

# 2008 Feather River Chinook Salmon Spawning Escapement Summary

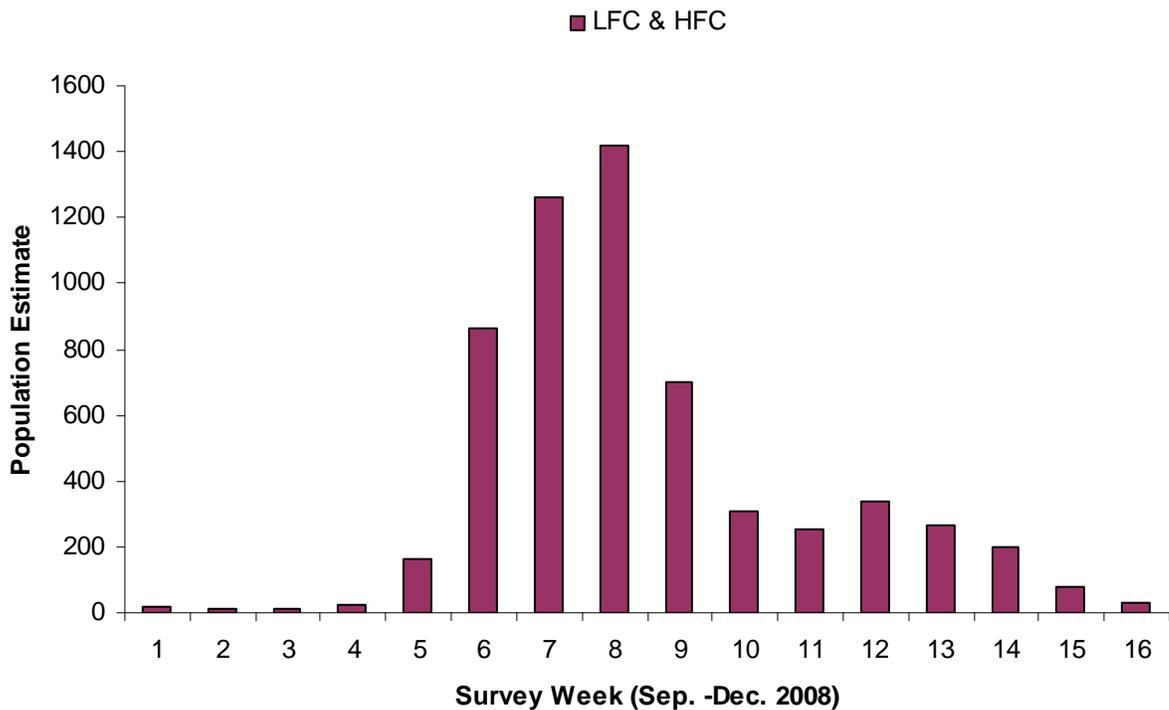
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The Chinook salmon spawning escapement survey began September 2 and continued through December 17, 2008. The Low Flow Channel (LFC) included the area in the Feather River from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet (TAO) and the High Flow Channel (HFC) extended from the TAO downstream to the Gridley Bridge (GB). Due to the low numbers of returning fish, the data from the LFC and HFC were pooled to generate one estimate for the lower Feather River.

