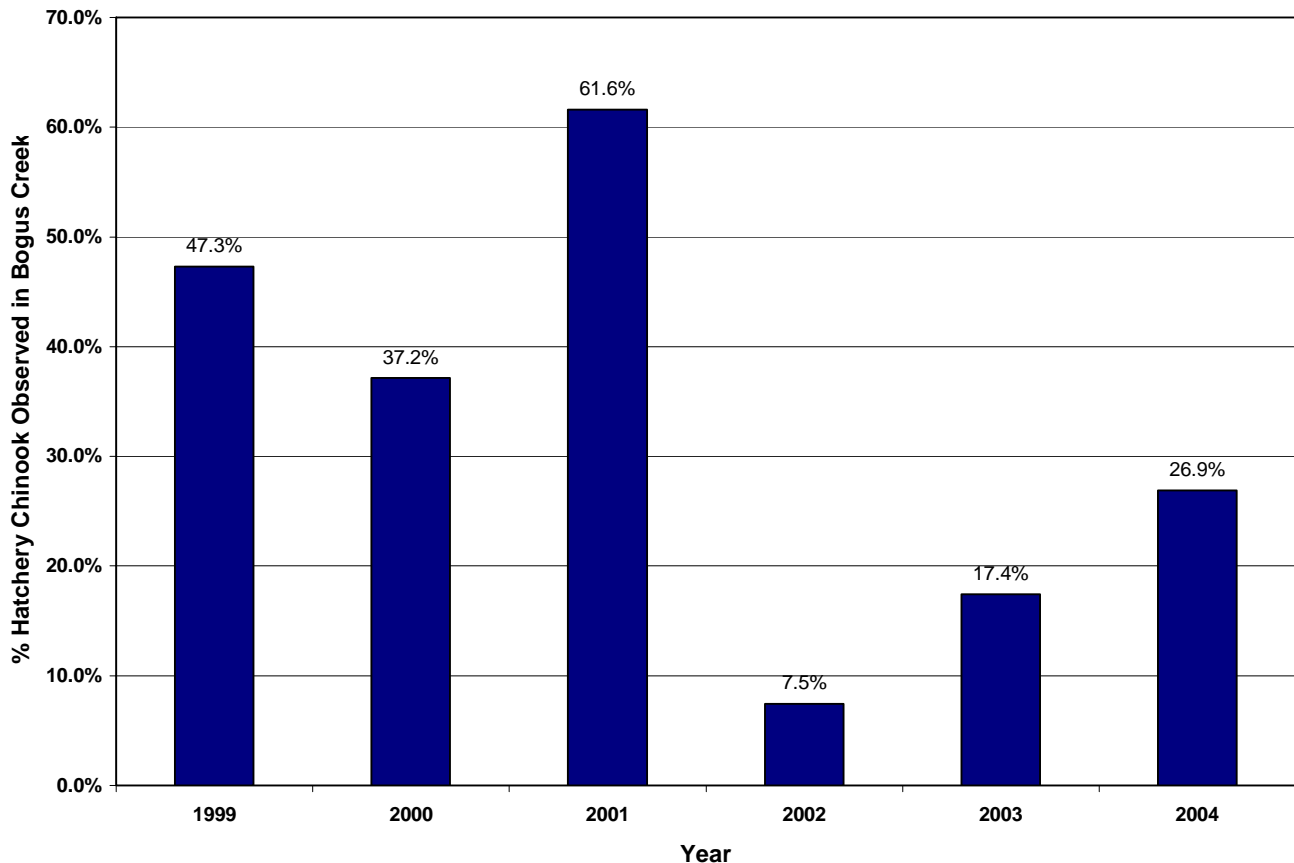


Figure 11. Estimated contribution of hatchery origin Chinook salmon observed in Bogus Creek from 1999 through 2004.

In 2002, the contribution of hatchery origin Chinook in Bogus Creek decreased substantially to only 7.5%. The actual contribution of hatchery fish in that year would be higher since the 4 year old returns from the 1998 yearling release cannot be accounted for. Nonetheless, the hatchery contribution rate for

2002 is substantially lower than was observed in the previous three years. Although the number of hatchery Chinook salmon observed in Bogus Creek increased to 26.9% of the run in 2004, the contribution of hatchery fish observed was still well below the rate observed prior to the 2002 run.

Coho Salmon

The 2004 sampling effort was the first time that the BCFCF was operated beyond early November to monitor coho salmon migrations into Bogus Creek. In previous efforts the video operation typically ended prior to November 11th after the Chinook migration into Bogus Creek had ended. This year's sampling effort also coincided with a relatively strong coho salmon brood year. In addition, the increased effort also allowed the Department to monitor movement of unmarked coho salmon that were released from IGH during the spawning run. A total of 377 unmarked coho were released from IGH during the 2004 season which included 337 caudal clip and floy tagged coho and 40 coho radio tagged by the USFWS. A total of 72 unmarked coho salmon from IGH were observed in Bogus Creek and these fish accounted for approximately 17% of the coho run. From data gathered during the spawning ground survey the Department estimated that approximately 27.7% of the coho salmon were of hatchery origin and 72.3% were of natural origin. Of the 72.3% of unmarked coho estimated in Bogus Creek, approximately 26.4% of these originated from unmarked coho salmon that previously entered IGH and were subsequently released. Release of unmarked coho salmon from IGH resulted in a substantial increase to the natural coho salmon population in Bogus Creek.

CONCLUSIONS

Bogus Creek continues to support a large number of Chinook salmon within the Klamath Basin each year. Although the presence of the hatchery adjacent to the creek has undoubtedly had a tremendous influence on the composition of the Chinook salmon run within Bogus Creek over the years, in recent years the contribution of hatchery origin Chinook in Bogus Creek has declined substantially. It is uncertain whether or not this trend will continue into the future, regardless, the importance of monitoring the annual escapement of Chinook salmon to Bogus Creek for fishery management purposes cannot be underestimated. This becomes even more evident when one considers the contribution that Bogus Creek Chinook salmon have provided to the overall natural escapement levels within the Klamath basin upstream of the Trinity River. This year Bogus Creek Chinook salmon accounted for 13% of the natural spawner escapement within the Klamath River upstream of the confluence of the Trinity River, and has accounted for an average of 25.8% of the natural escapement since 1978. Failure to collect this data would negatively impact fishery management efforts within the basin.

Currently, the Bogus Creek Salmon Study is focused on describing the characteristics of the Chinook salmon run annually. With the listing of coho salmon as threatened under both the federal Endangered Species Act (ESA) and California Endangered Species Act (CESA) the Department increased effort towards monitoring coho salmon populations in Bogus Creek this year. This effort was accomplished without additional funding allocations and it is hoped that a secure source of funding can be obtained in the future to ensure that this effort continues.

There are no flow gauges or temperature monitoring stations currently in place on Bogus Creek. Establishment of a temporary flow staff gauge on lower Bogus Creek would provide information on flow levels that is currently lacking. A temperature monitoring station would also provide some information on the suitability of Bogus Creek to support rearing coho salmon and steelhead trout

throughout the year. If possible, the KRP will develop a temporary gauging station and temperature monitoring site near the BCFCF in the fall of 2005.

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