

Feather River Fall Chinook Cohort Reconstruction Brood Year 1998

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Introduction

A cohort reconstruction of the 1998 brood year was developed to estimate monthly ocean abundance through the life of the cohort. It also provides a means to estimate maturation rates, ocean harvest rates, and stray rates for each age of the brood from ocean age 2 through age 5. Population size and run size at age provides a basis to forecast ocean abundance and set harvest objectives for the stock. Ocean fishery contact rates derived from the reconstruction can be used to predict harvest given the ocean abundance forecast and a proposed ocean fishing season. These parameters can be used to evaluate fishery management objectives in terms of ocean harvest rate caps or river spawning escapement goals. Because these parameters can be variable from year to year a relatively long time series of cohort reconstructions is necessary to account for this variability. Additional variability from sampling methodology and the consistency of coded-wire tag (CWT) recovery programs from in river harvest and spawning ground surveys add to the overall variability and uncertainty of the estimates.

Sacramento River fall chinook (*Oncorhynchus tshawytscha*) comprises approximately 90% of all escapement returning to Central Valley (CV) streams and hatcheries. Ocean fishery harvest of Sacramento River fall chinook is managed by the Pacific Fishery Management Council's (PFMC) Fishery Management Plan's Final Framework Amendment of 1984 to ensure that a goal range of 122,000-180,000 hatchery and natural adults return to the Sacramento River to spawn. Ocean fishery management must also meet Federal Endangered Species Act (ESA) constraints for Sacramento River winter and CV spring chinook. Currently, the PFMC uses the Central Valley index (CVI) as a prediction of CV stocks ocean abundance. This forecast is non age or stock specific and is a simple index of the true ocean abundance of all ages and stocks from the CV. The CVI is simply the ocean harvest south of Point Arena plus the total escapement of adults to the CV in the same year. The CV harvest rate index is the proportion of the CVI that is made up of chinook landings south of Point Arena. These relationships are used to evaluate if a proposed ocean fishing season's structure will allow escapements to the CV in the magnitude of the FMP goal range 122,000 to 180,000.

Each year the Feather River Hatchery (FRH) releases about 6.5 million fall chinook salmon; this represents about 30% of the estimated 23 million fall chinook produced annually in the Sacramento River Basin hatchery system (i.e., FRH, Coleman National Fish Hatchery, Nimbus Fish Hatchery).

Fall chinook are named for their spawning migration timing. Fall chinook leave the ocean in late summer and migrate up river to spawn in the Fall. Emergence begins in November and goes through March. Juvenile out migration occurs 60-150 days after hatching (Myers et al. 1998). Most Fall chinook mature at age 3 with a smaller number holding over in the ocean until age 4. The age 5 component of the cohort is very small. Males that return at age 2 are referred to as jacks and are not considered adults. A given river run may contain members from four different brood years depending on their cohort population size.

Since 1976, hatcheries have used CWTs to evaluate relative survival rates and fishery harvest of fish produced at the hatchery. These fish have a small (0.5-1 mm) CWT inserted into their nasal tissues generally during their first 6-12 months of life and are adipose-clipped for a visual identification of the presence of a CWT. A unique CWT code links the fish to a specific release

group (e.g., hatchery, stock, date released, release site, release size). CWT recovery information can be used to piece together the life history of the cohort and in estimating the effects of fisheries on salmon populations. In turn, information about hatchery fish can be extrapolated to fish of natural origin.

The number of CWT fish recovered in inland and ocean waters depends, in part, on the number of fish marked and released, the fraction of these fish that are legal-sized, and sampling levels. These parameters vary across time and area and thus must be accounted for in estimating total cohort abundance at age and to allow for meaningful comparisons across time and area. Four kinds of CWT recovery expansions are used in the analyses to account for: (1) sampling; (2) hatchery production; (3) contacts (versus harvest); and (4) impacts (versus harvest). The expansion for sampling converts the observed number of each CWT code collected during sampling to the number of tags with that code that would have been expected if all fish had been examined (a 100% sampling rate); it is specific to each sampling program at the time of recovery. The expansion for hatchery production converts the observed number fish of each CWT code to the total number of tagged plus untagged fish from that release group; it is specific to each particular release code. The expansion for contacts converts the number of legal-sized fish that were harvested to the number of fish of all sizes that were contacted by the fishing gear; it is specific to month, area, age and release type of the fish, and the minimum legal size limit in effect at the time of contact. The expansion for impacts converts the contacts to total impacts, including harvest, hook-and-release mortality, and dropoff mortality; it is also specific to month, area, age and release type of the fish, and the minimum size limit in effect at the time of contact.

