California Department of Fish and Game

Klamath River Project

Recovery of Fall-run Chinook and Coho Salmon at Iron Gate Hatchery

October 4, 2011 to December 12, 2011

Prepared by:
Diana Chesney and Morgan Knechtle
California Department of Fish and Game
Klamath River Project
1625 South Main Street
Yreka, CA 96097

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ABSTRACT

A total of 18,039 fall-run Chinook salmon, (Chinook, *Oncorhynchus tshawytscha,* entered Iron Gate Hatchery (IGH) during the fall 2011 spawning season from October 4, 2011 through November 29, 2011. Klamath River Project (KRP) staff systematically (random) sampled 1 in every 10 Chinook as well as all adipose-clipped (AD) Chinook during recovery efforts, for a sample size of 4,976. Scale samples and sex and fork length data were collected for all sampled Chinook. Analysis of the length-frequency distribution for randomly sampled Chinook males indicates that the preliminary cutoff point between grilse and adults occurred at ≤ 62 cm fork length. Randomly sampled male Chinook ranged in size from 41 to 103 cm. fork length, and randomly sampled female Chinook ranged from 55 to 93 cm. fork length. Based on scale age analysis, the KRTAT estimated that 52.9% (9,549) of the run were grilse. Females accounted for 26.5% (4,772) of the run while males accounted for 73.5% (13,267). The 2011 return to IGH contributed roughly 10% to the total (Klamath basin) in-river run and 12% to the total spawner escapement. Based on coded wire tag expansion, KRP staff estimated that 84% of the Chinook (both grilse and adults) entering IGH during the 2011 season were of hatchery origin.

A total of 586 coho salmon (coho, *Oncorhynchus kisutch*) entered IGH during the 2011 spawning season. The recorded dates for the coho run were from October 10, 2011 to December 12, 2011. KRP staff collected biological data (sex, fork length, presence of marks or clips, scale samples, and tissue samples) on every coho that entered the hatchery as well as otoliths from coho used for spawning. Males ranged in size from 38 to 80 cm. fork length, while females ranged in size from 46 to 76 cm. fork length. Based on the length frequency distribution of 382 male coho, grilse were estimated to be ≤ 55 cm. fork length, for an age composition of 22.5% grisle and 77.5% adult coho in 2011. Of the 586 coho sampled by KRP staff, 522 (89%) had left maxillary clips, 63 (10.9%) had no clips. and one (0.1%) had both a left and a right maxillary clip. Two adipose-clipped coho were recovered at IGH during the 2011 season. These 2 fish were scanned for the presence of a coded wire tag, but were negative. For the second year, coho were spawned at IGH in 2011using a spawning matrix provided weekly by NOAA Fisheries Salmon Genetics Repository in Santa Cruz, CA., using tissue samples obtained from coho as they entered IGH. All coho salmon (except for the first 22) entering IGH during the 2011 were pit tagged. A targeted number entering each week were also disc tagged and held pending genetic analysis for potential use as brood stock. Any coho not utilized as brood stock were released back to the Klamath River at Iron Gate Hatchery.

INTRODUCTION

Iron Gate Hatchery

The Iron Gate Hatchery (IGH) is located adjacent to the Klamath River (river mile 190), in Siskiyou County, CA, approximately 120 miles north of Redding, near the Oregon border (Figure 1). This hatchery was established in 1963 to mitigate for loss of habitat between Iron Gate Dam and Copco Dam. The production goals for the hatchery are listed in Table 1 (CDFG and PP&L 1996).

Table 1. Production goals for anadromous salmonid releases from Iron Gate Hatchery, Klamath River.

Species	Number released	Released	Run timing
Chinook Salmon	5,100,000 smolts	May-June	mid September to early November
	900,000 yearlings	November	
Coho	75,000 yearlings	March	late October to early January
Steelhead	200,000 yearlings	March-May	November to March

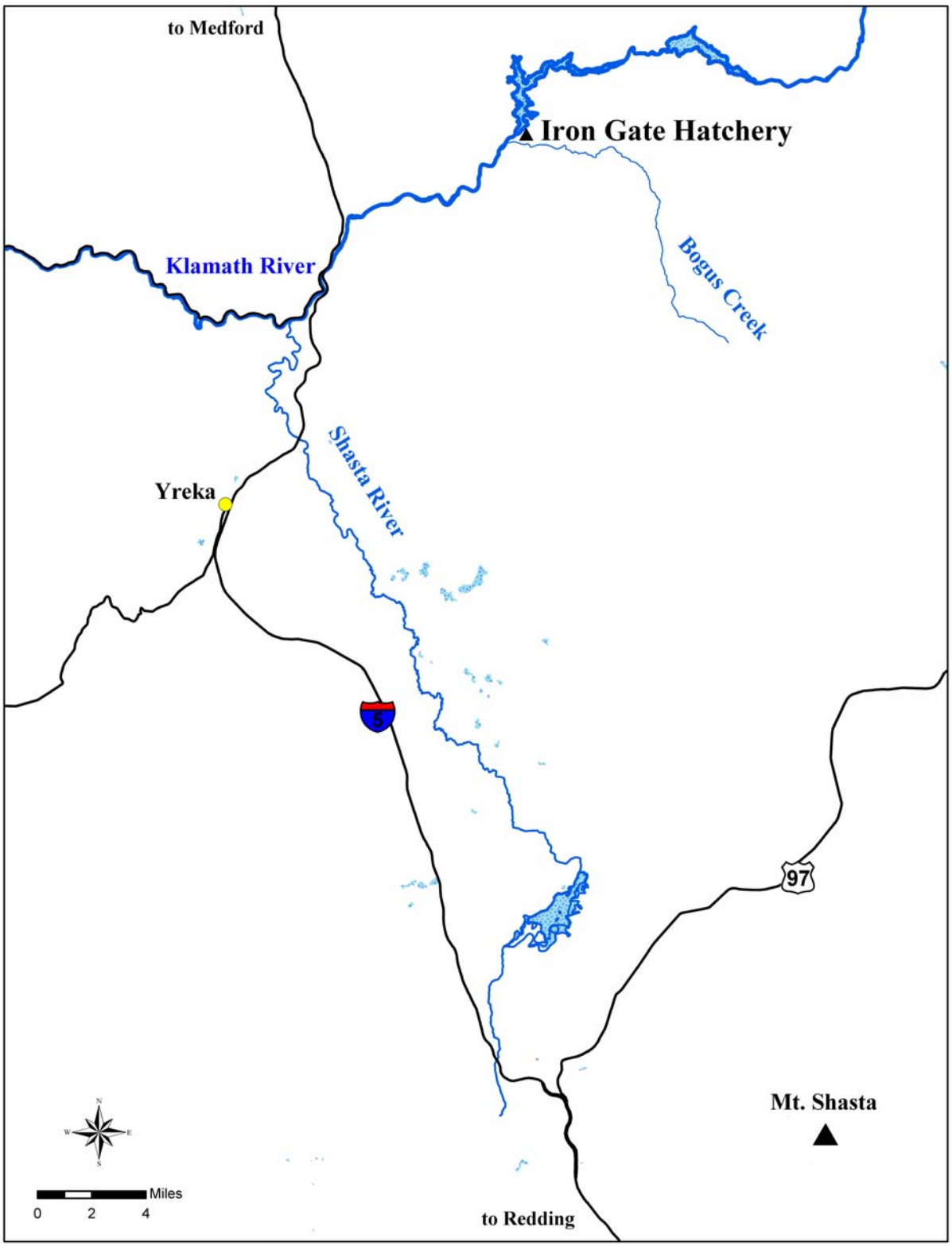

Figure 1. Location of Iron Gate Hatchery, Siskiyou County, California.

Klamath River Project

The California Department of Fish and Game's (CDFG) Klamath River Project (KRP) conducts systematic random sampling of fall-run Chinook (Chinook) salmon annually during the spawning season. The purpose of the sampling is to characterize the adult Chinook run entering IGH in terms of age and sex composition, and to recover data from all coded wire tags (CWT) recovered from the heads of adipose fin clipped (AD) Chinook. All Chinook tagged at IGH are marked with an adipose fin clip to identify the CWT salmon when they return to the hatchery or other locations during subsequent spawning seasons. Data from CWT fish provide a reference of known-age fish which is used, along with scale samples and analysis of length frequency distribution, to determine the age composition of the run. KRP staff also sample coho salmon (coho) that enter IGH, typically from mid October through December.

Coded Wire Tagging

2011 was the third year of 25 percent constant fractional marking at IGH. A total of 905,505 juvenile Chinook (671,755 to be released as fingerlings and 233,750 to be released as yearlings) were AD clipped and coded wire tagged in 2011. The total release of tagged and untagged fingerlings was 3,980,328. Due to an outbreak of coldwater disease among Chinook fingerlings in the spring of 2011, tagging was delayed and both the tag rates and release dates were affected. The approximate tag rate for the fingerling release group was 18%, and for the yearling group, 25%. The first three raceways (C, D and E) of Chinook fingerlings each received a unique tag code, while series F, G and H shared a tag code.

In 2011, as in 2010, tagging operations at IGH were conducted by Pacific States Marine Fisheries Commission personnel in collaboration with CDFG.

MATERIALS AND METHODS

Chinook Salmon

Starting in 1997 all Chinook entering the fish ladders have been allowed to enter IGH. Upon entering the hatchery, Chinook selected by IGH staff as brood stock are spawned or held in round tanks until they are ready to spawn. Readiness to spawn is determined by hatchery staff and based on timing, firmness of the ovaries, and ease of stripping eggs when handled. Once daily or weekly egg goals are met, extra Chinook are sacrificed and sent to a processing plant. In 2011, KRP staff conducted a systematic random sample of every 10^{th} Chinook along the process line, as well as all AD Chinook. These random and non-random fish were set aside for sampling. Sampling included collection of data on fork length, sex, presence or absence of clips and/or marks, scale samples and spawning disposition. All Chinook leaving the hatchery building were put on ice and trucked to a processing plant for eventual distribution.

