

BOGUS CREEK SALMON STUDIES

2005



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ABSTRACT

The California Department of Fish and Game's (CDFG), Klamath River Project (KRP) operated a video fish counting facility and conducted spawning ground surveys (carcass surveys) on Bogus Creek during the Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) spawning season. The purpose of these surveys is to describe the run characteristics of adult fall-run Chinook and coho salmon into Bogus Creek. Video fish counting operations began on September 12th. High storm flows forced the temporary removal of the Bogus Creek Fish Counting Facility (BCFCF) from November 6th until November 18th. This down time did not affect Chinook salmon monitoring efforts as the migration of Chinook into Bogus Creek had nearly ended prior to November 6th. Operations at the BCFCF ended for the season on December 1st when a second high flow damaged the weir structure and camera. Monitoring of the coho salmon run was compromised by high flow conditions during the 2005 season.

The total number of Chinook salmon that entered Bogus Creek during the 2005 season is estimated to be **5,397** 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 2,405 (45%) males and 2,992 (55%) females. Based on a grilse cut off of ≤ 52 cm, adults comprised approximately 98.92% (5,339 fish) and grilse comprised 1.08% (58 fish) of the run. Males ranged in fork length from 46cm to 103cm and averaged 75cm. Females ranged in fork length from 54cm to 95cm and averaged 70cm. A total of 131 heads were collected from Chinook salmon that appeared to be adipose fin-clipped. These included Chinook with positive ad-clips as well as those carcasses where the presence of an ad-clip was uncertain do to either natural erosion or decay. Of the 131 heads that were collected, Thirty two (32) of the heads collected did not contain CWTs and 3 heads contained tag codes that were unreadable, and the remaining 96 heads contained CWTs that were legible. All of the CWTs recovered were from IGH releases. After application of sample expansion rates and hatchery production multipliers KRP staff estimate that 1,931 Chinook (35.8%) of the Chinook salmon that entered Bogus Creek were of hatchery origin from Iron Gate Hatchery.

A net total of 102 coho salmon were observed passing upstream through the BCFCF during the 2005 season. Fifteen (15) 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 2005 is estimated to be **117** fish. A total of 101 coho salmon were observed in the spawning ground surveys from November 15 to December 13. Males comprised 47.5% and females comprised 52.5% of the run. Males ranged in size from 59 cm to 77 cm and averaged 69 cm. Females ranged in size from 52 cm to 73 cm and averaged 66 cm. Several of the coho salmon carcasses observed were marked with a left maxillary clip (48 fish) indicating that these fish originated from IGH. During the 2005 coho spawning season the Department applied a caudal clip and floy tag to 124 unmarked coho salmon that entered Iron Gate Hatchery and were subsequently released providing these fish the opportunity to spawn naturally. A total of 10 coho salmon with a caudal clip and/or Floy tag were observed in Bogus Creek.

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.

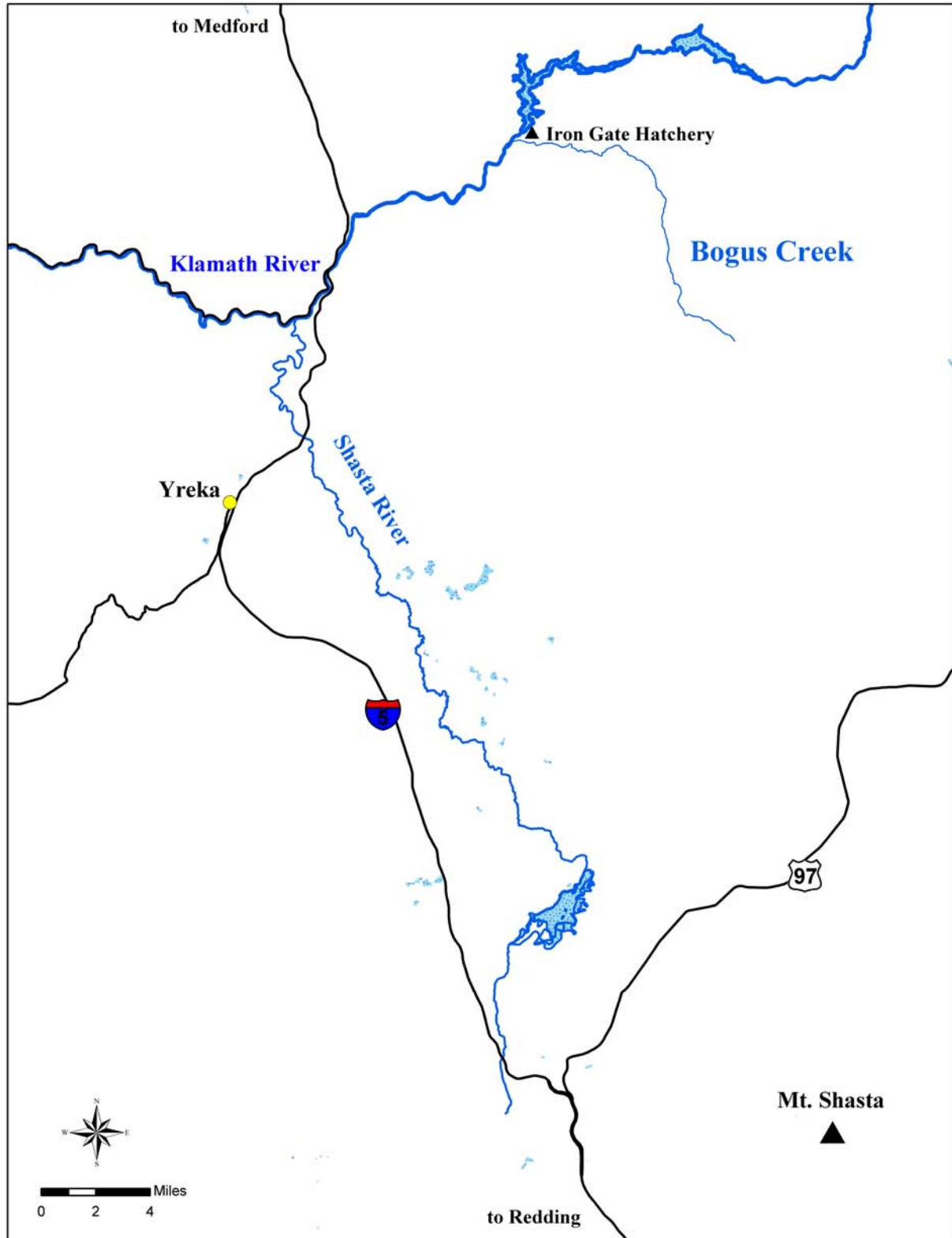


Figure 1. Location of Bogus Creek, tributary to the Klamath River, Siskiyou County.

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 to aid in the operation of the weir and conduct spawning ground surveys on Bogus Creek during the 2005 Chinook salmon 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 (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 12th, 2005 at 10:27 hrs PST. 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) equipped with a 3.5 – 8mm 1:1.4 Computar lens¹ 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 standard time.

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 Tuesday and Friday throughout the Chinook salmon spawning season and then additional surveys were conducted once a week through December 13th to recover additional information for spawning coho salmon. The first survey was conducted on October 18th and the last survey was conducted on December 13th. A total of ten surveys were performed twice a week during the Chinook salmon spawning season and 3 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. Each survey was conducted by three crews (one crew per reach), consisting of a minimum of two people

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

for each crew. Fork length measurements (cm), scale samples and sex determinations and information regarding spawning success for females were systematically collected from every fourth carcass examined during the survey. All scale samples were provided to the Yurok Tribal Fisheries Department for analysis each week. 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. Every coho salmon carcass that was recovered during the survey was sampled.