Description of Databases

The cohort reconstruction and the conclusions based on it depend on the accuracy and reliability of the CWT data collected from fisheries, spawning ground surveys and hatcheries. The creation of the data bases and verification of the data in them provides the foundation of the cohort reconstruction. Considerable effort and attention went into uncovering and correcting errors, and identifying data gaps. The database formats used for the Feather River cohort reconstruction will also facilitate the addition of new or corrected data for additional brood years.

Coded-Wire Tag (CWT) databases

Release data and hatchery production factors

The database FRH_9601REL.dbf (219 records) is the database containing the “master” list of all fall chinook CWT release groups (brood years 1996-2001) tagged at FRH. These releases help determine the age structure of FRH escapement during 2000 – 2003 that is needed to rebuild the 1998 brood year cohort. The 1998 brood year had 102 release groups, 44 tagged and 58 untagged. Each hatchery *release group* has been assigned to one of three general *release types*, based on release location and life history stage at release; a release group can contain one or several CWT release codes. Fingerling and yearling release stages were determined by fish weight and date of release. Most fingerlings weigh less than 13 g and are released during spring at approximately 6 months of age; yearlings generally weigh (>60 g) and are released the following fall. Approximately 7.5 million 1998 brood year FRH fall chinook fingerlings were released. FRH also

released 1998 brood year yearlings but their small release numbers (n<25,000) and lack of CWTs made it impossible to rebuild this release group. Table 1 and Figure 1 show the release types and release locations for 1998 brood year FRH fall chinook fingerling releases.

Information for each CWT release group was thoroughly checked for missing or misreported data (Appendix 1). In several cases, large groups of fish were released untagged. Based on their release location, release date(s) and release size, these fish were linked to similarly-sized CWT fish released at approximately the same time in the same area. When several CWT releases occurred; the proportion tagged with each CWT code to the total tagged was used to represent the untagged fish. For example, if 20% of the tagged fish belonged to CWT code A12345, then 20% of the additional untagged production was applied to this CWT release. Production factors for these CWT fish were calculated using the following formula:

$$\text{Production Factor} = \frac{(\# \text{ CWT fish tagged} + \# \text{ fish shed tag} + \# \text{ released untagged} + \text{additional untagged})}{\# \text{ CWT tagged}}$$

This database is linked to all ocean and inland recovery files to add release type, brood year, and production factor, which are needed in the age structure, size-at-age and cohort analyses.

Table 1. Release types used in the FRH CWT release database (brood years 1996-2001).

Release type	Release Location	Release stage	Number of release groups
INBF	InBasin FRH Production – released Feather R/ Sacramento R Basin	Fingerling	96 Tagged 13 Untagged
TRKF	Trucked FRH Production – released S.F. Bay / San Pablo Bay	Fingerling	47 Tagged 207 Untagged
XHAF	Experimental/Extra FRH Production – released Yolo Bypass & San Joaquin Basin	Fingerling	74 Tagged 0 Untagged

Recovery data and sample expansion factors

All 1998 brood year FRH CWTs recovered in inland and ocean waters on the west coast were downloaded from the Pacific States Marine Fisheries Commission’s Regional Marking Information System (RMIS). Several programs and databases, operating on recovery data in a series of steps, were used to create the ocean recoveries database, recoveries into the Feather River Basin and the database containing recoveries from all other river basins were developed. Each recovery in the ALLOCEANREC.dbf is assigned a PFMC fishery management area (Table 2; Figure 2) based on the sample/catch area where it was originally collected, and this is the area the cohort analyses uses to determine fishery impacts by time, area, and fishery.

Release Locations for Feather River CWTs 1998 Brood Yr.