Heads were taken from all AD Chinook (random and non-random fish) as well as data on fork length and sex, and scale samples. Heads collected from AD-clipped fish were run through a tag detector prior to freezing, and whether a tag was detected was noted on the data sheets. All heads were sent to the KRP's Arcata office for tag extraction and reading.

Preliminary grilse and adult cutoff fork lengths were determined using length frequency analysis of randomly sampled male Chinook, and final grilse/adult and age composition determinations were made by the Klamath River Technical Advisory Team (KRTAT) using scale age proportions.

Coho Salmon

As coho entered IGH in 2011, hatchery personnel anaesthetized the fish using CO2, determined whether each fish would be retained for potential spawning or released back to the river, then sent the fish to a processing tank, where KRP staff collected biological data including tissue samples, scale samples, fork length, sex and clip/tag information. Those coho retained as potential brood stock were given a disc tag with a unique number and a passive integrated transponder (PIT) tag with a unique number, then allowed to recover in fresh water before being put into hatchery holding tanks. Tissue samples were sent to the National Oceanic and Atmospheric Administration (NOAA) salmon genetics repository in Santa Cruz, CA. via overnight Federal Express. Fish to be released were given a PIT tag only, allowed to recover and released into the river at the spawning building location.

As in 2010, NOAA genetics laboratory staff developed a spawning matrix designed to minimize the spawning of closely related individuals. The weekly matrix, sent via e-mail to the KRP, displayed a series of columns with the disc tag number of each female coho at the top of a column, and beneath it, disc tag numbers of males in descending order of spawning suitability for that female. Males which were determined to be too closely related to any given female were denoted with an asterisk as "do not spawn" and were listed at the bottom of each column (Table 2).

On subsequent spawning days, coho were brought into the hatchery from the holding tanks and spawning readiness was determined by IGH personnel. Each female determined ready to spawn was killed and held on the spawning table; then as spawning-ready males were brought in, disc tag numbers were matched with the spawning matrix to find the best-suited males for each female. In 2011, coho crosses were 2 :1 (two males to one female), except for three pairings where only one male was available. IGH and KRP personnel tracked the use of marked vs. unmarked individuals and the use of grilse for spawning. Otoliths were collected from all spawned coho.

Table 2. Sample breeding matrix provided by the NOAA Salmon Genetics Repository for Iron Gate Hatchery in 2011 (Females are listed along the top row and males are listed in columns below each female).

F_029F	F_032F	F_035F	F_047F	F_050F	F_061F	F_064F	F_065F	F_067F	F_077F	F_078F	F_080F
M_166M	M_181M	M_48M	M_185M	M_153M	M_24M	M_187M	M_163M	M_24M	M_166M	M_186M	M_181M
M_164M	M_102M	M_164M	M_165M	M_150M	M_50M	M_176M	M_153M	M_150M	M_117M	M_141M	M_184M
M_56M	M_154M	M_153M	M_164M	M_184M	M_118M	M_153M	M_150M	M_174M	M_167M	M_180M	M_187M
M_124M	M_172M	M_166M	M_171M	M_165M	M_185M	M_150M	M_164M	M_176M	M_176M	M_155M	M_24M
M_176M	M_165M	M_124M	M_154M	M_47M	M_168M	M_178M	M_174M	M_155M	M_102M	M_184M	M_186M
M_102M	M_174M	M_118M	M_150M	M_178M	M_124M	M_24M	M_184M	M_77M	M_161M	M_24M	M_67M
M_159M	M_153M	M_56M	M_153M	M_24M	M_165M	M_171M	M_176M	M_164M	M_119M	M_174M	M_185M
M_118M	M_169M	M_134M	M_166M	M_181M	M_153M	M_165M	M_24M	M_50M	M_168M	M_56M	M_160M
M_47M	M_177M	M_162M	M_124M	M_185M	M_177M	M_47M	M_48M	M_47M	M_162M	M_185M	M_45M
M_181M	M_184M	M_172M	M_118M	M_160M	M_183M	M_184M	M_77M	M_162M	M_159M	M_143M	M_169M
M_165M	M_183M	M_185M	M_183M	M_134M	M_150M	M_155M	M_162M	M_182M	M_153M	M_61M	M_177M
M_153M	M_161M	M_159M	M_181M	M_186M	M_159M	M_185M	M_116M	M_178M	M_184M	M_50M	M_171M
M_183M	M_170M	M_180M	M_169M	M_171M	M_176M	M_161M	M_178M	M_143M	M_172M	M_168M	M_141M
M_163M	M_131M	M_169M	M_141M	M_176M	M_166M	M_61M	M_166M	M_185M	M_177M	M_48M	M_154M
M_177M	M_176M	M_47M	M_24M	M_102M	M_162M	M_174M	M_143M	M_166M	M_160M	M_150M	M_168M
M_154M	M_166M	M_178M	M_177M	M_173M	M_178M	M_77M	M_165M	M_184M	M_24M	M_169M	M_56M
M_167M	M_164M	M_182M	M_47M	M_77M	M_164M	M_48M	M_182M	M_134M	M_181M	M_182M	M_161M
M_150M	M_152M	M_88M	M_184M	M_187M	M_167M	M_119M	M_124M	M_165M	M_56M	M_77M	M_150M
M_134M	M_175M	M_131M	M_168M	M_141M	M_154M	M_175M	M_47M	M_159M	M_163M	M_187M	M_159M
M_174M	M_118M	M_141M	M_45M	M_174M	M_169M	M_186M	M_134M	M_153M	M_88M	M_67M	M_180M
M_182M	M_141M	M_150M	M_50M	M_61M	M_184M	M_141M	M_181M	M_61M	M_131M	M_134M	M_175M
M_162M	M_143M	M_163M	M_143M	M_180M	M_181M	M_181M	M_102M	M_45M	M_150M	M_172M	M_173M
M_161M	M_171M	M_155M	M_102M	M_183M	M_171M	M_182M	M_119M	M_173M	M_140M	M_171M	M_178M
M_143M	M_67M	M_117M	M_48M	M_155M	M_131M	M_180M	M_161M	M_175M	M_50M	M_170M	M_167M
M_88M	M_150M	M_152M	M_186M	M_161M	M_102M	M_162M	M_173M	M_118M	M_183M	M_178M	M_152M
M_48M	M_117M	M_140M	M_175M	M_131M	M_45M	M_173M	M_45M	M_169M	M_48M	M_47M	M_170M
M_185M	M_159M	M_160M	M_162M	M_172M	M_175M	M_164M	M_140M	M_187M	M_179M	M_45M	M_131M
M_24M	M_187M	M_177M	M_178M	M_159M	M_155M	M_134M	M_56M	M_48M	M_178M	M_175M	M_143M
M_175M	M_124M	M_61M	M_187M	M_168M	M_161M	M_88M	M_141M	M_163M	M_61M	M_88M	M_182M
M_178M	M_186M	M_183M	M_170M	M_169M	M_182M	M_179M	M_179M	M_180M	M_134M	M_176M	M_119M
M_172M	M_185M	M_171M	M_56M	M_182M	M_180M	M_159M	M_88M	M_171M	M_152M	M_177M	M_140M
M_179M	M_56M	M_167M	M_180M	M_170M	M_160M	M_172M	M_50M	M_183M	M_47M	M_181M	M_172M
M_171M	M_168M	M_45M	M_182M	M_56M	M_186M	M_154M	M_118M	M_116M	M_118M	M_119M	M_176M
M_117M	M_163M	M_77M	M_131M	M_166M	M_134M	M_102M	M_154M	M_124M	M_175M	M_173M	M_50M
M_169M	M_178M	M_176M	M_161M	M_175M	M_143M	M_166M	M_175M	M_154M	M_67M	M_153M	M_179M
M_184M	M_24M	M_143M	M_176M	M_177M	M_61M	M_160M	M_171M	M_119M	M_170M	M_164M	M_174M
M_131M	M_179M	M_186M	M_172M	M_119M	M_170M	M_116M	M_186M	M_141M	M_77M	M_183M	M_183M
M_45M	M_77M	M_50M	M_160M	M_48M	M_77M	M_143M	M_172M	M_186M	M_171M	M_152M	M_116M
M_173M	M_180M	M_168M	M_88M**	M_179M	M_173M	M_163M	M_155M	M_168M	M_186M	M_161M	M_48M
M_119M	M_162M	M_179M	M_77M**	M_124M	M_48M	M_170M	M_169M	M_167M	M_180M	M_165M	M_77M
M_140M	M_45M	M_119M	M_159M**	M_118M	M_174M	M_118M**	M_61M	M_161M	M_154M	M_116M	M_117M
M_141M	M_173M	M_181M	M_152M**	M_162M	M_141M	M_169M**	M_160M	M_177M	M_187M	M_162M	M_88M**
M_170M	M_47M	M_170M	M_167M**	M_50M	M_152M**	M_183M**	M_187M	M_179M	M_124M	M_166M	M_165M**
M_180M	M_167M	M_174M	M_173M**	M_45M	M_187M**	M_117M**	M_183M	M_172M	M_165M	M_124M	M_102M**
M_77M	M_116M	M_175M	M_134M**	M_164M	M_47M**	M_131M**	M_159M	M_102M	M_116M**	M_118M**	M_124M**
M_187M	M_88M	M_161M	M_140M**	M_143M**	M_56M**	M_177M**	M_131M	M_140M	M_185M**	M_179M**	M_162M**
M_50M	M_140M	M_67M	M_179M**	M_88M**	M_67M**	M_124M**	M_170M	M_131M	M_164M**	M_159M**	M_155M**
M_116M	M_182M	M_173M	M_155M**	M_167M**	M_172M**	M_140M**	M_185M	M_170M**	M_174M**	M_140M**	M_118M**
M_61M**	M_50M**	M_24M	M_117M**	M_116M**	M_163M**	M_168M**	M_117M**	M_152M**	M_45M**	M_131M**	M_134M**
M_155M**	M_134M**	M_102M	M_119M**	M_154M**	M_88M**	M_56M**	M_167M**	M_88M**	M_155M**	M_154M**	M_166M**
M_152M**	M_160M**	M_165M**	M_67M**	M_152M**	M_119M**	M_45M**	M_180M**	M_56M**	M_169M**	M_160M**	M_153M**
M_168M**	M_155M**	M_184M**	M_61M**	M_67M**	M_140M**	M_152M**	M_177M**	M_67M**	M_182M**	M_163M**	M_164M**
M_160M**	M_61M**	M_187M**	M_163M**	M_163M**	M_179M**	M_50M**	M_168M**	M_160M**	M_173M**	M_102M**	M_61M**
M_186M**	M_119M**	M_154M**	M_174M**	M_117M**	M_116M**	M_67M**	M_67M**	M_181M**	M_141M**	M_167M**	M_163M**
M_67M**	M_48M**	M_116M**	M_116M**	M_140M**	M_117M**	M_167M**	M_152M**	M_117M**	M_143M**	M_117M**	M_47M**