## Population Estimate:

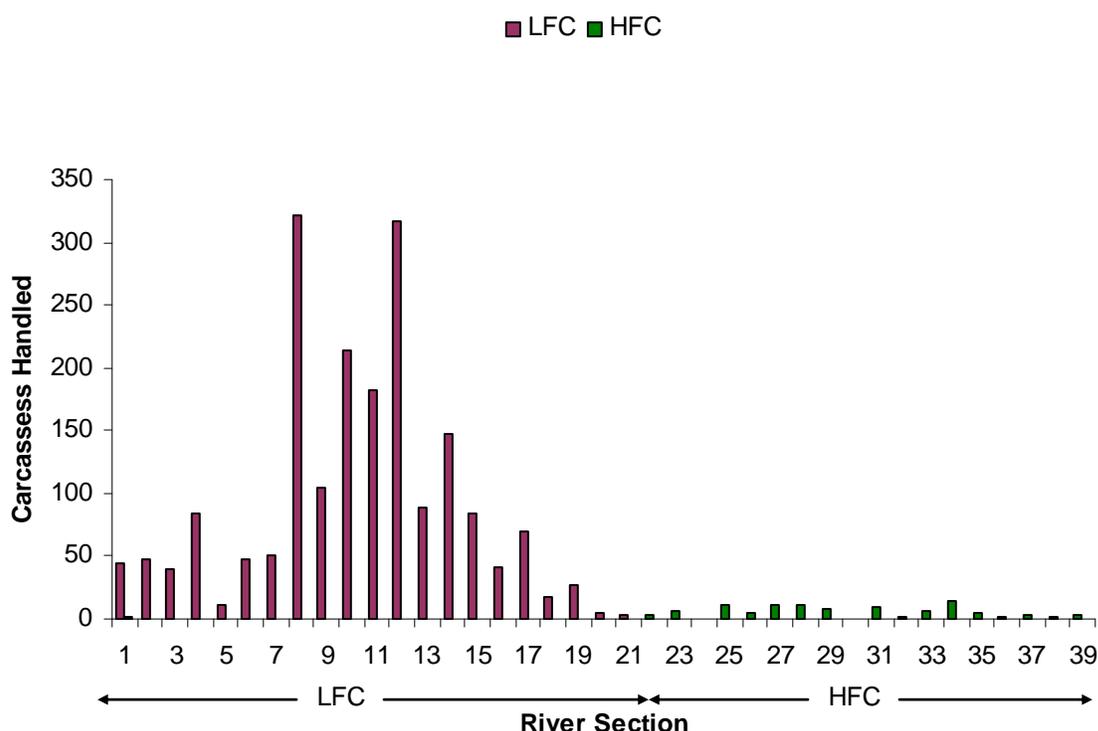
The carcass mark-recapture study, using a pooled Peterson estimator to calculate total escapement, resulted in a population estimate for the lower Feather River of 5939 Chinook salmon. There were an estimated 236 grilse (fish  $\leq 65$  cm fork length). These estimates include both fall-run and spring-run Chinook salmon since their spawning is currently not fully segregated on the Feather River.

**Figure 1. Weekly population estimates in the lower Feather River (LFC & HFC) during the 2008 Chinook salmon escapement survey.**



Approximately 95% of the spawning population utilized the LFC. This is the second highest percentage for any of the previous years monitored by DWR (began surveys in 2000). The long term average for the LFC's spawning population since 2000 is 73%. In the LFC, section 8, river mile (RM) 66.5, had the highest carcass concentration followed by section 10, RM 65.5. The highest concentrations of spawning in the HFC were found in sections 34, RM 55, followed by sections 25, 27, and 28, RM 58, 57 and 57 respectively (Figure 2).

**Figure 2. Carcasses recovered by survey section in the lower Feather River (LFC & HFC) during the 2008 Chinook salmon escapement survey. Note: Section 1 in the LFC and Section 22 in the HFC are the most upstream areas surveyed in each reach.**



Pre-spawning Mortality:

Monitoring of pre-spawn mortality began in 2000 and has yielded an average of 37.7% (2000-2007), markedly higher than this year's average of 14.1% (Table 1). 426 female salmon were examined to determine if they had successfully deposited their eggs. As in previous years, pre-spawning mortality was generally higher in the first weeks of the survey (September-October), and decreased over time for both channels (Figure 3). There were no fish found that could be examined for egg retention during week 1, therefore the pre-spawning mortality depicted for this week is not representative of pre-spawning mortality over time. The previous 9 years of data show that pre-spawning mortality during week 1 normally approaches 100%.