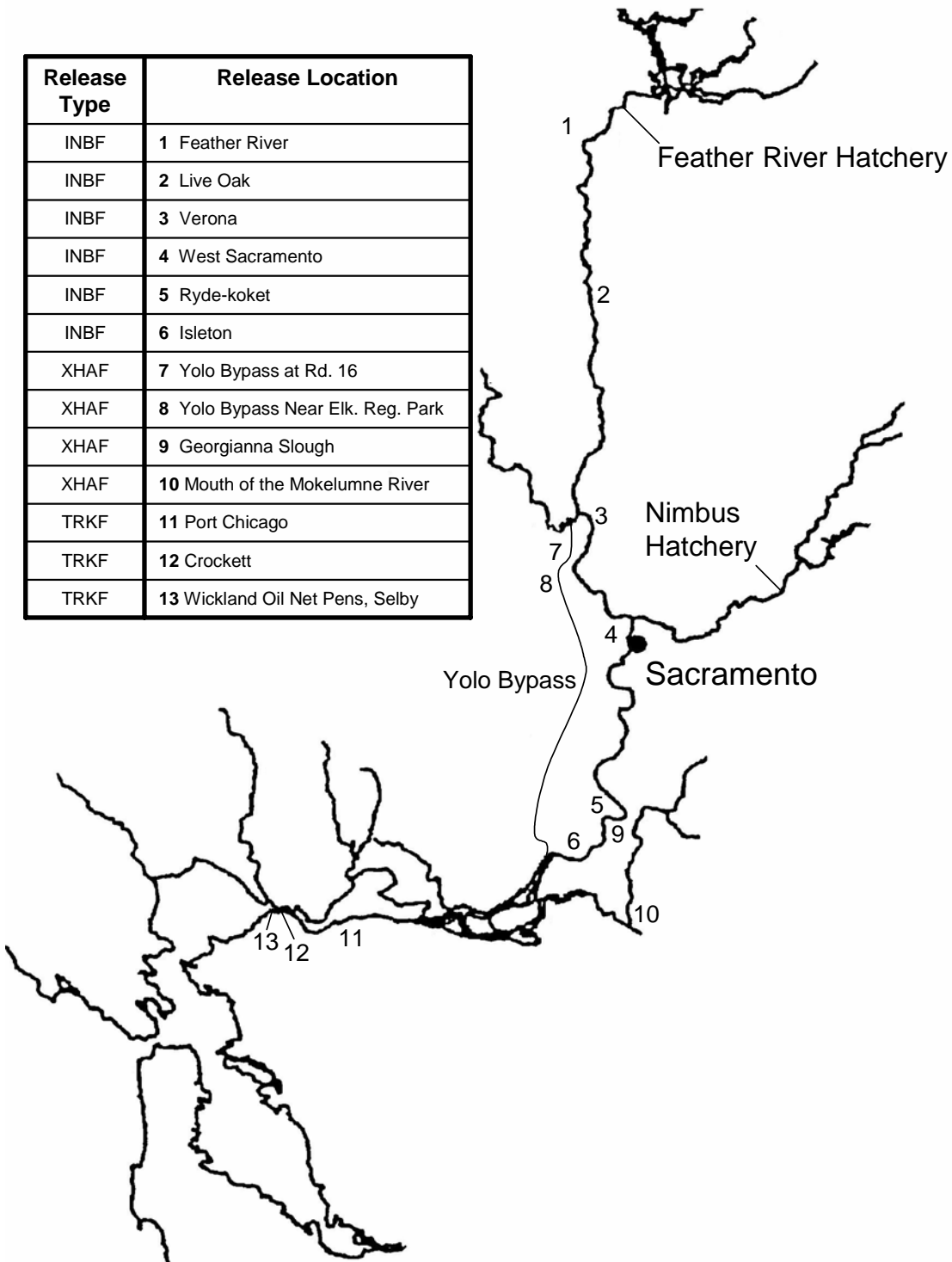


Figure 1. Release location and release type of brood year 1998 Feather River fall chinook CWTs. Release types: INBF – Inbasin FRH fingerling releases, TRKF – Trucked FRH fingerlings, and XHAF – Experimental/Extra production FRH fingerlings.

Table 2. The PFMC ocean fishery management areas, major ports, and the geographic boundaries between them.

Fishery Management Area*	Major Port Area*	Sample / Catch Area
NOR	NO	North of Heceta Head
COS	CO	Between Heceta Head and Humbug Mtn. (Cape Blanco)
KMZO	KO	Between Humbug Mtn. (Cape Blanco) & CA/OR border
KMZC	KC	Between CA/OR border and Horse Mtn.
FTB	FB	Between Horse Mtn. and Pt. Arena
SNF	SF	Between Pt. Arena and Pigeon Pt.
MON	MO	South of Pigeon Pt.

* NOR = NO = Northern part of Oregon; COS = CO = Coos Bay; KMZO = KO = Oregon part of Klamath Management Zone; KMZC = KC = Californian part of Klamath Management Zone; FTB = FB = Fort Bragg; SNF = SF = San Francisco; MON = MO = Monterey.