After IGH reached its egg-taking goal, all coho not used in spawning were released into the river. KRP personnel removed the disc tags and recorded the PIT tag numbers of released fish. PIT tag numbers of released coho that re-entered the hatchery were recorded as well. All coho tissue samples were sent at the end of the season to the NOAA facility in Santa Cruz.

RESULTS

Chinook Salmon

Chinook began entering IGH on October 4, 2011. A total of 18,039 Chinook returned to IGH during the fall 2011 spawning season. Of these, KRP staff collected scale samples, determined sex, and measured fork lengths for 4,976 Chinook. Randomly sampled male Chinook ranged in size from 44 to 103 cm. fork length (Figure 2), and randomly sampled female Chinook ranged from 55 to 93 cm. fork length (Figure 3). A preliminary grilse cutoff was made using the length frequency distribution for 1,313 randomly sampled Chinook males. The preliminary cutoff point between grilse and adults occurred at $\leq$ 62 cm. in fork length, yielding approximately 51.8% grilse (9,344 grilse and 8,,695 adults). Final grilse and adult proportions and age composition determinations were made by the KRTAT using scale age proportions, for a grilse component of 52.9% (9,549) and an adult component of 47.1% (8,490). Females accounted for 26.5% (4,772) of the run and males accounted for 73.5% (13,267). The last Chinook of the season entered IGH on December 9, 2011.

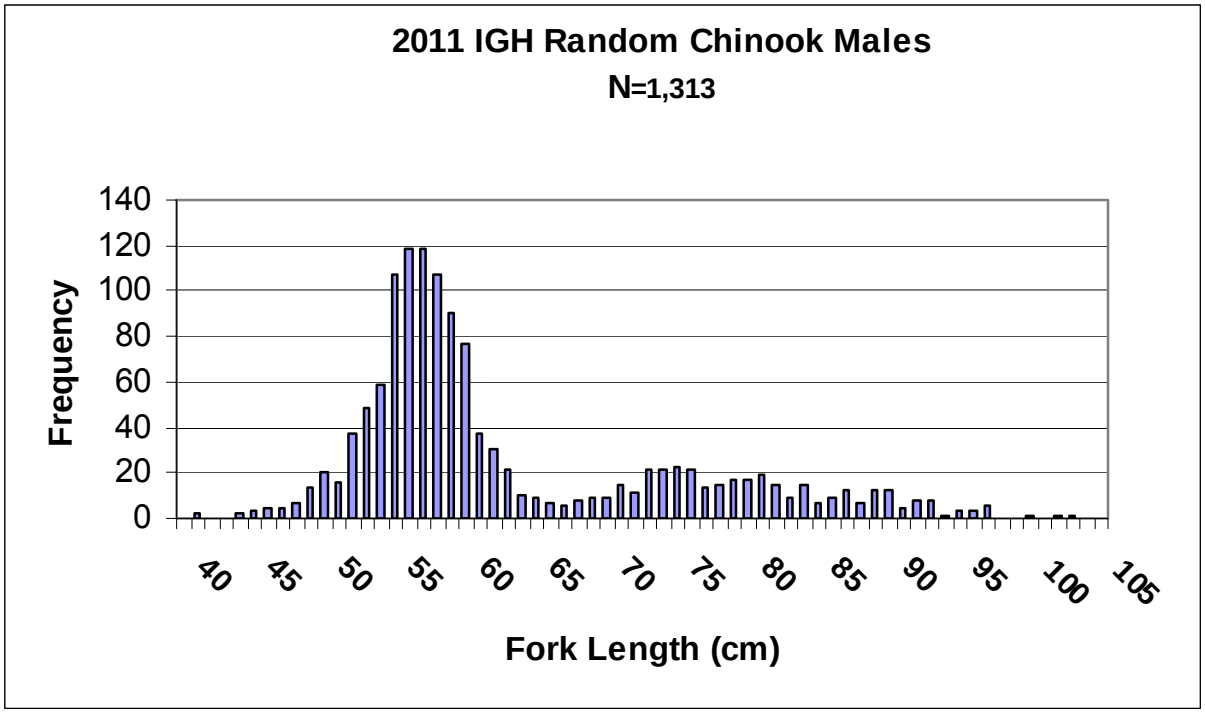

Figure 2. Length frequency distribution for random sample of male Chinook salmon recovered at IGH during the 2011 spawning season.

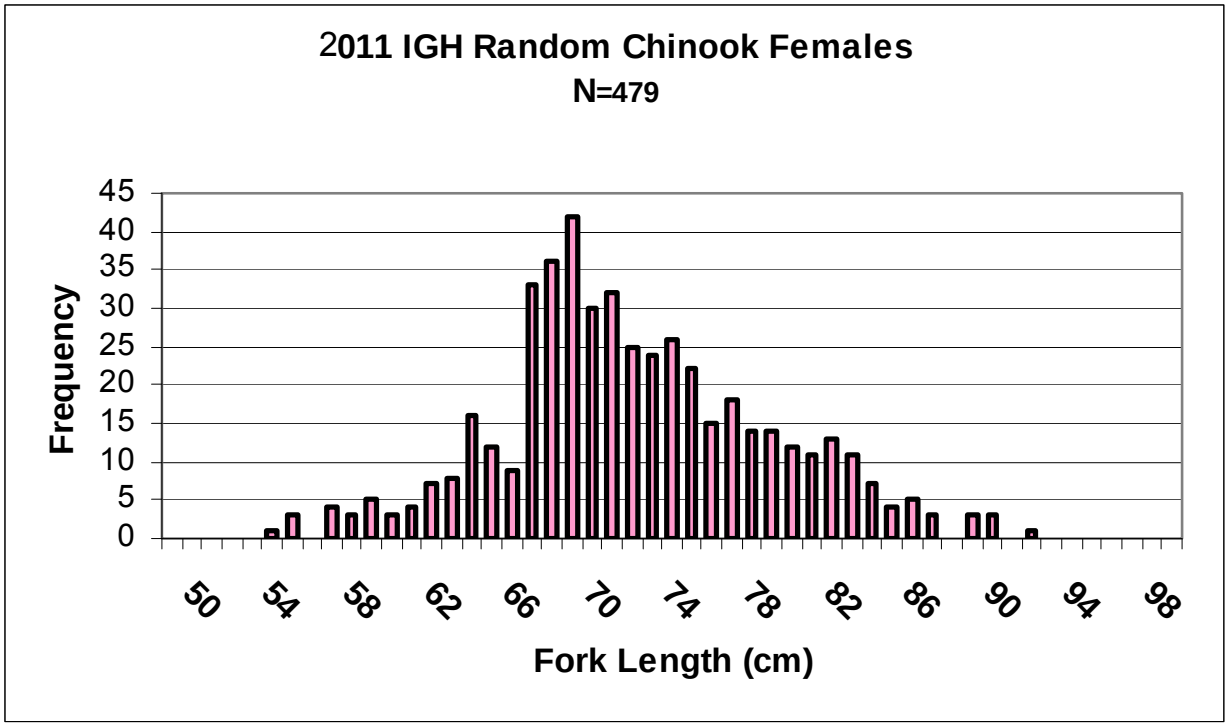

Figure 3. Length frequency distribution for random sample of female Chinook salmon recovered at IGH during the 2011 spawning season.

Heads from 3,509 AD Chinook (from random and non-random fish) were collected for CWT recovery, of which 3,415 had CWTs. Of these, 20 CWTs were lost during dissection and 5 CWTs were unreadable. The contribution of lost or unreadable CWTs was estimated by applying the proportions of known CWTs (3,415) to the 25 lost or unreadable CWTs. (Table 3).