Figure 4 shows the weekly percentage of pre-spawning mortality of examined females for both channels combined. (Again, due to the paucity of data in the HFC, numbers for both channels were combined for all graphs and analyses). When calculating overall pre-spawning

mortality over time, it is higher during weeks 6, 7 and 8 of the survey, which corresponds with higher concentrations of fish. Though the scale is low, a general trend in the lower Feather River can be seen when compared to the population estimate (Figure 1); as numbers of fish increase, pre-spawn mortality increases. This comparison is significant for the two channels combined ( $\alpha = 0.05$ ,  $P < 0.001$ ) with 89.7% of pre-spawn mortality being explained by population.

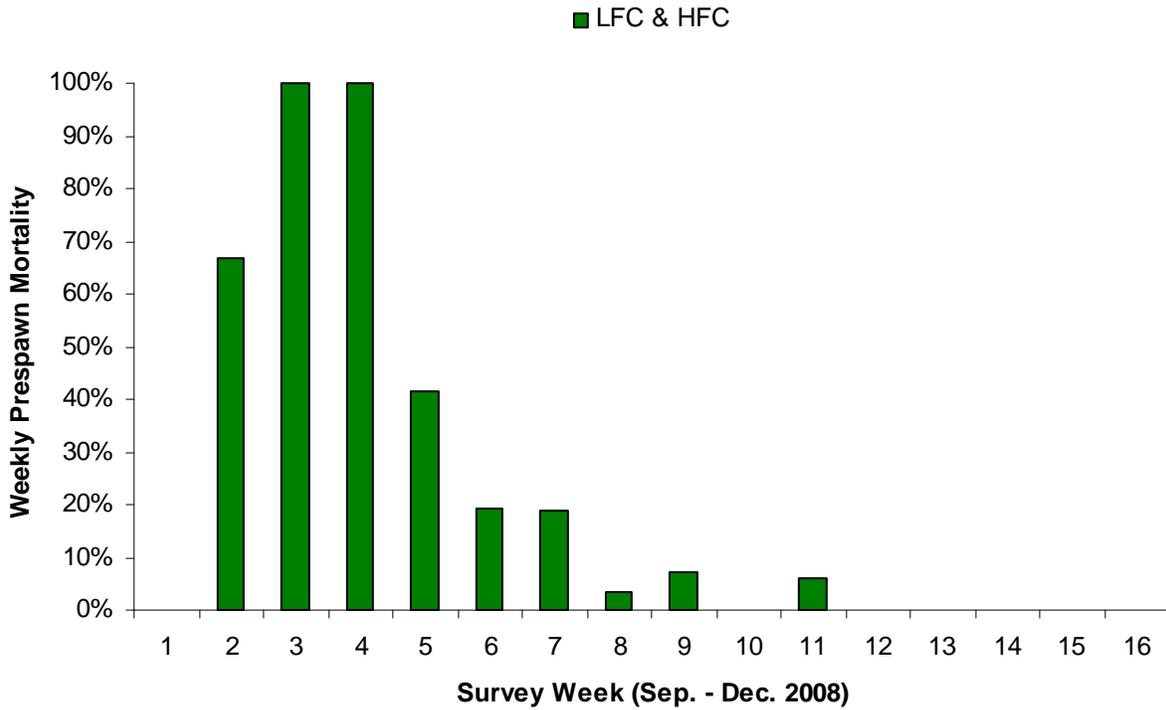
There is also a correlation between *yearly* pre-spawning mortality and population densities. For the years 2000-2008 a regression was done using the inverse sine of pre-spawning mortality percentages as the dependent variable and population density as the independent variable. Though there are only 9 data points, the results are significant. A regression analysis indicates that 75.6% of pre-spawning mortality (Figure 5) can be explained by population density ( $p = 0.0050$ ).

Though both population density and time of year are two of the main factors in predicting pre-spawn mortality, the causes remain unclear. Other likely factors influencing pre-spawn mortality include stress associated with upstream migration, water temperatures, and angling pressure (when allowed).