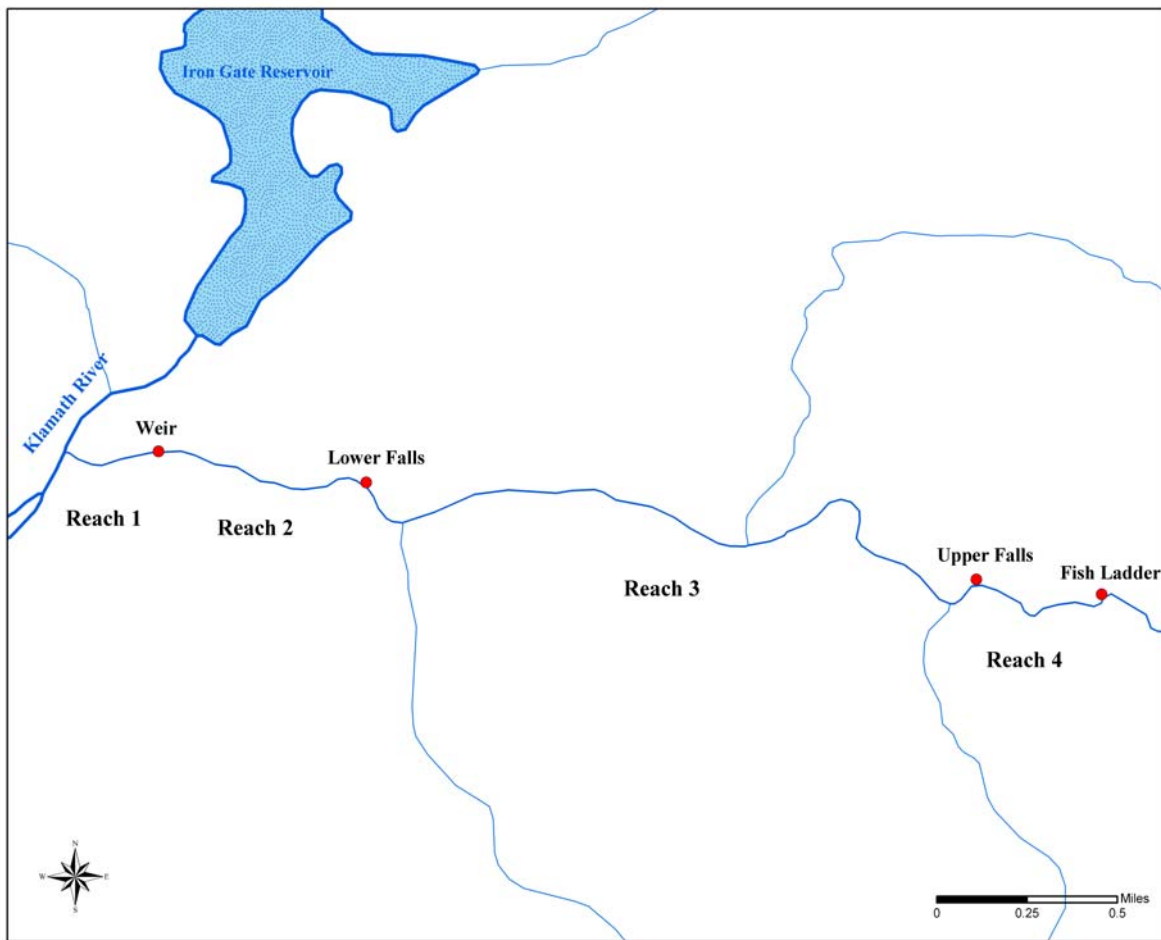


Figure 2. Map of spawning ground survey reaches on Bogus Creek used during the 2005 field season. The weir denotes the location of the Bogus Creek Fish Counting Facility (BCFCF).

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) was applied.

RESULTS

OPERATION OF THE BOGUS CREEK FISH COUNTING FACILITY

The BCFCF began recording fish movements at 10:27 hrs PST on September 12th, 2005. On September 13th the video recorded malfunctioned from 13:46 hrs until 17:31 hrs when staff corrected the problem. On November 6 high flows forced the removal of the video equipment at 07:34 hrs. Unfortunately the underwater camera housing and some of the tripods that support the Alaska Weir were damaged during the high flows (Figure 3). Repairs had to be made to the camera housing and tripods. As a result, the BCFCF was not reinstalled until 16:54 hrs on November 18th. Another larger storm passed through Siskiyou County on December 1st and the resulting high flows destroyed the temporary weir structure. All of the tripods, support channels, and conduit was washed downstream several hundred feet. This loss in equipment signaled the end of migration monitoring for the remainder of the 2005 season.



Figure 3. Photograph of the BCFCF taken on November 8th after peak flows had receded. The damaged camera housing (lid removed) is visible in the lower right corner. The collapsed tripods are visible in the left center of the picture downstream of concrete raceway and pad.

During the season staff noticed that several Chinook salmon were passing back through the counting flume in a downstream direction rather than continuing through the flume upstream in a deliberate motion as has occurred in past years. Placement of an additional dam board just downstream of the counting flume created slower water velocities through the counting flume and this may have encouraged salmon to hold within the counting flume for longer periods. Removal of one of the dam boards during the season appeared to reduce this problem by creating faster water velocities through the counting flume.

CHINOOK SALMON

In 2005 a total of 5,549 Chinook salmon were counted as they swam upstream through the BCFCF and 1,435 Chinook salmon were counted moving downstream, leaving a net total of 4,159 Chinook salmon in Bogus Creek upstream of the BCFCF. The first Chinook salmon was observed on September 13th and the last Chinook salmon was observed on November 22nd. The run peaked on October 14th when 573 Chinook were counted moving upstream through the BCFCF (Figure 4).