The estimated contribution of unknown CWTs was then added to the contribution of known CWTs to determine the total contribution of hatchery Chinook entering IGH. All but 3 of the 3,415 CWTs recovered (and successfully read) originated from IGH**,** and the remaining 3 originated from Trinity River Hatchery (TRH). Based on the expansion of CWTs, KRP staff estimated that 84.5% of the Chinook entering IGH during the 2011 season were of hatchery origin (Table 4). Of the expanded CWT returns in 2011, 2,200 (15%) were from yearling release groups and 12,928 (85%) were from smolt release groups

The Klamath River Technical Advisory Team (KRTAT) met in February of 2012 to review the 2011 Chinook run monitoring efforts and estimate the age composition of the 2011 run (KRTAT 2012). The KRTAT used scale age proportions for developing adult age structure and the grilse cutoff point for the 2011 IGH fall Chinook returns (Table 5).

Table 3. Estimated contribution of 25 Ad-cliped Chinook salmon with unknown coded-wire-tag (CWT) codes (lost or unreadable) that were recovered at Iron Gate Hatchery (IGH) based on the proportional distribution of known CWTs recovered at IGH during the 2011 season.

CWT	BY	# CWTs Recovered	Proportion of CWTs recovered	Estimated Number	Production Multiplier	Expanded Estimate
601020704	2006	1	0.000292826	0.00732	9.58	**0**
608020000	2007	8	0.002342606	0.05857	19.84	**1**
608020001	2007	4	0.001171303	0.02928	18.10	**1**
608020002	2007	6	0.001756955	0.04392	15.93	**1**
608020003	2007	7	0.002049780	0.05124	16.26	**1**
608020004	2007	5	0.001464129	0.03660	16.66	**1**
608020005	2007	10	0.002928258	0.07321	17.59	**1**
608020006	2007	122	0.035724744	0.89312	10.64	**10**
65357	2008	1	0.000292826	0.00732	3.99	**0**
68820	2008	2	0.000585652	0.01464	4.05	**0**
068642	2008	46	0.013469985	0.33675	4.02	**1**
068643	2008	93	0.027232796	0.68082	4.02	**3**
068644	2008	154	0.045095168	1.12738	4.03	**5**
068645	2008	257	0.075256223	1.88141	4.02	**8**
068646	2008	335	0.098096633	2.45242	4.03	**10**
068647	2008	314	0.091947291	2.29868	4.06	**9**
068648	2008	156	0.045680820	1.14202	4.02	**5**
068661	2008	16	0.004685212	0.11713	4.02	**0**
068662	2008	23	0.006734993	0.16837	4.03	**1**
68710	2009	603	0.176573939	4.41435	4.02	**18**
68711	2009	491	0.143777452	3.59444	4.01	**14**
68712	2009	335	0.098096633	2.45242	4.04	**10**
68713	2009	184	0.053879941	1.34700	4.17	**6**
68714	2009	125	0.036603221	0.91508	4.01	**4**
68715	2009	92	0.026939971	0.67350	4.04	**3**
68716	2009	25	0.007320644	0.18302	4.01	**1**
Totals		**3,415**	**1.0000**	**25**		**111**

Table 4. Estimated contribution of hatchery origin Chinook salmon recovered at Iron Gate Hatchery during the 2011 spawning season.

CWT	Release Location	Brood Year	Age	Release Type	Number Recovered	Production Multiplier	Expanded Estimate
Estimated contribution of known CWTs:							
601020704	IGH	2006	**5**	Fy	1	9.58	**10**
608020000	IGH	2007	**4**	Ff	8	19.84	**159**
608020001	IGH	2007	**4**	Ff	4	18.10	**72**
608020002	IGH	2007	**4**	Ff	6	15.93	**96**
608020003	IGH	2007	**4**	Ff	7	16.26	**114**
608020004	IGH	2007	**4**	Ff	5	16.66	**83**
608020005	IGH	2007	**4**	Ff	10	17.59	**176**
608020006	IGH	2007	**4**	Fy	122	10.64	**1,298**
65357	TRH	2008	**3**	Ff	1	3.99	**4**
68820	TRH	2008	**3**	Fy	2	4.05	**8**
068642	IGH	2008	**3**	Ff	46	4.02	**185**
068643	IGH	2008	**3**	Ff	93	4.02	**374**
068644	IGH	2008	**3**	Ff	154	4.03	**621**
068645	IGH	2008	**3**	Ff	257	4.02	**1,033**
068646	IGH	2008	**3**	Ff	335	4.03	**1,350**
068647	IGH	2008	**3**	Ff	314	4.06	**1,275**
068648	IGH	2008	**3**	Fy	156	4.02	**627**
068661	IGH	2008	**3**	Fy	16	4.02	**64**
068662	IGH	2008	**3**	Fy	23	4.03	**93**
68710	IGH	2009	**2**	Ff	603	4.02	**2,424**
68711	IGH	2009	**2**	Ff	491	4.01	**1,969**
68712	IGH	2009	**2**	Ff	335	4.04	**1,353**
68713	IGH	2009	**2**	Ff	184	4.17	**767**
68714	IGH	2009	**2**	Ff	125	4.01	**501**
68715	IGH	2009	**2**	Ff	92	4.04	**372**
68716	IGH	2009	**2**	Fy	25	4.01	**100**
				Subtotal	**3415**		**15,128**
Estimated contribution of unknown CWTs							
200000					20		
400000					5		
				Subtotal	**25**		**111**
		Total Estimated Hatchery Contribution =					**15,239**
Unreadable CWTs: 200000=CWT lost, 400000=CWT unreadable							

Table 5. Age composition of the 2011 Chinook salmon run that entered Iron Gate Hatchery (IGH), as developed by the Klamath River Technical Advisory Team (KRTAT).

Age 2	Age 3	Age 4	Age 5	Total Adults	Total Run
9,549	6,212	2,276	1	8,490	18,039
52.9%	34.4%	12.6%	.0055%	47.1%	

Coho Salmon

Five hundred eighty-six (586) coho entered IGH during the fall 2011 season between October 10, 2011 and December 12, 2011. Of these, 522 (89.1%) had left maxillary (LM) clips, indicating they were of IGH origin, 61 (10.4%) were unmarked, one (.002%) had both a left and right maxillary clip, and 2 (.003%) had AD clips with no maxillary clips (indicating Oregon or Washington hatchery origin). These two AD fish did not contain coded wire tags. Male coho ranged in size from 38 to 80 cm. in fork length (Figure 4). Female coho ranged in size from 46 to 76 cm. in fork length (Figure 5). Based on the length frequency distribution of 382 male coho, grilse were estimated to be $\leq$ 55 cm fork length. Of the 586 coho salmon (male and female) sampled by the KRP, 132 (22.5%) were grilse.

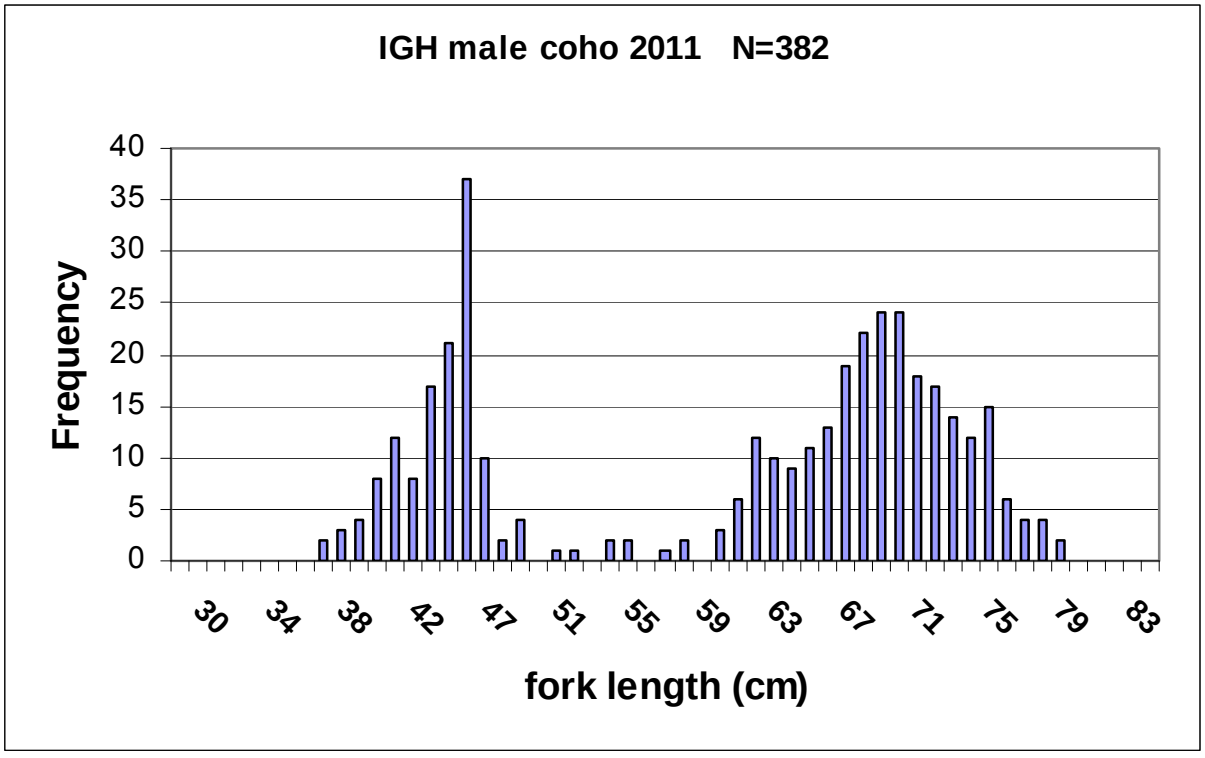

Figure 4. Length frequency distribution for random sample of male coho salmon recovered at Iron Gate Hatchery during the 2011 spawning season.