**Table 1. Spawning status of female Chinook salmon examined during the 2008 escapement survey in the lower Feather River.**

River Section	# Spawned	# Unspawned	Unknown	Total	Unspawned
LFC (Sect. 1-21)	333	59	11	403	14.6%
HFC (Sect. 22-39)	22	1	0	23	4.3%
Overall	355	60	11	426	14.1%

**Figure 3: Weekly percentage of unspawned females in the lower Feather River (LFC & HFC) during the 2008 Chinook salmon escapement survey.**



**Figure 4: Overall percentage of unspawned females in the lower Feather River (LFC & HFC) during the 2008 Chinook salmon escapement survey.**

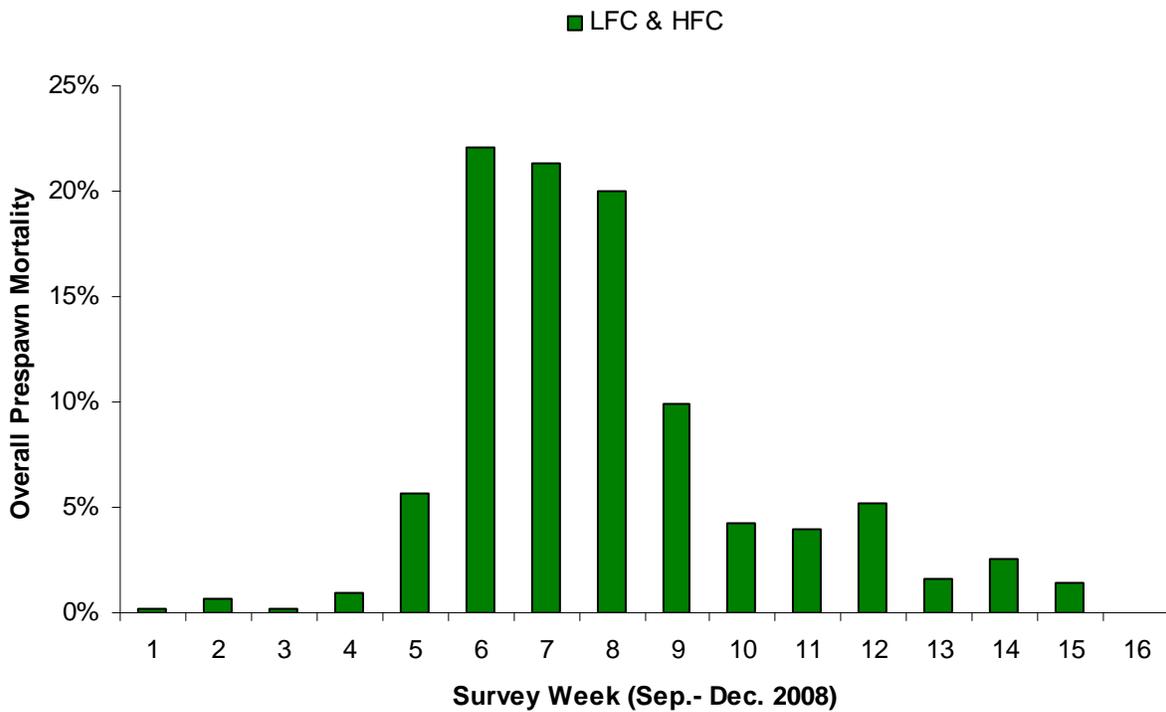
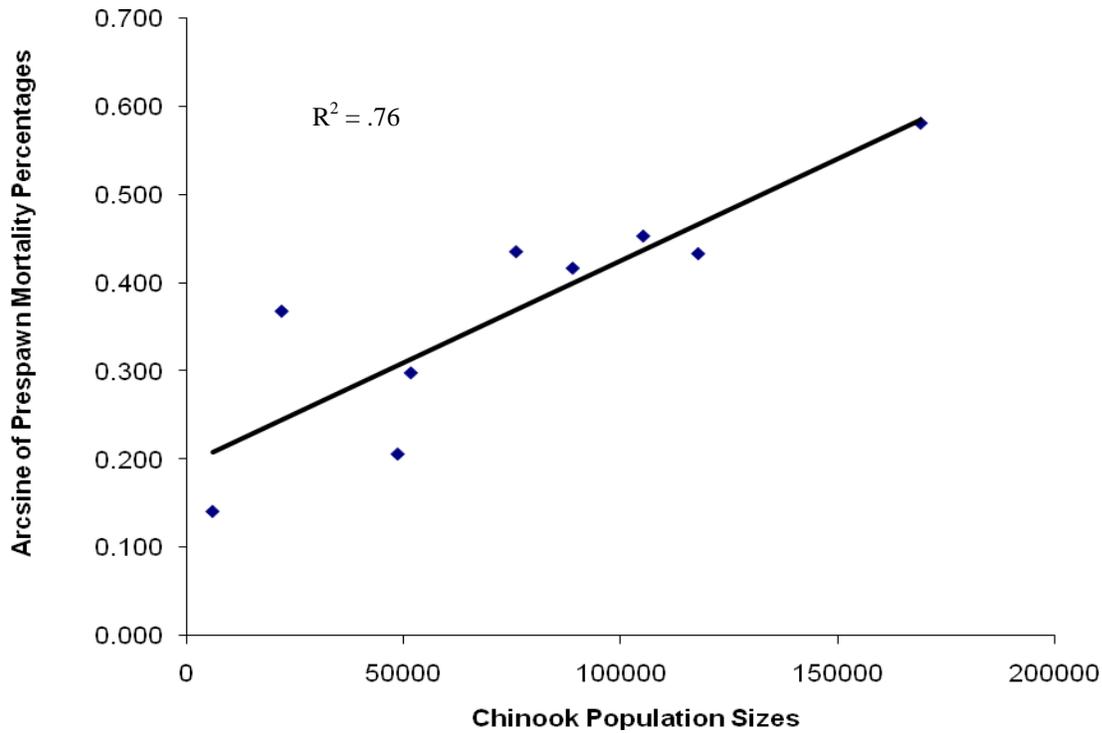