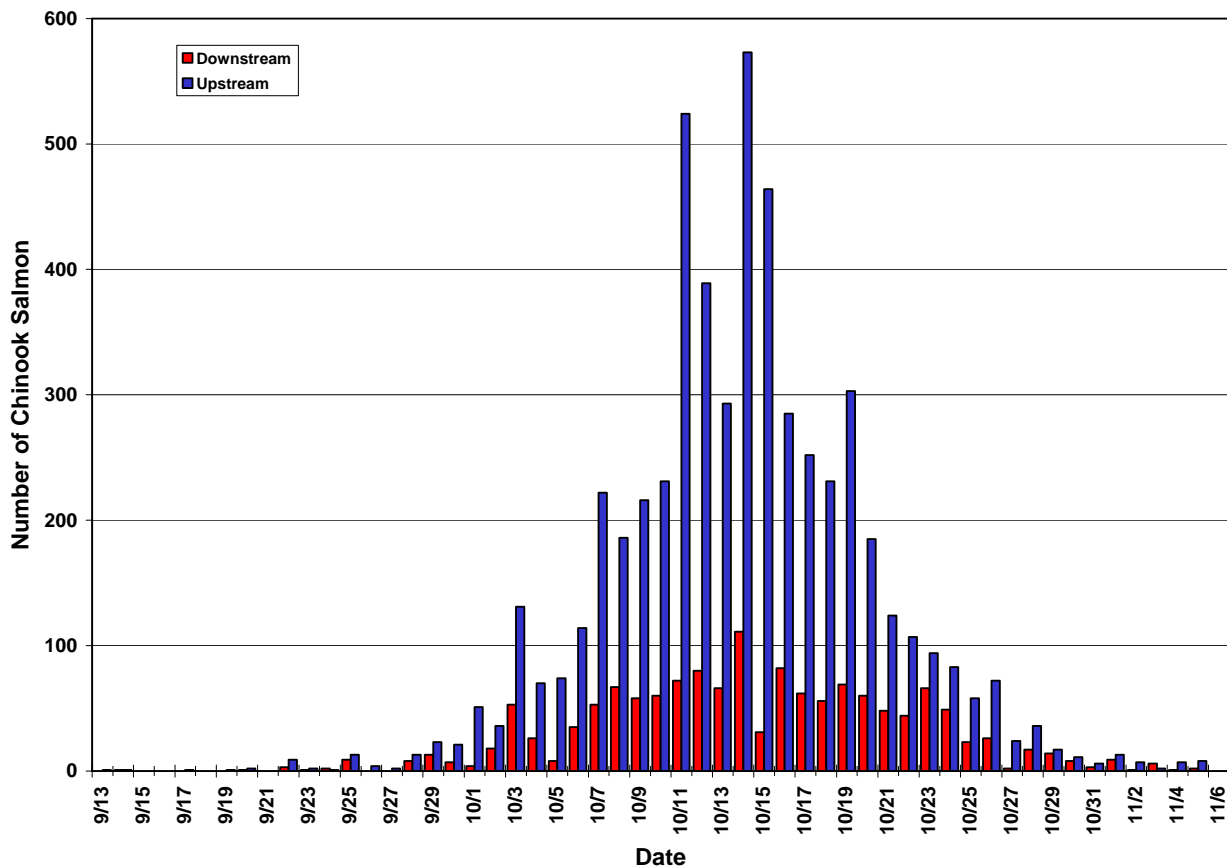


Figure 4. Run timing of Chinook salmon through the BCFCF during the 2005 season. Both upstream and downstream movements through the counting flume are shown.

The majority of Chinook salmon passed through the BCFCF upstream during daylight hours and peaked in the afternoon after 16:00 hrs (Figure 5). The proportion of downstream Chinook relative to Chinook salmon swimming upstream was greatest during the late afternoon and night. Many of these fish may

have inadvertently entered the entrance of the flume while milling around in the holding pool upstream of the weir.

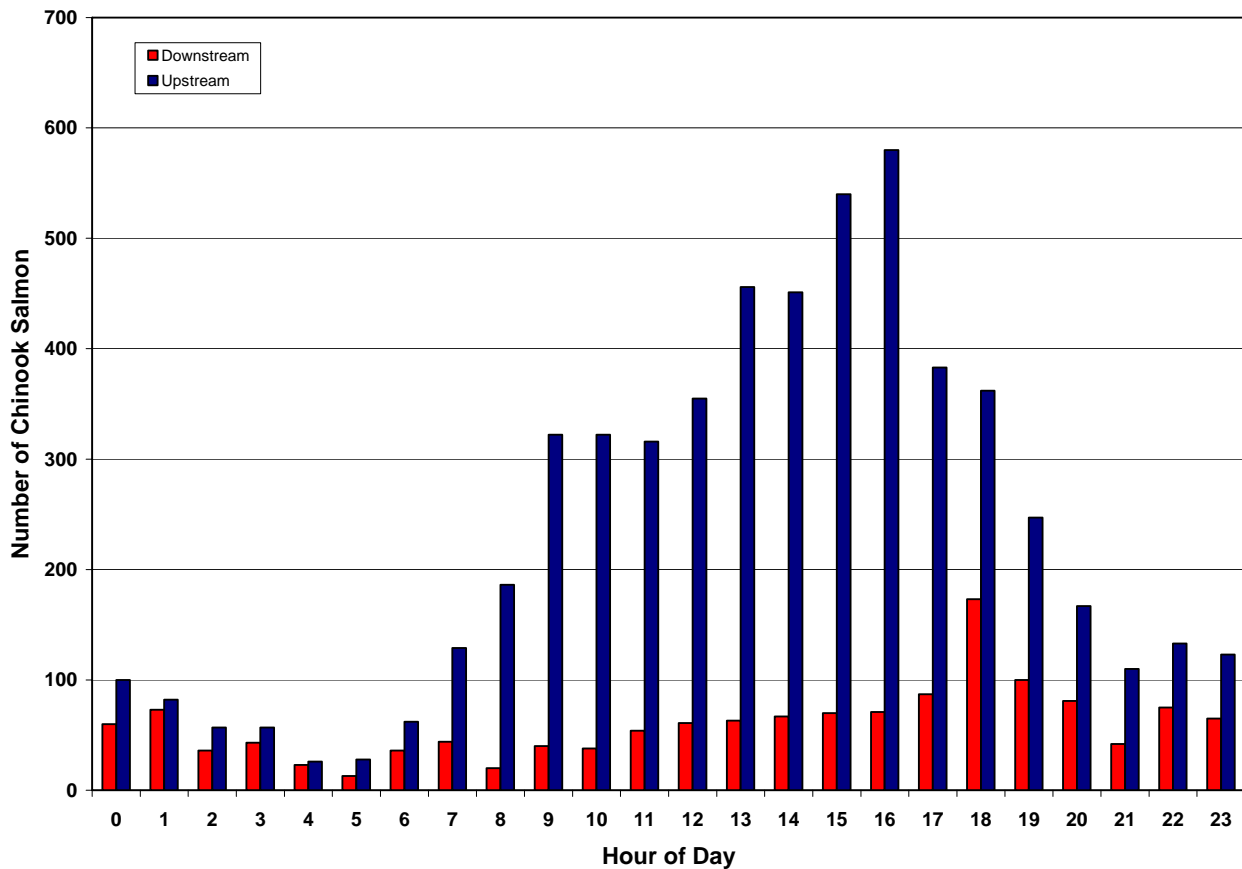


Figure 5. Summary of daily run timing of Chinook salmon observed at the Bogus Creek Fish Counting Facility during 2005. Both upstream and downstream movements through the counting flume are shown.

An additional, 1,238 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 2005 season is estimated to be **5,397** 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 2,405 (45%) males and 2,992 (55%) females. Based on a grilse cut off of ≤ 52 cm, adults comprised approximately 98.92% (5,339 fish) and grilse comprised 1.08% (58 fish) of the run.

Spawning Ground Surveys

A total of 930 Chinook salmon carcasses were systematically sampled in the spawning ground survey. Of the 930 Chinook salmon carcasses examined, 515 were females, 414 were males, and the gender for one carcass could not be determined do to predation. Males ranged in fork length from 46cm to 103cm and averaged 75cm (Figure 6). Based on the length frequency distribution of male Chinook salmon presented on Figure 6, grilse were determined to be ≤ 52 cm in fork length. Females ranged in fork length from 54cm to 95cm and averaged 70cm (Figure 7).