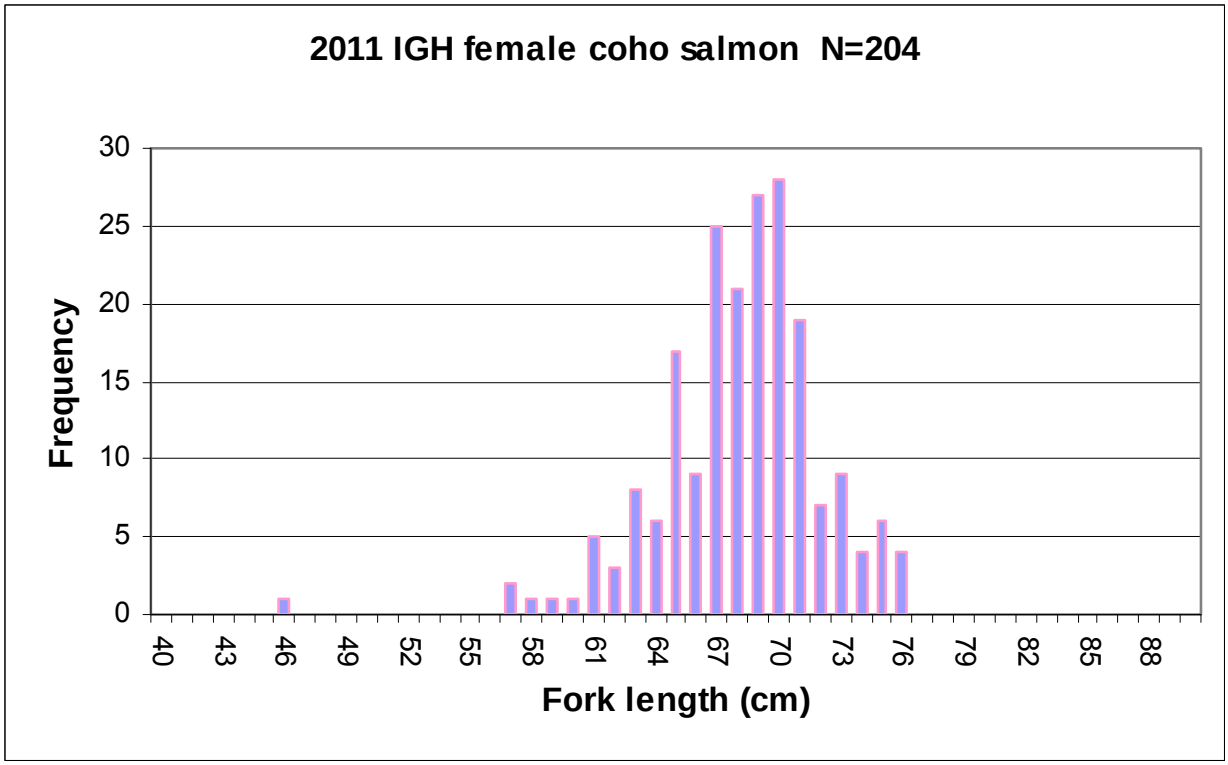

Figure 5. Length frequency distribution for random sample of female coho salmon recovered at Iron Gate Hatchery during the 2011 spawning season.

A total of 259 coho salmon which entered IGH were pit tagged and released back to the Klamath River., antenna arrays detected 17 of these coho entering the Shasta River at the Shasta River Fish Counting Facility (SRFCF, approximately 700 feet above the confluence with the Klamath River). Of the 17, one was also detected at Big Springs Creek (RM 32.9) four days after its release from IGH and later Parks Creek (RM 35) 21 days later. The other 16 fish were only detected at the SRFCF. The number of days between release from IGH and detection at the SRFCF ranged from 4 to 22 and averaged 11 days. Sixteen of the 17 coho detected in the Shasta River were left maxillary clipped, indicating IGH origin, and one was not marked. The fish that reached Parks Creek (Big Springs complex) was a left maxillary clipped fish and had the shortest travel time between release from IGH and first detection (4 days).

Sixty-eight coho salmon pit tagged and released from IGH were detected at the nearby Bogus Creek Fish Counting Facility, located approximately .3 miles from the mouth of Bogus Creek just below IGH. Bogus Creek, Shasta River and the Scott River (antenna located at Scott River Fish Counting Facility river mile 18) were the only locations where antenna arrays were installed and maintained by Yreka Fisheries staff, so it is unknown where else IGH released coho may have strayed. There were no detections of IGH released PIT tagged coho salmon at the Scott River Fish Counting Facility.

Thirty-two (12.4%) pit tagged coho re-entered IGH after their initial release.

DISCUSSION

Chinook Salmon

Since 1978, KRP has been monitoring the escapement of fall-run Chinook in the Klamath River basin, excluding the Trinity River. The Trinity River Project (TRP) has been monitoring salmon returns in the Trinity River basin during the same period, and the combined run size information generated from these two efforts is summarized in the CDFG "Mega Table" each year. Chinook run size data are compiled and reviewed by the KRTAT during their annual age composition meeting in late January or early February. During the age composition meeting, results of the scale analysis are integrated into run size data to estimate the age structure for each of the various stocks within the basin. Age-specific estimates of natural and hatchery in river escapement coupled with ocean harvest data allows for cohort reconstruction of Klamath River fall-run Chinook. Age-specific estimates of natural and hatchery in-river escapement and harvest are the foundation of model-based forecasting of next year's abundance in the ocean. (KRTAT 2012).

Klamath Basin fall Chinook ocean abundance forecasts are input by the KRTAT into the Klamath Ocean Harvest Model, which models ocean mortality and fishery impacts to allow for ocean fishery options and meet mandated in-river tribal and sport harvest sharing and in-river adult natural spawner escapement targets. Thus, the run size estimates that are compiled each year provide a critical source of data necessary for the effective management of fall Chinook each year.

The 2011 run (18,039) of Chinook salmon at IGH exceeds the 34-year average of 15,916 by 2,123 fish (Figure 6). In 2011 IGH Chinook comprised roughly 10% of the total (Klamath basin) in-river run (188,845) and 12% of the total spawner escapement (144,314) (Table 6).

The percentage of grilse returning to IGH in 2011 (52.9%) was the highest observed in 34 years of record keeping (Figure 7) and the return of grilse to nearby Bogus Creek (42%) was the third highest during that time period. Returns of two year old Chinook were unusually high throughout the basin (KRTAT 2012). Table 7 shows grilse and adult returns to Iron Gate Hatchery and Bogus Creek from 1978 to 2011. A low observed incidence of *Ceratomyxa shasta* (True et al., 2011), along with favorable flow and temperature conditions in the main stem Klamath River during spring and early summer, and favorable ocean conditions were likely contributors to the above normal survival of age two fall Chinook (brood year 2009).

The Chinook salmon releases from IGH include both smolt and yearling releases. The current production goals include releases of 5,100,000 Chinook smolts in May and June and 900,000 yearlings the following November. In 2011, 4,021,411 Chinook smolts and 935,000 yearling Chinook were released from IGH. 2011 was the third year that a total count of Chinook smolts in the raceways was made by the automated tagging trailer, which accurately counts all fish that are pumped into the trailer and diverts 25% for clipping and tagging. During the first three years of automated tagging trailer operation

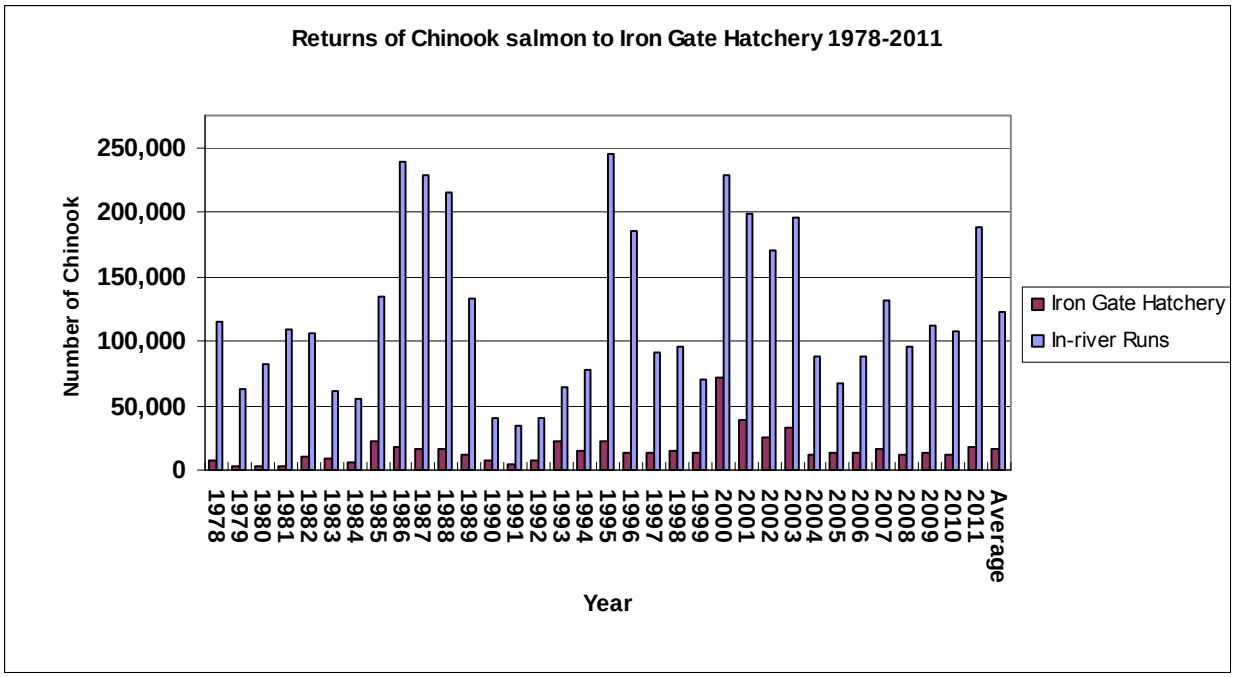

Figure 6. Chinook salmon escapement to Iron Gate Hatchery and in-river runs of Chinook salmon in the Klamath River, 1978 to 2011.