Figure 5. Regression of pre-spawn mortality by population density for the years 2000-2008.



### CWT Sampling:

During the CWT survey we examined 625 fish for adipose fin clips; of these we were able to identify 622 as clipped or not clipped, leaving a remainder of 3 fish with unknown clip status. Of the 622, 81 adipose fin clipped fish were found, had their heads taken and sent to DFG for processing. DFG processed all 81 fish and the CWT was recovered from 71 (87.7%). 4 fish were determined to be strays from 3 different hatcheries (see Table 4). The majority of the clipped fish were found in the LFC (Table 2) and earlier in the survey (Figure 6). We examined 77 fish in addition to the CWT survey that were recorded as clipped or not clipped, but the heads were not collected from clipped fish. Of these, 6 (7.8%) were adipose fin clipped.

**Table 2. Adipose fin presence/absence summary from Chinook salmon examined for the CWT survey in the Feather River during the 2008 escapement survey.**

River Section	Clipped	Non-clipped	CWT Rate
LFC (Sect. 1-21)	80	500	13.8%
HFC (Sect. 22-39)	1	41	2.4%
Overall	81	541	13.0%

**Figure 6. Percentage of examined Chinook salmon with adipose fin clips for the CWT survey in the LFC and HFC of lower Feather River during the 2008 Chinook salmon escapement survey.**