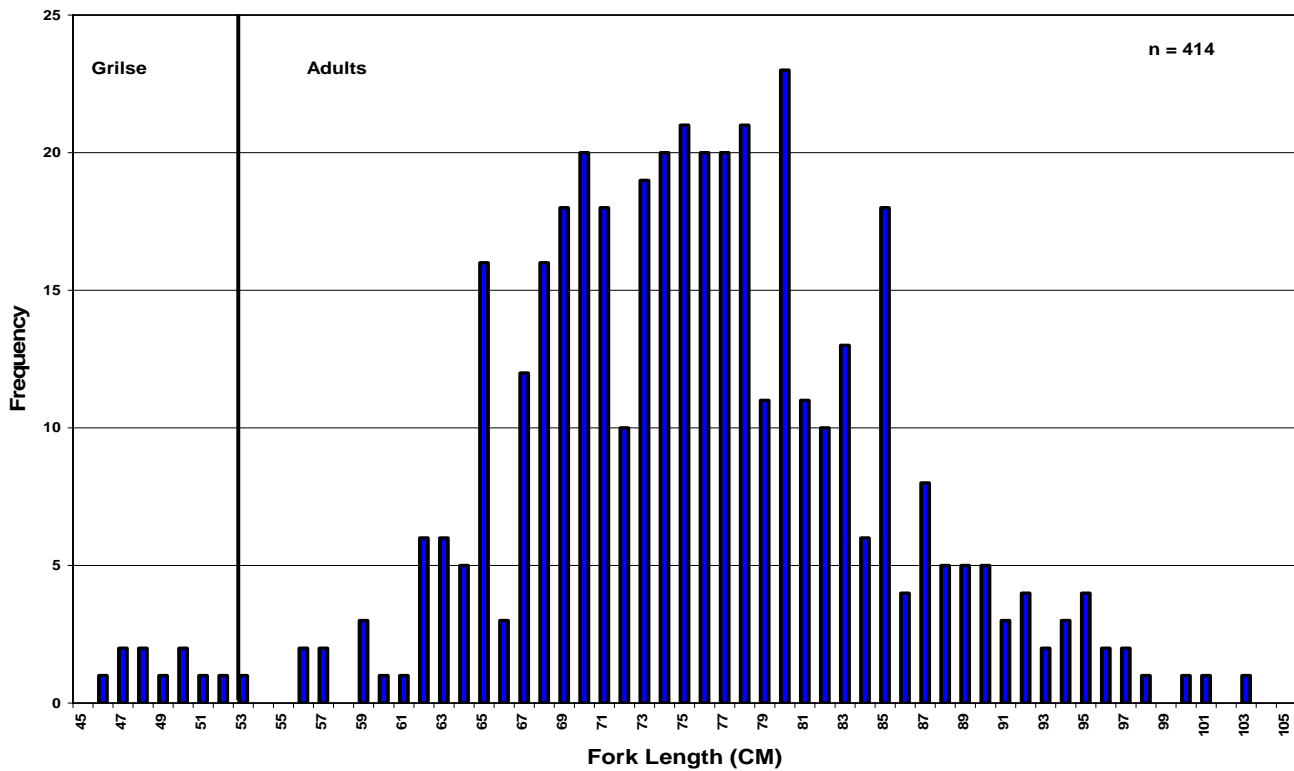


Figure 6. Length Frequency distribution of male Chinook salmon observed during spawning ground surveys in Bogus Creek, 2005 (n = 414).

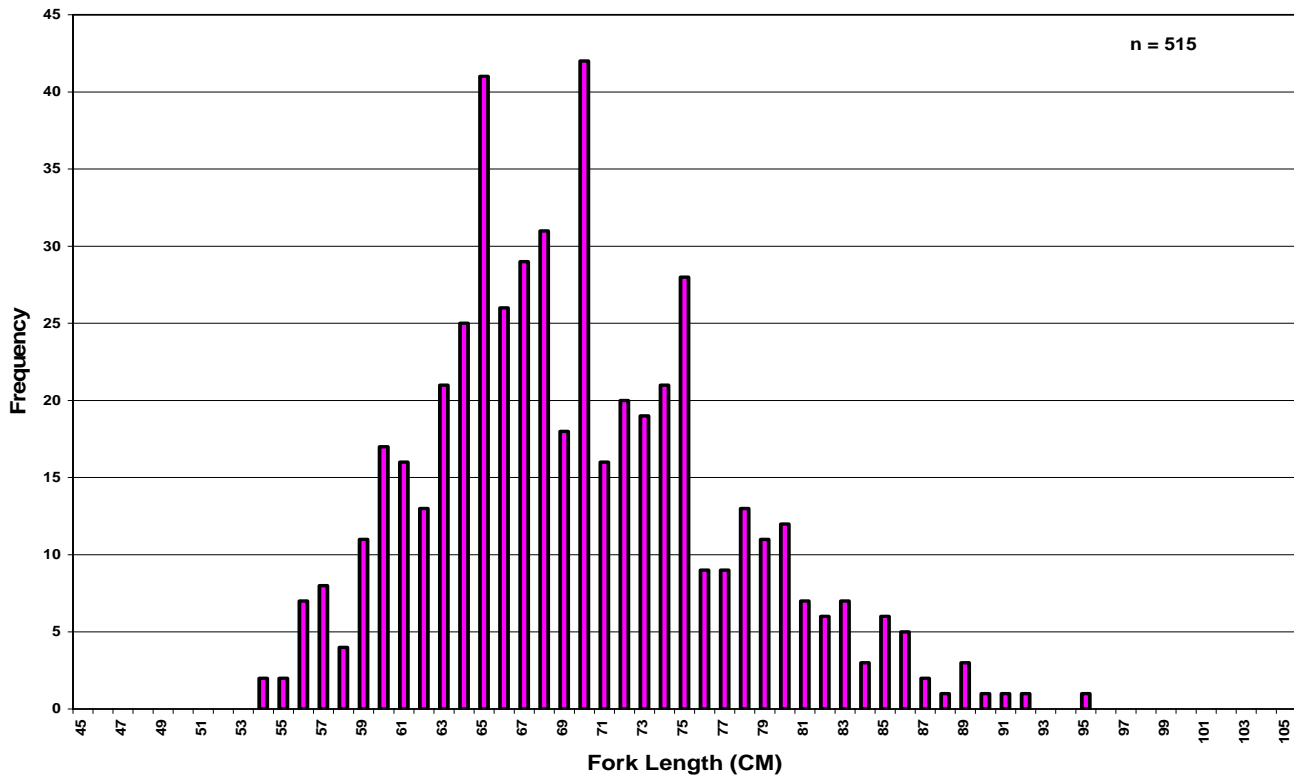


Figure 7. Length frequency distribution of female Chinook salmon observed during spawning ground surveys in Bogus Creek, 2005 (n = 515).

Hatchery Contribution Estimate

A total of 131 heads were collected from Chinook salmon that appeared to be adipose fin-clipped. These included Chinook with positive ad-clips as well as those carcasses where the presence of an ad-clip was uncertain do to either natural erosion or decay. Of the 131 heads that were collected, Thirty two (32) of the heads collected did not contain CWTs and 3 heads contained tag codes that were unreadable, and the remaining 96 heads contained CWTs that were legible. All of the CWTs recovered were from IGH releases. A total of 36 CWTs were recovered in Reach 1, downstream of the BCFCF, and a total of 61 CWTs were recovered in Reaches 2, 3, and 4, upstream of the BCFCF. To estimate the total hatchery contribution the number of recoveries for each CWT was multiplied by the production multiplier derived at the time of release from IGH. In addition, a sample expansion based on the inverse of the number of carcasses (2,529) examined upstream of BCFCF divided by the total number of Chinook salmon that was observed passing through the BCFCF (4,159), was applied to all CWT recoveries upstream of the BCFCF (Table 1).

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 2005.

CWT	Release Location	Brood Year	Age	Release Type	Number Recovered	Production Multiplier	Expanded	Sample Expansion	Total Estimate
Spawning Ground Surveys, Reach 1									
66354	IGH	2000	5	Y	3	8.5096	26	1	26
601020403	IGH	2001	4	F	1	30.6631	31	1	31
66355	IGH	2001	4	Y	3	9.3246	28	1	28
66356	IGH	2001	4	Y	3	10.5505	32	1	32
66357	IGH	2001	4	Y	7	9.8064	69	1	69
601020404	IGH	2002	3	F	9	16.3173	147	1	147
601020405	IGH	2002	3	F	2	15.7441	31	1	31
601020406	IGH	2002	3	F	5	17.6863	88	1	88
601020407	IGH	2002	3	F	1	28.4657	28	1	28
66359	IGH	2002	3	Y	1	9.9983	10	1	10
400000	Estimated contribution for unreadable CWTs				1	9.8938	10	1	10
Subtotal =					36	Subtotal = 500			
Spawning Ground Surveys, Reach 2, 3, and 4									
66355	IGH	2001	4	Y	8	9.3246	75	1.6445	123
66356	IGH	2001	4	Y	1	10.5505	11	1.6445	17
66357	IGH	2001	4	Y	14	9.8064	137	1.6445	226
601020404	IGH	2002	3	F	17	16.3173	277	1.6445	456
601020405	IGH	2002	3	F	10	16.3173	163	1.6445	268
601020406	IGH	2002	3	F	6	15.7441	94	1.6445	155
601020407	IGH	2002	3	F	2	17.6863	35	1.6445	58
66358	IGH	2002	3	Y	1	28.4657	28	1.6445	47
66359	IGH	2002	3	Y	1	9.9983	10	1.6445	16
601020408	IGH	2003	2	F	1	19.2041	19	1.6445	32
400000	Estimated contribution for unreadable CWTs				2	9.8938	20	1.6445237	33
Subtotal =					63	Subtotal = 1431			
Total Estimate Hatchery Contribution =									1,931
Release Type: Y = Yearling; F = Fingerling									
400000 CWT: 3 CWTs were unreadable and based on forklength these 3 tags were assumed to be 2001BY, Yearling release.									
The production multiplier value is the inverse of the proportion of effectively tagged versus total released for that group from IGH.									
Sample expansion equals the inverse of the number sampled during carcass surveys divided by the video estimate.									