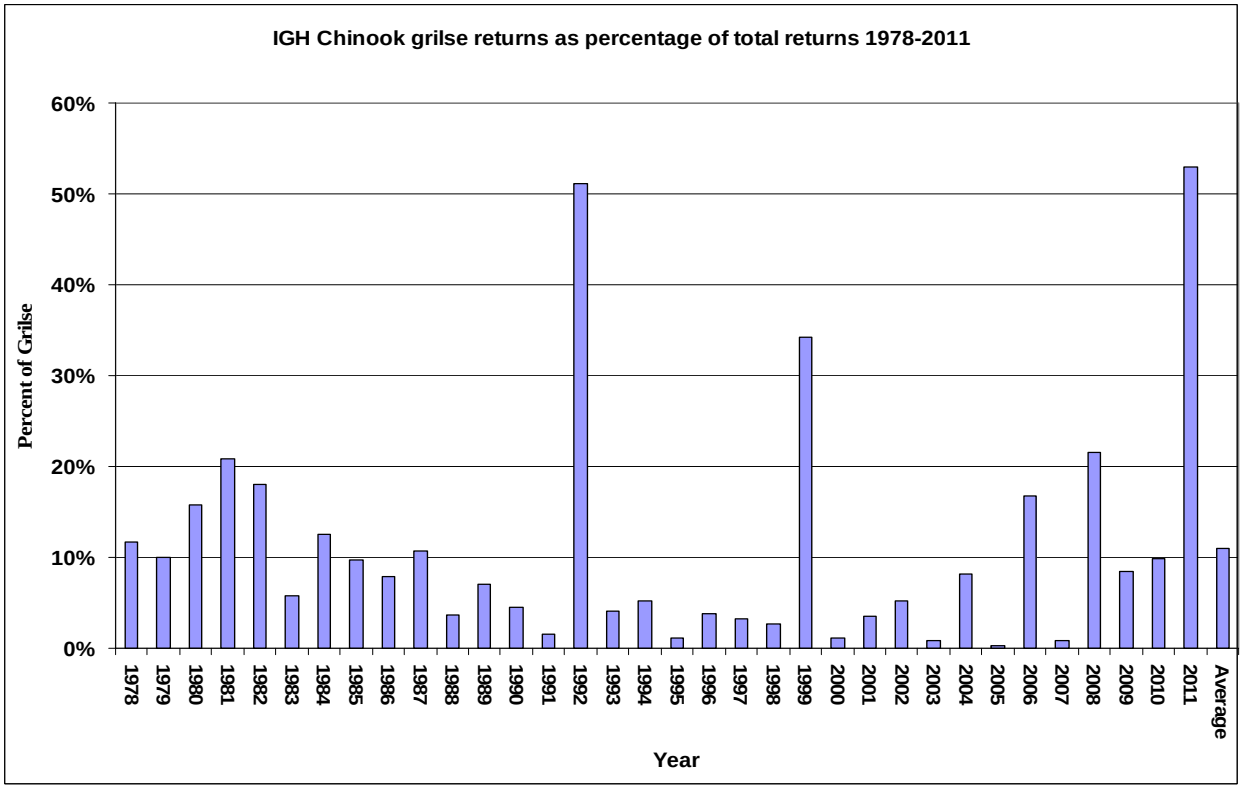

Figure 7. Grilse returns as a percentage of total Chinook salmon returns to Iron Gate Hatchery, 1978-2011.

the estimated number of ponded Chinook has been compared to the number of inventoried Chinook through the tagging trailer. In all three years the ponded number of Chinook was overestimated by approximately 15 to 20 percent. If overestimation of the ponded number of fish occurred at the same rate as observed in the last three years in years prior to the implementation of the tagging trailer, the release numbers have been over- estimated by approximately 15 to 20 percent. One outcome of overestimating the untagged portion of a release is that the production multipliers are higher then they should be and as a result for every year in which this occurred hatchery contributions have been overestimated. It is unknown as to the extent to which this problem has occurred in previous years.

Because of delays in tagging caused by treatment of fish for coldwater disease, IGH obtained approval from the CDFG Northern Regional Manager to release the fingerling groups after the target release period (mid-May to mid-June), and before the targeted size at release, defined as 90/lb. Fingerling groups were released on June 23, 2011. River temperatures ranged between 60 and 64 degrees F (15.5 -17.9 degrees C) during the release week, and flows were 2200 CFS below Iron Gate Dam. Yearling groups were released between November 7 and November 10, 2011.

One of the recommendations of the Joint Hatchery Review Committee (2001) was for IGH to produce more yearlings and less smolts, to reduce hatchery-origin/natural-origin interactions during the typically low flow and poor water quality months of June and July. Flows during the mid-October to mid-November yearling release period are typically higher, and water quality better, resulting in less competition for food and space during out-migration. (CDFG and NMFS 2001). Table 8 shows a comparison of return rates between CWT Chinook released as smolts and as yearlings.

At this time there are physical and funding constraints that limit the Department's ability to implement an increased rearing program for yearling Chinook salmon. In addition, the 2009 Hatchery Scientific Review Group (HSRG 2012) recommended excluding yearling-released Chinook from the spawning matrix due to domestication concerns. One of the group's recommendations is the application of a secondary mark to these fish to enable differentiation from smolt-released fish upon their return as adults.

Table 6. Historic Chinook salmon totals (includes adults and grilse) for the Klamath Basin, Iron Gate Hatchery and Bogus Creek, 1978-2011.

Year	In-River Run (IRR)	Spawner Escapement (SE)		Iron Gate Hatchery			Bogus Creek		
	Totals	Totals	% IRR	Totals	% IRR	% SE	Totals	% IRR	% SE
1978	115,728	90,135	77.9%	7,870	7%	9%	5,579	5%	6%
1979	62,970	42,255	67.1%	2,558	4%	6%	5,938	9%	14%
1980	82,413	57,683	70.0%	2,863	3%	5%	5,070	6%	9%
1981	108,422	56,333	52.0%	2,595	2%	5%	3,642	3%	7%
1982	106,020	67,076	63.3%	10,186	10%	15%	7,143	7%	11%
1983	61,392	47,960	78.1%	8,885	14%	19%	3,048	5%	6%
1984	55,542	30,375	54.7%	6,094	11%	20%	3,504	6%	12%
1985	133,827	104,487	78.1%	22,110	17%	21%	4,647	4%	4%
1986	239,559	180,263	75.2%	18,557	8%	10%	7,308	3%	4%
1987	228,182	143,890	63.1%	17,014	7%	12%	10,956	5%	8%
1988	215,696	130,749	60.6%	16,715	8%	13%	16,440	8%	13%
1989	133,440	72,438	54.3%	11,690	9%	16%	2,662	2%	4%
1990	40,274	25,705	63.8%	7,040	17%	27%	785	2%	3%
1991	34,425	19,121	55.5%	4,067	12%	21%	1,281	4%	7%
1992	40,391	28,479	70.5%	7,318	18%	26%	1,154	3%	4%
1993	64,810	48,945	75.5%	21,711	33%	44%	3,716	6%	8%
1994	78,354	60,850	77.7%	14,566	19%	24%	8,260	11%	14%
1995	245,542	217,312	88.5%	22,940	9%	11%	46,432	19%	21%
1996	185,305	108,325	58.5%	14,165	8%	13%	10,797	6%	10%
1997	91,729	70,303	76.6%	13,727	15%	20%	10,030	11%	14%
1998	95,286	75,157	78.9%	15,326	16%	20%	6,835	7%	9%
1999	70,296	50,088	71.3%	14,120	20%	28%	6,165	9%	12%
2000	228,323	188,642	82.6%	72,474	32%	38%	35,051	15%	19%
2001	198,676	142,324	71.6%	38,568	19%	27%	12,575	6%	9%
2002	170,014	99,016	58.2%	24,961	15%	25%	17,834	11%	18%
2003	195,791	152,390	77.8%	32,260	16%	21%	15,610	8%	10%
2004	88,589	53,478	60.4%	11,519	13%	22%	3,788	4%	7%
2005	67,579	56,188	83.1%	13,997	21%	25%	5,397	8%	10%
2006	88,258	70,986	80.4%	13,990	16%	20%	4,132	5%	6%
2007	132,167	95,998	72.6%	17,149	13%	18%	4,741	4%	5%
2008	95,619	64,487	67.4%	11,231	12%	17%	4,566	5%	7%
2009	112,685	73,688	65.4%	13,492	12%	18%	5,926	5%	8%
2010	107,500	69,584	64.7%	11,347	11%	16%	4,566	4%	7%
2011	188,845	144,314	76.4%	18,039	10%	12%	5,517	5%	6%
Average	**122,460**	**86,442**	**69.8%**	**15,916**	**13%**	**19%**	**8,562**	**6%**	**9%**
MAX	**245,542**	**217,312**	**89%**	**72,474**	**34%**	**44%**	**46,432**	**19%**	**21%**
MIN	**34,425**	**19,121**	**52%**	**2,558**	**2%**	**5%**	**785**	**2%**	**3%**
ST DEV	**63,540**	**48,788**	**0.1**	**12,752**	**0.1**	**0.1**	**9,277**	**0.0**	**0.0**

1/ For the 1995 season the gates at IGH were closed at times, therefore a significant portion of the IGH returns were diverted to Bogus Creek.