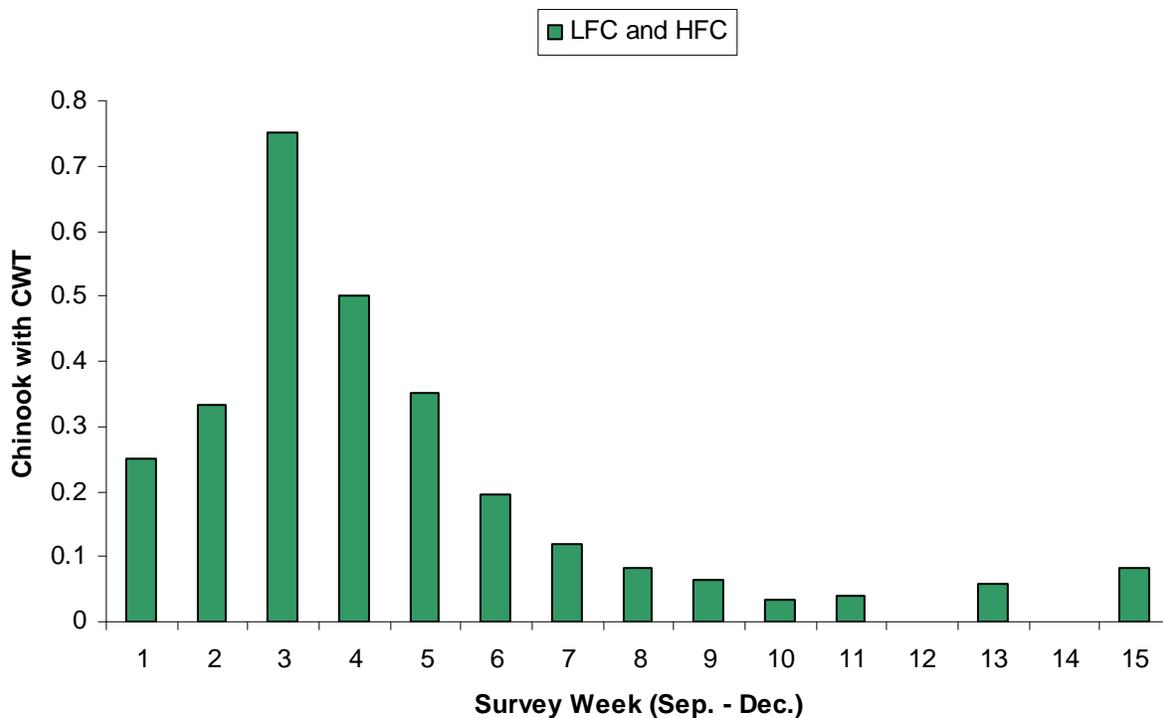


Table 3A shows the in-river spawning population of Chinook was dominated by age-3 fish (63.4%), while age-4 fish (24.0%) made up nearly the remainder of the population, with a few age-2 (9.9%) and age-5 fish (2.8%). The hatchery population showed a similar trend, but with a greater percentage of age-3 fish (72.2%) and a smaller percentage of age-4 fish (18.7%) (Table 3B). Ages 1, 2, & 5-fish were not as common; together making up less than 10% of the total hatchery population (Table 3B). This year's hatchery age-2 fish population (8.2%) was only slightly less than the in-river percentage of 9.9. Age-5 fish were the least common, making up only 0.9% of the population. It is important to note, that an inconsistent tagging rate for each

brood year does affect the overall proportions of each age-class represented. In addition, a very small percentage of fall-run get tagged (between 10% and 25% depending on brood year) compared to spring-run (~100%).

**Table 3. Age composition of Feather River Hatchery origin Chinook salmon recovered during 2008 from the A) in-river escapement survey including both the LFC and HFC, and B) the Feather River Hatchery.**

**A) In-river**

Age	HFC CWT Recoveries	LFC CWT Recoveries	Total	%
1	0	0	0	0.0
2	0	7	7	9.9
3	1	44	45	63.4
4	0	17	17	24.0
5	0	2	2	2.8