Pre-Spawn Mortalities

A total of 515 Chinook salmon female carcasses were systematically sampled (1 in 4) during the spawning ground survey. Each of these was examined to determine if they had spawned prior to death. Females with approximately 1/2 or more of their eggs still present in the body cavity when examined were identified as a pre-spawn mortality. Of the 515 female Chinook carcasses examined, spawning success could not be determined for one female because the body cavity had been eaten by predators or scavengers, 477 females (92.8%) were found to have spawned, and 37 females (7.2%) still contained more than 1/2 of their spawn and were identified as pre-spawn mortalities.

COHO SALMON

High flows on November 6th forced the removal of the video recording equipment and damaged the camera box and two of the weir tripods. It took several days to repair the camera box and as a result the BCFCF was not operating from November 6th (07:34hrs) to November 18th (16:54hrs). Since the camera was inoperable, there was no monitoring of coho salmon movements into Bogus Creek during this time. High flows on December 1st forced removal of the BCFCF for the remainder of the season. Therefore, the coho salmon numbers reported do not accurately represent the entire number of coho that likely entered Bogus Creek during the 2005 season.

The first adult coho salmon was observed entering Bogus Creek on October 28th and the last coho salmon was observed on November 30th which was the last full day of operations for the BCFCF. A total of 118 coho salmon were observed moving upstream through the BCFCF and 16 coho salmon were observed moving back downstream through the BCFCF (Figure 8). Therefore, a net total of 102 coho salmon were seen entering Bogus Creek upstream of the BCFCF.

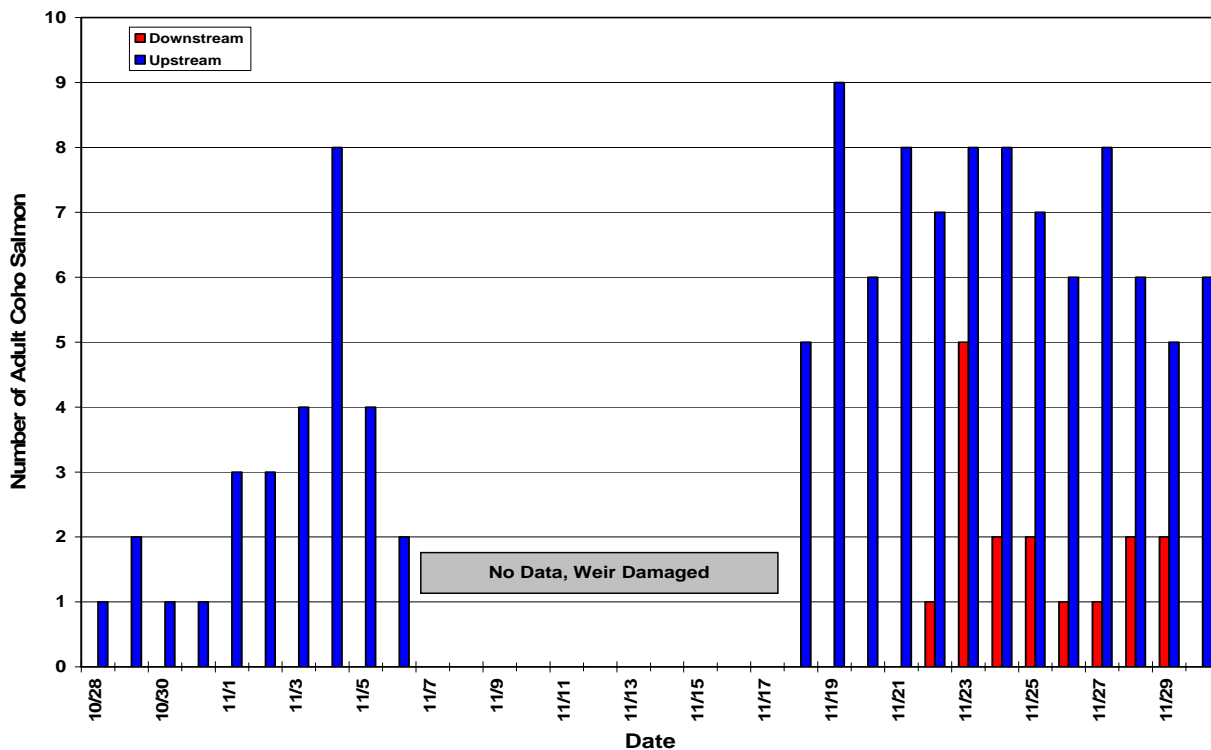


Figure 8. Run timing of coho salmon observed passing through the Bogus Creek Fish Counting Facility during the 2005 season. A total of 118 coho were observed moving upstream and 16 coho salmon were observed moving downstream through the BCFCF.

Diel movements of coho salmon through the BCFCF were greatest in the evening hours, peaking between 19:00hrs and midnight (Figure 9). This movement pattern is consistent with observations during the 2004 season (Hampton 2005).