Table 7. Adult and grilse components of Chinook salmon returns to Iron Gate Hatchery and Bogus Creek, 1978-2011.

Year	Iron Gate Hatchery				Bogus Creek			
	Grilse	Adults	Total	% Grilse	Grilse	Adults	Total	% Grilse
1978	925	6,945	7,870	11.8%	651	4,928	5,579	11.7%
1979	257	2,301	2,558	10.0%	494	5,444	5,938	8.3%
1980	451	2,412	2,863	15.8%	1,749	3,321	5,070	34.5%
1981	540	2,055	2,595	20.8%	912	2,730	3,642	25.0%
1982	1,833	8,353	10,186	18.0%	2,325	4,818	7,143	32.5%
1983	541	8,371	8,912	6.1%	335	2,713	3,048	11.0%
1984	764	5,330	6,094	12.5%	465	3,039	3,504	13.3%
1985	2,159	19,951	22,110	9.8%	1,156	3,491	4,647	24.9%
1986	1,461	17,096	18,557	7.9%	1,184	6,124	7,308	16.2%
1987	1,825	15,189	17,014	10.7%	1,208	9,748	10,956	11.0%
1988	609	16,106	16,715	3.6%	225	16,215	16,440	1.4%
1989	831	10,589	11,690	7.1%	444	2,218	2,662	16.7%
1990	321	6,719	7,040	4.6%	53	732	785	6.8%
1991	65	4,002	4,067	1.6%	20	1,261	1,281	1.6%
1992	3,737	3,581	7,318	51.1%	556	598	1,154	48.2%
1993	883	20,828	21,711	4.1%	431	3,285	3,716	11.6%
1994	758	13,808	14,566	5.2%	443	7,817	8,260	5.4%
1995	259	22,681	22,940	1.1%	1,207	45,225	46,432	2.6%
1996	543	13,622	14,165	3.8%	377	10,420	10,797	3.5%
1997	452	13,275	13,727	3.3%	221	9,809	10,030	2.2%
1998	403	14,923	15,326	2.6%	205	6,630	6,835	3.0%
1999	4,830	9,290	14,120	34.2%	2,628	3,537	6,165	42.6%
2000	839	71,635	72,474	1.2%	373	34,678	35,051	1.1%
2001	1,364	37,204	38,568	3.5%	648	11,927	12,575	5.2%
2002	1,294	23,667	24,961	5.2%	304	17,530	17,834	1.7%
2003	290	31,970	32,260	0.9%	188	15,422	15,610	1.2%
2004	937	10,582	11,519	8.1%	295	3,493	3,788	7.8%
2005	42	13,955	13,997	0.3%	58	5,339	5,397	1.1%
2006	2,386	11,604	13,990	17.1%	764	3,368	4,132	18.5%
2007	154	16,995	17,145	0.9%	95	4,646	4,741	2.0%
2008	2,414	8,817	11,231	21.5%	1,565	3,001	4,566	34%
2009	1,132	12,258	13,492	8.4%	471	5,455	5,926	8%
2010	1,071	10,276	11,347	9.4%	292	3,179	3,471	8%
2011	9,549	8,490	18,039	52.9%	2,343	3,174	5,517	42%
Average	1,351	14,555	15,917	11.0%	726	7803	8529	13.7%

Table 8. Return rates of IGH smolt and yearling CWT releases for brood years 1990-1996, 1999, 2000 and 2002-2006.

Brood Year	IGH Smolt Releases			IGH Yearling Releases			Ratio of yearling/smolt return rates
	# CWTs Released	# CWTs Returned	% Return	# CWTs Released	# CWTs Returned	% Return	
1990	188,595	713	0.378%	95,880	740	0.772%	2.04
1991	191,200	96	0.050%	90,982	167	0.184%	3.66
1992	185,464	1015	0.547%	74,024	269	0.363%	0.66
1993	188,562	40	0.021%	98,099	196	0.200%	9.42
1994	194,644	94	0.048%	86,564	453	0.523%	10.84
1995	191,799	85	0.044%	90,172	954	1.058%	23.87
1996	196,648	162	0.082%	95,396	581	0.609%	7.39
1999	182,131	686	0.377%	91,220	514	0.563%	1.50
2000	187,417	277	0.148%	100,702	707	0.702%	4.75
2002	210,114	367	0.175%	109,711	295	0.269%	1.54
2003	261,888	70	0.027%	48,592	60	0.123%	4.62
2004	205,950	691	0.336%	98,752	215	0.218%	0.65
2005	209,754	194	0.092%	103,157	445	0.431%	4.66
2006	309,671	224	0.072%	103,361	230	0.223%	3.08
2007	307,204	340	0.111%	103,876	300	0.289%	2.61
AVERAGE			**0.167%**			**0.435%**	**5.42**

Coho Salmon

In recent years, returns of coho salmon to IGH (Figure 8) have been more stable than returns of naturally produced salmon throughout the basin (Chesney, D. et al 2009; Knechtle, M. et al 2009). There is increasing concern among fishery managers that the conservation of remaining upper Klamath River coho genetic resources is necessary to prevent short-term risk of extinction. Because of the relatively stable returns of coho to IGH, there are proposals in place to use IGH coho in excess of mitigation needs to supplement escapement to areas of severely depressed runs, such as the Shasta River.

The 2009 Draft Hatchery Genetic Management Plan (HGMP) was developed for IGH as part of the CDFG's application for an ESA Section 10(a)(1)(A) permit for hatchery operation. The HGMP is intended to guide hatchery practices toward the conservation and recovery of listed species, specifically, the upper Klamath River coho population unit. Changes to the management of IGH coho, including the use of NOAA's spawning matrix and the addition of bird exclusion netting in the outdoor rearing raceways, were recommendations of the draft HGMP and were implemented in 2010 (CDFG, 2011). The draft HGMP also recommends increasing the proportion of natural origin broodstock (pNOB) and the proportion of jacks included in the broodstock (pJacks) (Table 9).

Table 9. Male, female and jack returns, number of females spawned, proportion of natural origin broodstock and jacks used in spawning, egg take, fecundity and yearlings released by brood year at IGH from 1993-2011.

Year	Males	Females	Jacks	Females spawned	Natural Origin Broodstock	pNOB	pJacks	# Eggs	Fecundity	Yearlings released
1993	361	314	29	219	?	~15	~1	503,326	2,298	79,506
1994	100	72	97	57	?	~15	~1	141,397	2,481	74,250
1995	708	793	29	294	?	~15	~1	782,170	2,660	81,489
1996	1,715	1,831	551	200	?	~15	~1	547,255	2,736	79,607
1997	825	1,047	302	126	16	6.3	~1	304,728	2,418	75,156
1998	243	268	158	122	75	30.7	~1	298,357	2,446	77,147
1999	90	61	18	35	5	7.1	~1	86,519	2,472	46,250
2000	295	428	631	95	52	27.4	~1	270,151	2,844	67,933
2001	972	1,494	107	126	22	8.7	~1	404,370	3,209	74,271
2002	566	627	108	187	68	18.2	~1	609,193	3,258	109,374
2003	609	708	241	197	172	43.7	~1	502,048	2,548	74,716
2004	630	865	239	276	10	4.0	~1	799,623	2,897	89,482
2005	596	799	30	103	10	4.9	~1	295,101	2,865	118,487
2006	112	151	69	85	10	5.9	~1	236,406	2,781	53,950
2007	300	325	154	124	10	4.0	~1	316,155	2,550	117,832
2008	508	770	24	148	9	3.0	~1	455,480	3,078	121,000
2009	21	25	18	20	6	15.0	~1	53,435	2,672	22,236
2010	193	235	57	91	22	12.1	6.0	259,490	2,792	155,840
2011	248	204	134	57	21	25.2	11.7	151,241	2,701	NA
Average	479	580	158	135	34	14	9	369,287	2,721	84,363

Figure 9 shows the relatedness coefficient (Rxy) of pairs of coho salmon spawned (yellow bars) at IGH during the 2011 season with the use of the NOAA spawning matrix. This was the second season for which the matrix was used. The maroon bars represent the optimal pairings of males and females that could be achieved if the most unrelated male was spawned with its most unrelated female for each mating. In the absence of the spawning matrix and if pairs were selected purely at random the resulting Rxy values are represented by blue bars (Garza et al., 2012) Highly inbred pairings result in Rxy values > 0.10 and as a result of utilizing the spawning matrix 27 inbred matings were prevented in 2011. With the combined efforts of NOAA, CDFG and PacifiCorps, future coho spawning operations will likely continue to improve the genetic fitness of IGH coho.

Beginning in 1997 all coho that entered IGH, whose origin was either IGH or TRH, would have been maxillary clipped prior to release. There are a small number of coho that may not have been clipped as a result of clipping error. As a result, the number of LM clips observed at IGH during recovery efforts slightly underestimates the actual number of hatchery origin coho present (Table 10).