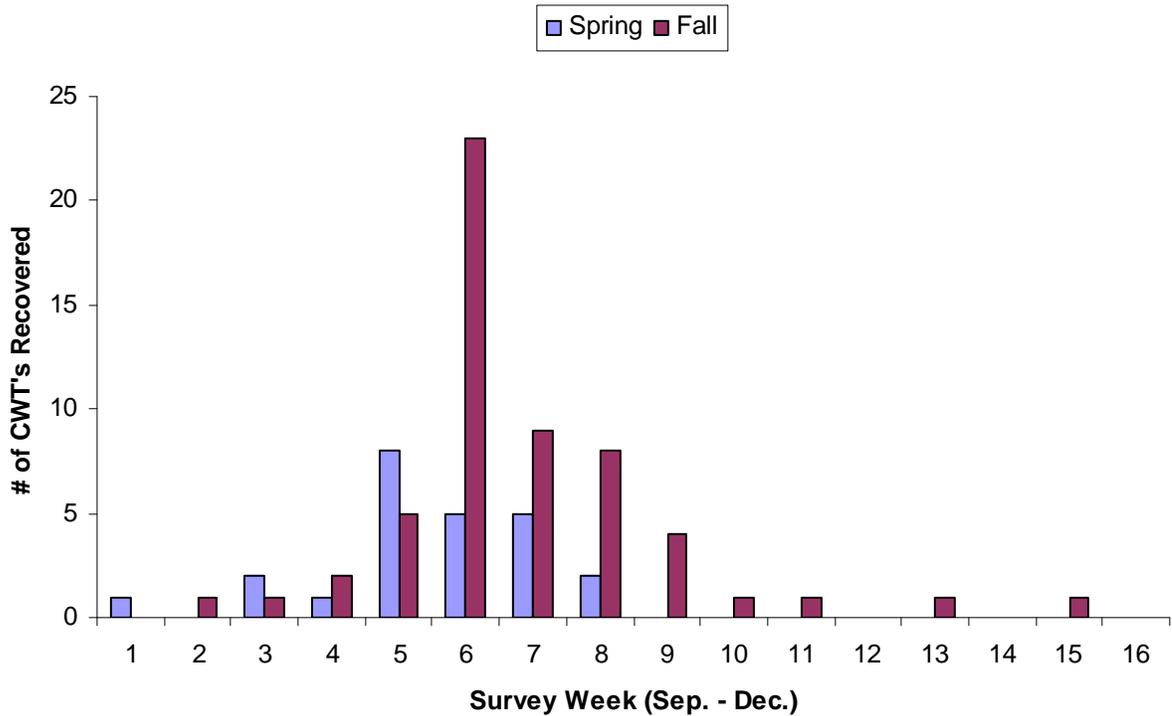
**B) Hatchery**

Age	CWT Recoveries	%
1	0	0.0
2	127	8.2
3	1117	72.1
4	290	18.7
5	14	0.9

Spring and Fall Chinook CWT Composition:

Salmon tagged as spring-run and fall-run at the Feather River Hatchery demonstrated considerable overlap in their temporal distribution (Figure 7). Occurrence of spring-run Chinook CWTs peaked at Week 5; a week earlier than fall-run Chinook CWTs. No spring run CWTs were collected after week 8. Only 57.1% (40 out of 70) of the fish displayed the phenotypic behavior of their specific spawning run, as designated by their CWT. Of the fish that displayed phenotypic fall-run behavior, only 52.0% were coded as fall-run. And of the fish that displayed phenotypic spring-run behavior, 70.0% were coded as spring-run. Furthermore, it appears that Chinook exhibiting the spring-run phenotype were marginally more successful at spawning than their fall-run counterparts (90% vs. 84% respectively).

**Figure 7. Weekly CWT in-river Chinook salmon CWT survey recoveries by run of Feather River Hatchery origin fish from the Feather River during the 2008 spawning season.**



**Strays:**

The majority (98.7%) of the tagged Chinook that returned to the lower Feather River and Feather River Hatchery in 2008 were of Feather River Hatchery Origin. 1.3% of tagged fish consisted of strays from Coleman National Fish Hatchery, Merced River Fish Facility, Mokelumne River Fish Instillation, and the Yuba River (Table 4). They were collected between the last week of September and the second week of December. All of these fish were fall-run fish ranging from age-2 to age-4, except for 4 late-fall from Coleman NFH (all age-2).

**Table 4. Weekly strays recovered by hatchery-origin during the 2008 Chinook salmon spawning season. Note: River = in-river recoveries and FRH = Feather River Hatchery.**

	<b>River</b>	<b>FRH</b>	<b>Total</b>
<b>Coleman</b>	1	6	7
<b>Merced R</b>	1	5	6
<b>Mokelumne R</b>	2	2	4
<b>Yuba River</b>	0	3	3
<b>Total</b>	4	16	20