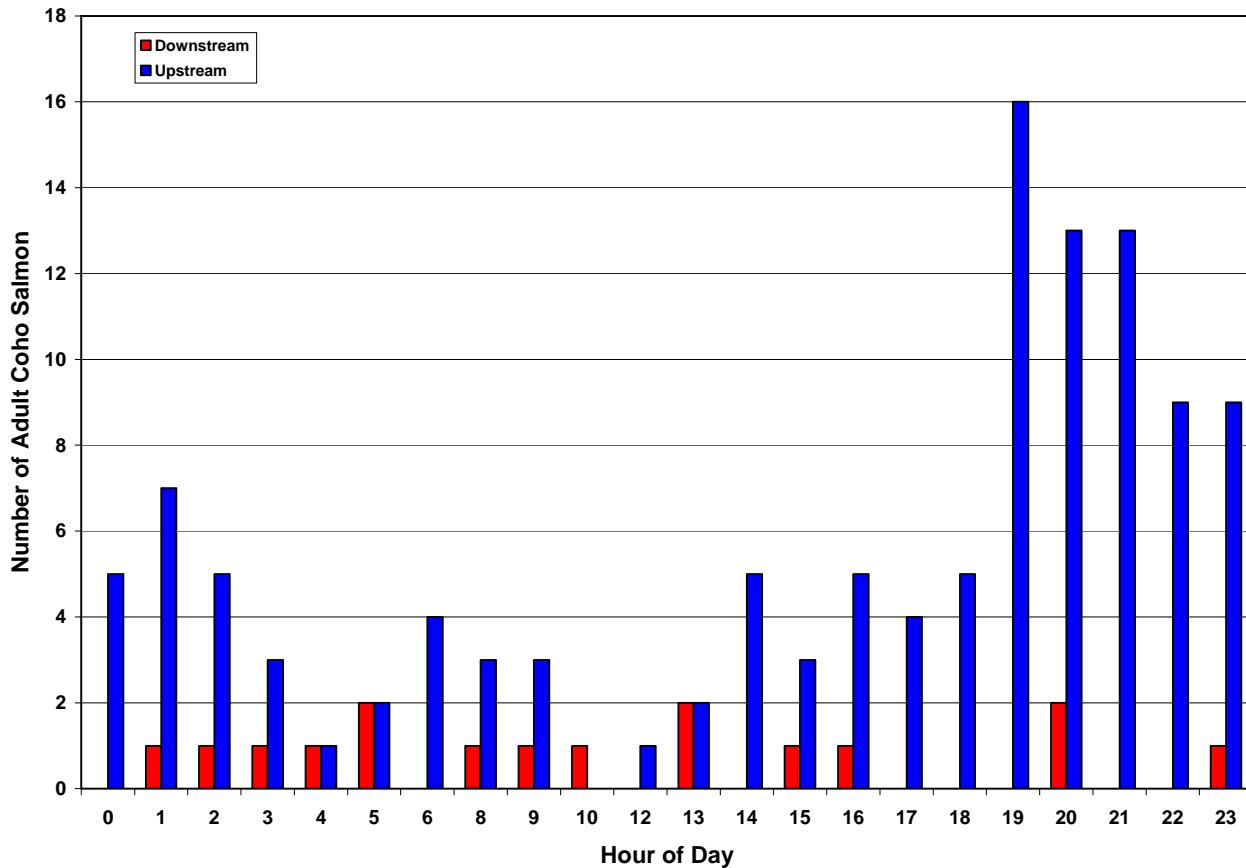


Figure 9. Diel migration patterns of coho salmon observed moving through the Bogus Creek Fish Counting Facility in 2005.

Spawning Ground Surveys

A total of 101 coho salmon carcasses were examined during the spawning ground surveys between November 15 and December 13, the date of the last survey. Fifteen (15) of the 101 carcasses sampled were in Reach 1, located downstream of the BCFCF. The remaining 86 carcasses were distributed in the three reaches upstream as follows; 41 carcasses in Reach 2, 42 carcasses in Reach 3, and 3 carcasses in Reach 4. On the last survey, conducted on December 13, staff also observed 4 live coho salmon still present in the creek. The flood of December 1st flushed an unknown number of carcasses out of the system. Therefore, the number of carcasses sampled during the survey doesn't truly represent the total number of carcasses that were likely present in the creek. In addition, salmon have access to several miles of Bogus Creek upstream of our survey area via a ladder that provides passage over a large waterfall at the end of Reach 4.

Of the 101 coho salmon carcasses examined, 53 (52.5%) were females and 48 (47.5%) were male. A fork length measurement could not be collected for one of the females sampled because much of the fish had been eaten by predators or scavengers. Female coho salmon ranged in fork length from 52cm to

73cm and averaged 66cm, while male coho salmon ranged in fork length from 59cm to 77cm and averaged 69cm (Figure 10).

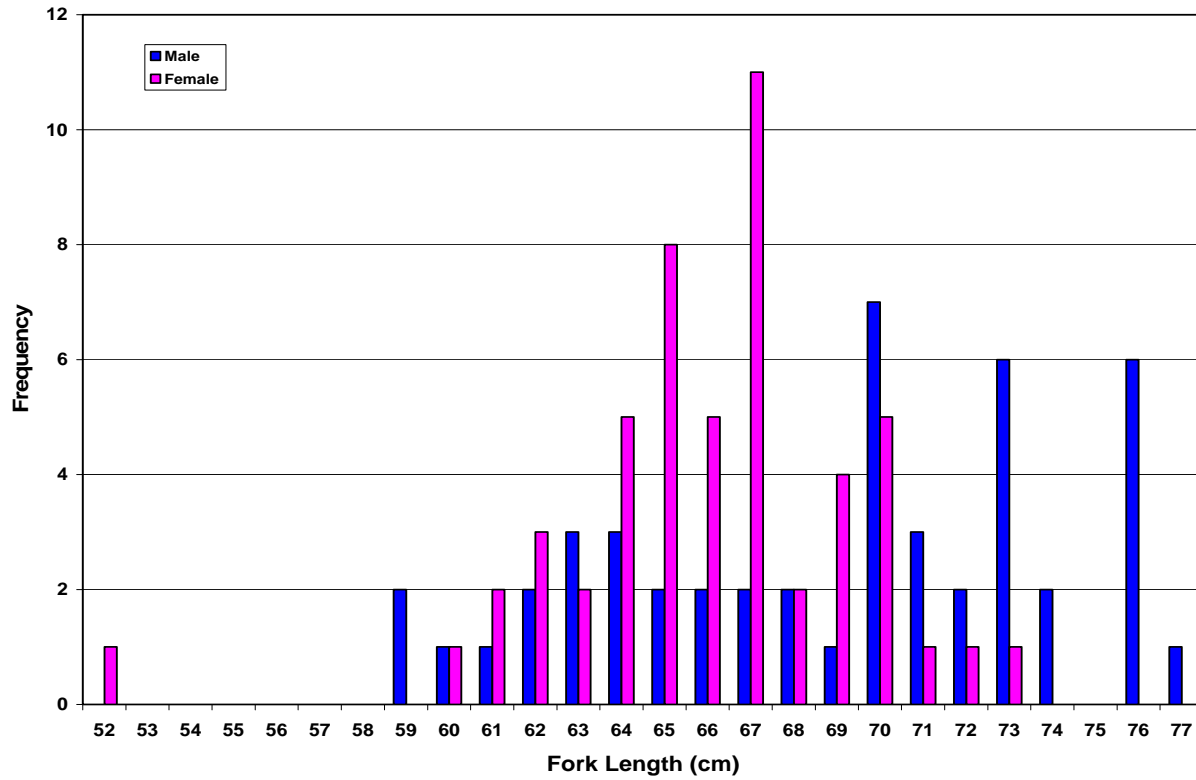


Figure 10. Fork length frequency distribution of male (n = 48) and female (n = 52) coho salmon observed in the Bogus Creek spawning ground surveys, 2005.

Hatchery Contribution

Forty eight (48) of the 101 coho salmon carcasses that were examined during the spawning ground survey were marked with a left maxillary clip. The left maxillary clip corresponds to hatchery origin coho salmon that were released from IGH. None of the carcasses sampled were right maxillary or adipose fin clipped. Therefore, approximately 47.5% of the coho salmon run in Bogus Creek was comprised of strays from IGH.

Unmarked Coho Salmon 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 IGH. Under this program all unmarked coho, with the exception of 10 coho salmon 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. A total of 124 unmarked coho salmon were released from IGH back to the Klamath River during the 2005 season.

Because of the proximity of Bogus Creek to IGH, several of the unmarked coho salmon that were released from IGH were anticipated to swim up Bogus Creek. Seven (7) caudal clipped/Floy tagged coho salmon were observed passing through the BCFCF upstream and 3 were observed moving back downstream through the facility. Ten (10) of the 101 coho salmon carcasses examined during the spawning ground were Floy tagged. One (1) of these was recovered in Reach 1 downstream of the BCFCF and the remaining 9 were recovered upstream of the BCFCF. A summary of the history of those unmarked coho salmon that were released from IGH and were subsequently recovered in Bogus Creek is presented in Table 2.

Table 2. Summary of unmarked coho salmon released from IGH and recovered during Bogus Creek spawning ground surveys, 2005.