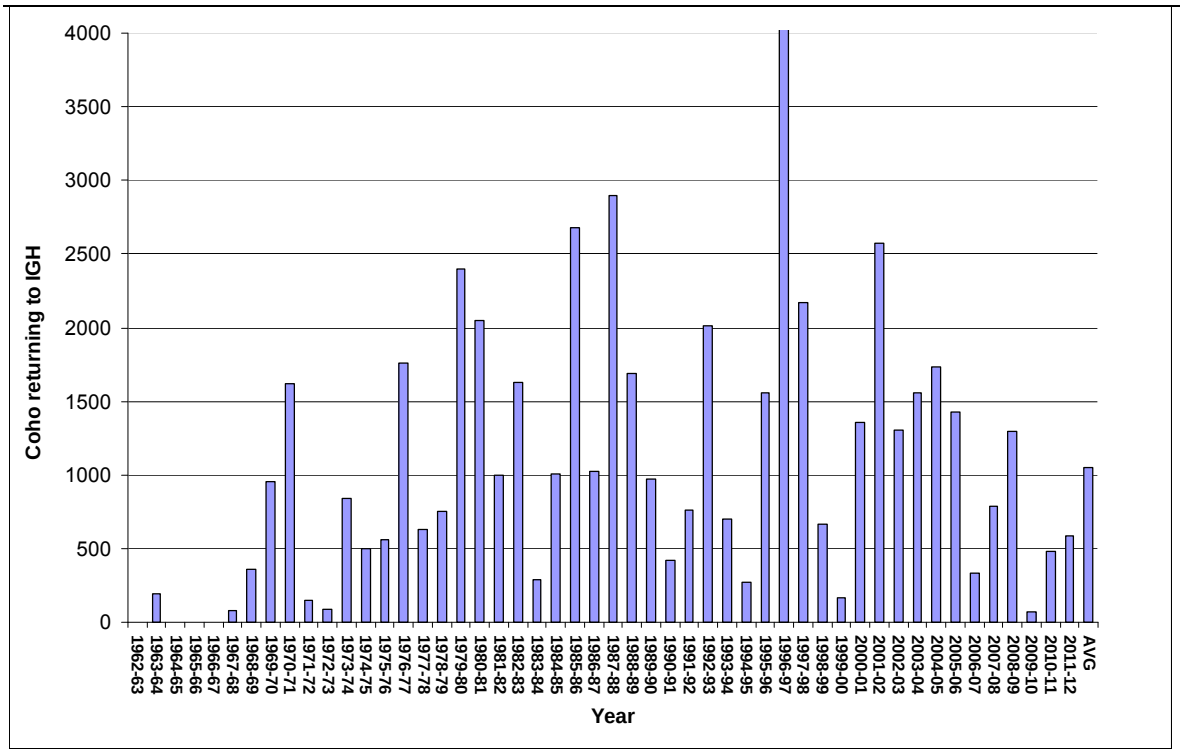

Figure 8. Coho salmon returns at Iron Gate Hatchery from 1962 to 2012

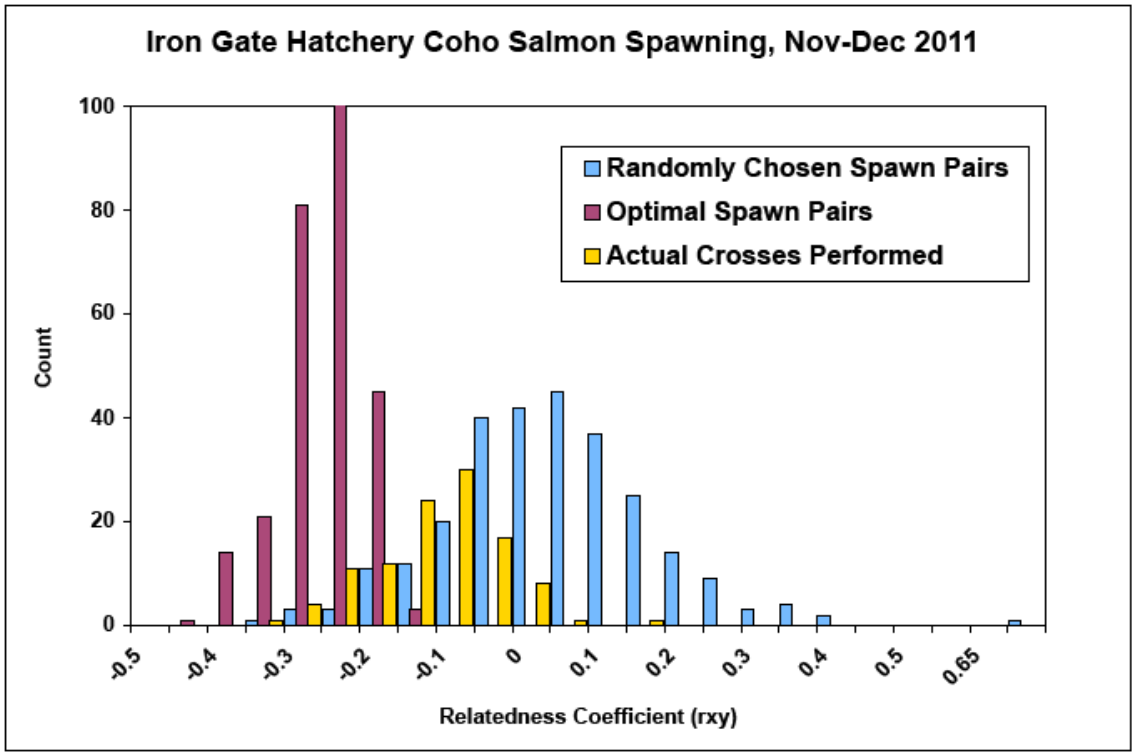

Figure 9. Observed relatedness coefficients of actual spawned pairs, optimally spawned pairs and randomly chosen pairs for IGH coho during the 2011 season (Figure provided by NOAA Southwest Fisheries Science Center Salmonid Genetic Laboratory).

Table 10. Summary of marked and unmarked coho salmon that entered IGH 1997-2011

1997/1998			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	121	44	165
LM	1,717	253	1,970
RM	5		5
AD	24	4	28
ADLM	5	1	6
ADRM			0
Total Clippe	1,751	258	2,009
Total Returr	1,872	302	**2,174**

1998/1999			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	207	82	289
LM	303	75	378
RM			0
AD	1	1	2
ADLM			0
ADRM			0
Total Clipped	304	76	380
Total Returns	511	158	**669**

1999/2000			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	12	3	15
LM	138	15	153
RM			0
AD	1		1
ADLM			0
ADRM			0
Total Clippe	139	15	154
Total Returr	151	18	**169**

2000/2001			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	198	64	262
LM	500	567	1,067
RM	4		4
AD	13		13
ADLM	8		8
ADRM			0
Total Clippe	525	567	1,092
Total Returr	723	631	**1,354**

2001/2002			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	217	29	246
LM	2,054	76	2,130
RM	136	2	138
AD	51		51
ADLM	7		7
ADRM	1		1
Total Clipped	2,249	78	2,327
Total Returns	2,466	107	**2,573**

2002/2003			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	216	9	225
LM	916	90	1,006
RM	25	0	25
AD	31	7	38
ADLM	5	2	7
ADRM			0
Total Clippe	977	99	1,076
Total Returr	1,193	108	**1,301**

2003/2004			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	575	14	589
LM	620	218	838
RM	66	3	69
AD	52	6	58
ADLM	2	0	2
ADRM	2	0	2
Total Clippe	742	227	969
Total Returr	1,317	241	**1,558**

2004/2005			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	399	25	424[*1]
LM	990	213	1,203
RM	31	1	32
AD	69	0	69
ADLM	0	0	0
ADRM	1	0	1
Other	5	0	5
Total Clipped	1,096	214	1,310
Total Returns	1,495	239	**1,734**

2005/2006			
FIN CLIPS	ADULTS	GRILSE	**Total**
Unmarked	138	2	140
LM	1,254	28	1,282
RM	2	0	2
AD	1	0	1
ADLM	0	0	0
ADRM	0	0	0
Other	0	0	0
Total Clippe	1,257	28	1,285
Total Returr	1,395	30	**1,425**

2006/2007			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	72	8	80
LM	176	27	203
RM	1	1	2
AD	16	0	16
ADLM	0	0	0
ADRM	0	0	0
Total Clippe	193	28	221
Total Returr	265	36	**301**

2007/2008			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	135	2	137
LM	480	163	643
RM	6	0	6
AD	2	0	2
ADLM	1	0	1
ADRM	0	0	0
Total Clipped	489	163	652
Total Returns	624	165	**789**

2008/2009			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	23	1	24
LM	1224	44	1268
RM	0	2	2
AD	0	0	0
ADLM	0	0	0
ADRM	0	0	0
LMRM	2	0	2
Total Clippe	1226	46	1272
Total Returr	1249	47	**1296**

2009/2010			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	11	5	16
LM	24	17	41
RM	11	2	13
AD	0	0	0
ADLM	0	0	0
ADRM	0	0	0
Total Clippe	35	19	54
Total Returr	46	24	**70**

2010/2011			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	84	3	87
LM	344	53	397
RM	0	1	1
AD	0	0	0
ADLM	0	0	0
ADRM	0	0	0
Total Clipped	344	54	398
Total Returns	428	57	**485**

2011/2012			
FIN CLIPS	**ADULTS**	**GRILSE**	**Total**
Unmarked	61	0	61
LM	386	136	522
LM/RM	1	0	1
AD	2	0	2
ADLM	0	0	0
ADRM	0	0	0
Total Clippe	389	136	525
Total Returr	450	136	**586**

Average 1997-2011

Clipped	Total	% Clipped
915	**1,099**	**81.7%**

LM=Iron Gate Hatchery (left maxillary clip)
RM= Trinity River Hatchery (right maxillary clip)
AD = Cole M. Rivers Hatchery (adipose clip)
*1 : 7 of these unmarked coho carried a cwt and were actually from Cole Rivers Hatchery

ADLM = Origin unknown, possible ODFW release or injury caused
ADRM = Origin unknown, possible ODFW release or injury caused
Other = Mutliple clips observed, either result of tag error, injury, or unkown origin

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