Floy Tag Number	Sex	Fork Length (cm)	Date of Entry/Release from IGH				Date and Location of Recovery in Bogus Creek	
			1 st Entry	2 nd Entry	3 rd Entry	4 th Entry	Date	Reach
2378	M	70	11/4/05				11/22/05	3
2379	M	68	11/4/05				11/29/05	3
2082	F	69	11/10/05				11/22/05	3
1535	M	70	11/14/05				11/22/05	3
1543	M	67	11/14/05	11/16/05	11/18/05		11/29/05	2
1547	M	73	11/14/05				11/29/05	3
2088	F	67	11/14/05				11/29/05	2
2096	M	72	11/14/05				12/13/05	2
1507	M	76	11/18/05	11/21/05	11/23/05	11/28/05	12/13/05	1
2333	F	70	11/28/05				12/13/05	2

As shown in Table 2, two of the unmarked coho salmon males that were released from IGH swam back up the ladder on multiple occasions before eventually entering Bogus Creek. All three of the unmarked coho salmon females appear to have spawned successfully in Bogus Creek based on the lack of eggs present when each carcass was examined during the survey. Of the 124 unmarked coho salmon that were released from IGH, 10 or about 8% of those are known to have entered Bogus Creek.

Pre-Spawn Mortalities

As mentioned previously, 53 female coho salmon carcasses were examined during the spawning ground survey. Staff was unable to determine spawning success for 2 of these carcasses because much of the carcass had been eaten by predators or scavengers prior to our examination. Of the remaining 51 female carcasses examined, 41 (80.4%) were determined to have spawned successfully and 10 (19.6%) were determined to be pre-spawn mortalities.

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 9,345 fish (Figure 11). The 2005 Chinook salmon run in Bogus Creek ranks as the seventeenth largest (5,397 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 to spawn naturally thus reducing potential interactions between hatchery and natural Chinook salmon populations within the basin.

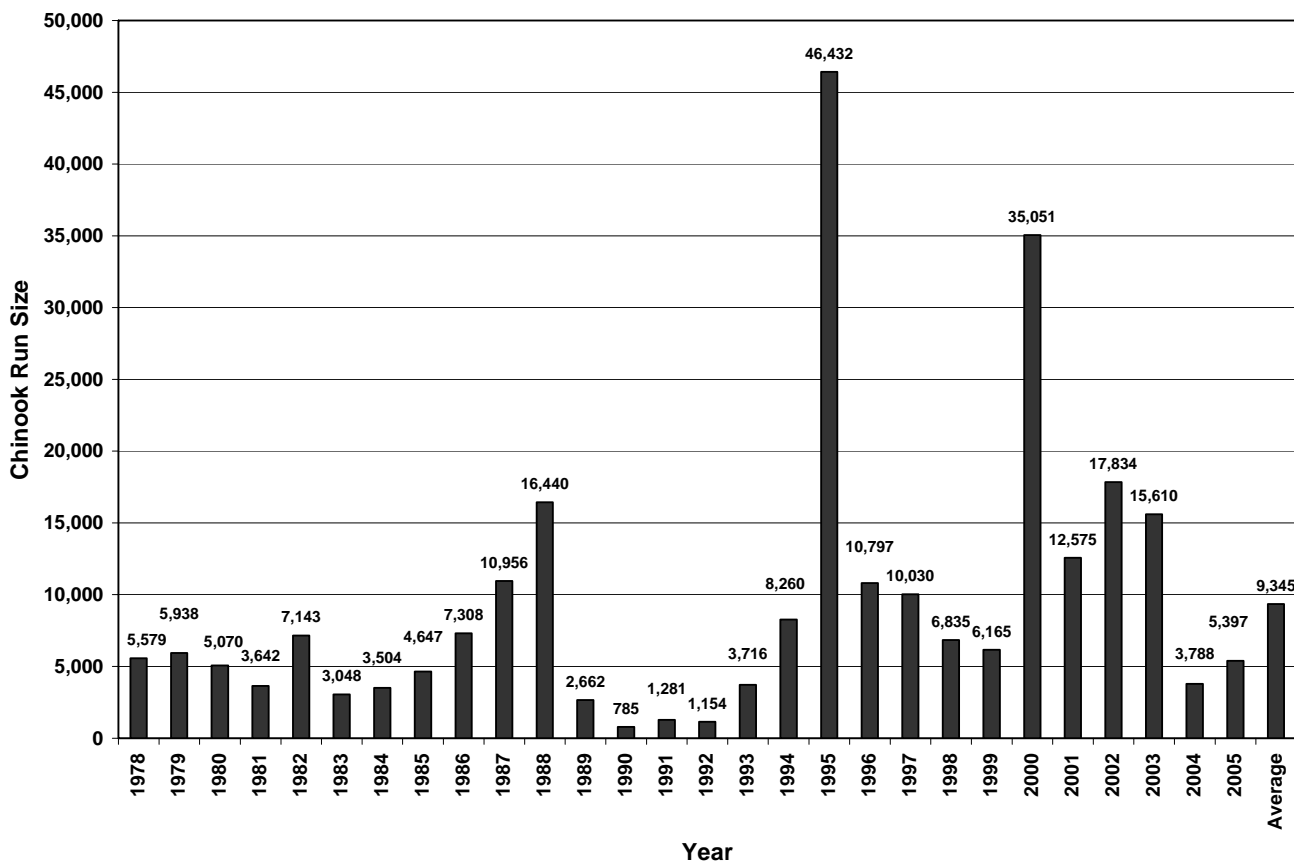


Figure 11. Total Chinook salmon escapement levels estimated to have returned to Bogus Creek from 1978 to 2005.

Bogus Creek often accounts for a substantial number of the natural spawning population within the Klamath Basin. Bogus Creek Chinook salmon spawning populations have comprised approximately 37% of the total natural spawning population that have been observed in the major tributary streams upstream of the Trinity River, which includes the Salmon River, Scott River, Shasta River, and Bogus Creek (Figure 12).

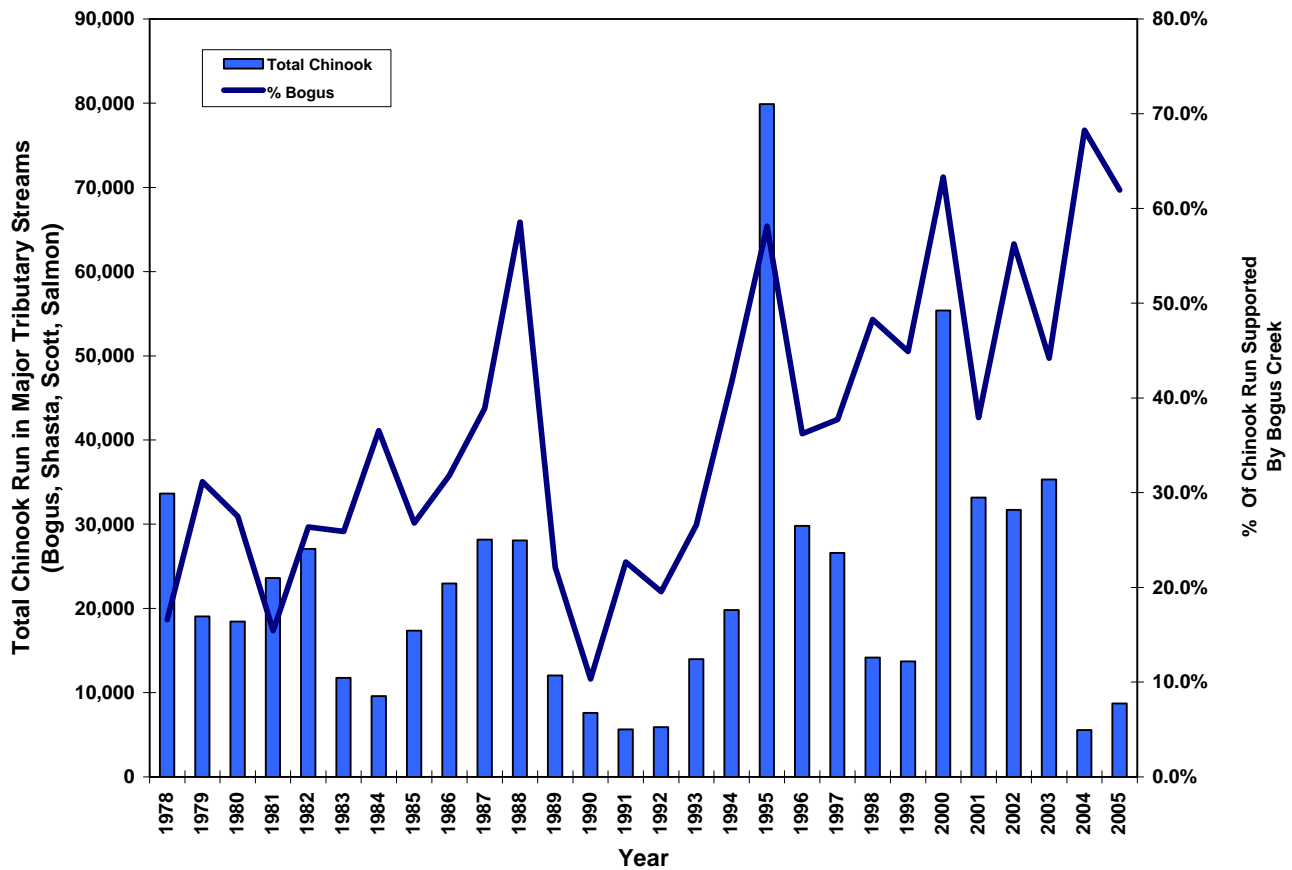


Figure 12. Percent contribution of Bogus Creek Chinook salmon to the total natural Chinook run size estimate for major tributary streams upstream of the Trinity River (Salmon River, Scott River, Shasta River, and Bogus Creek) from 1978 to 2005.

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 13). 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.

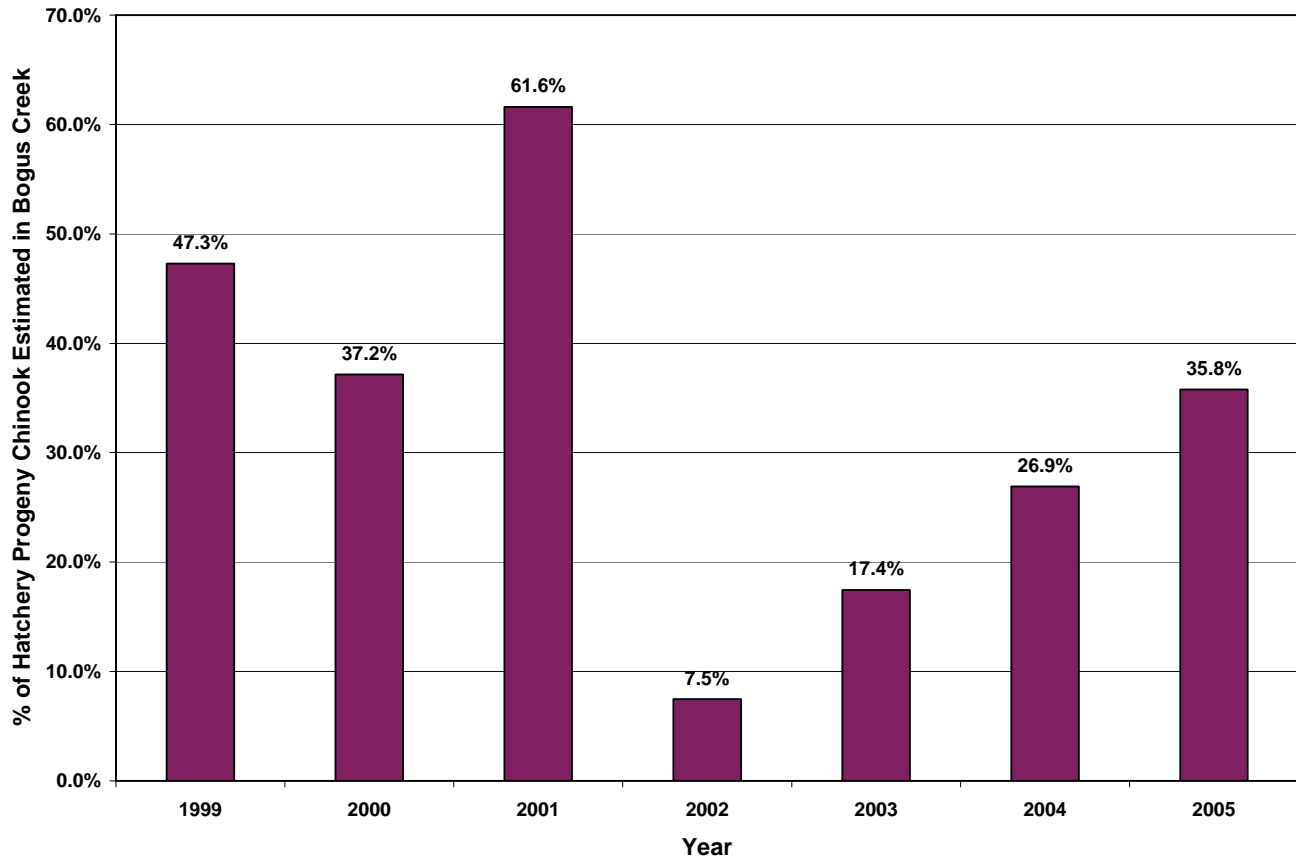


Figure 13. Estimated contribution of hatchery origin Chinook salmon observed in Bogus Creek from 1999 through 2005.

COHO SALMON

The occurrence of several early storms during the 2005 season greatly hindered the Department's ability to effectively monitor the escapement of coho salmon into Bogus Creek this year. The findings presented in this report only describe the number of coho salmon observed during periods when the BCFCF was fully operational. Given the fact that the BCFCF was down for two weeks during November and for the entire month of December, the actual number of coho salmon that probably entered Bogus Creek during the 2005 is likely much higher than the 118 coho salmon that were observed at the BCFCF this year. Based on data collected from the 101 coho salmon carcasses sampled during the spawning ground survey, the Department estimates that coho salmon originating from IGH comprised approximately 47.5% (48 coho) of the run and 52.5% (53 coho) were unmarked indicating that they are likely of natural origin. Of the 53 unmarked coho observed, 10 were caudal clipped/Floy tagged indicating that they were unmarked coho salmon that previously entered IGH and were released.

In 2004 the Department observed a total of 414 coho salmon in Bogus Creek, of which, 176 coho salmon carcasses were examined during the spawning ground survey. Of the 176 carcasses examined, 27.7% (48 coho) were of hatchery origin and 72.3% (125 coho) were unmarked. The proportion of the hatchery origin coho salmon in Bogus Creek during the 2005 season appears to have increased substantially when compared to the 2004 run. This finding appears to be an artifact related more to the low numbers of naturally produced coho that returned to the Klamath Basin during the 2005 season and does not appear to be caused by an increase in the numbers of hatchery coho that strayed into Bogus

Creek given the fact that the total number of hatchery origin coho salmon carcasses examined in both the 2004 and 2005 seasons were equal (48 coho).

ACKNOWLEDGEMENTS

The California Department of Fish and Game would like to thank Siskiyou County High School students who assisted KRP staff in completing spawning ground surveys on Bogus Creek. Their contribution was integral to the success of the project. We would also like to express our appreciation to the various landowners who have graciously provided permission to access Bogus Creek on their lands.

The KRP would also like to express their sincere gratitude to the Klamath River Task Force and the Yreka Fish and Wildlife Service Office for their funding and assistance in completing this study. Their assistance was instrumental in being able to make timely repairs to the BCFCF following damage incurred as a result of high flows.