Table 3. Ocean CWT recoveries by age.

1	2	3	4	5	Total
1	1,158	10,756	769	3	12,687

Table 4. Ocean CWT recoveries by month and fishery.

	≤Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	≥Oct	Total
Sport	99	585	463	589	1,170	579	140	59	3,684
Troll	31	334	2,821	2,164	1,520	1,040	826	267	9,003
Total	130	919	3,284	2,753	2,690	1,619	966	326	12,687

Table 5. Ocean CWT recoveries, by year.

1998	1999	2000	2001	2002	2003	Total
134	1566	1164	3183	1,955	4,685	12,687

Table 6. Ocean CWT recoveries by release type.

INBF	TRKF	XHAF	Total
3,244	8,597	846	12,687

Table 7. Ocean CWT recoveries, by fishery and management area. ^{a)}

	NOR	COS	KMZO	KMZC	FTB	SNF	MON	Total
Sport	292	205	96	127	373	1,896	695	3,684
Troll	2,280	1,048	39	55	628	3,209	1,744	9,003
Total	2,572	1,253	135	182	1,001	5,105	2,439	12,687

^{a)} Management areas: NOR = Northern Oregon, COS = Coos Bay, KMZO = Klamath Management Zone-Oregon, KMZC = Klamath Management Zone-California, FTB = Fort Bragg, SNF = San Francisco & MON = Monterey.

Table 8. Ocean CWT recoveries, by management area, month, and fishery.

Sport	≤Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	≥Oct.	Total
NOR	0	0	2	27	114	103	35	11	292
COS	0	5	1	36	84	58	20	1	205
KMZO	0	0	23	16	26	16	13	3	96
KMZC	0	0	21	49	28	20	9	0	127
FTB	24	17	48	97	143	41	3	0	373
SNF	12	182	271	316	707	311	53	44	1,896
MON	63	381	97	48	69	30	7	0	695
Total	99	585	463	589	1,170	579	140	59	3,684

Troll	≤Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	≥Oct.	Total
NOR	13	74	428	319	240	406	568	235	2,280
COS	18	173	218	227	148	151	90	23	1,048
KMZO	0	0	4	10	7	10	5	3	39
KMZC	0	0	0	0	0	2	53	0	55
FTB	0	0	144	0	168	227	89	0	628
SNF	0	87	1,066	941	847	244	18	6	3,209
MON	0	0	961	670	110	0	3	0	1,744
Total	31	334	2,821	2,164	1,520	1,040	826	267	9,003

Both Fisheries	≤Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	≥Oct.	Total
NOR	13	74	430	343	354	509	603	246	2,572
COS	18	178	219	263	232	209	110	24	1,253
KMZO	0	0	27	26	32	26	18	6	135
KMZC	0	0	21	49	28	22	62	0	182
FTB	24	17	192	97	311	268	92	0	1,001
SNF	12	269	1,337	1,257	1,554	555	71	50	5,105
MON	63	381	1,058	718	179	30	10	0	2,439
Total	130	919	3,284	2,753	2,690	1,619	966	326	12,687

Ocean Regulations database

The ocean regulations database, OCEANREGS.dbf, contains all ocean chinook fishery regulations in effect since 1982 by major port area, date, fishery (commercial troll and sport), and minimum size limit (PFMC 2004). The programs GETKOHMAREA.prg and GETLIMIT.prg use this database respectively 1) to determine whether the default PFMC fishery management area was actually open on the given sample date; and 2) to obtain the minimum size limit in effect on the sample date. If either program encounters a problem, it flags the record for user intervention. All flagged records were reviewed, given a correct Fishery management area, and placed in FIXEDKOHM.dbf (n=10) so that the problem will be corrected automatically with future downloads. Ultimately, the corrections will be incorporated in the server databases, but in the meantime this method avoids the need to correct a record manually more than once.

Catch/Effort database

The catch/effort database, CATCH_EFFORT.dbf, consists of the number of chinook salmon landed and days fished by fishery in both Oregon and California. Although the effort data are not used in cohort reconstruction it is included with the catch for future analysis of contact rates/effort. Sport effort is measured in angler-days fished, while commercial effort is in boat-days fished. Previously, CDFG estimated the number of days fished in the commercial fishery, \hat{f} , using a mean-per-unit estimator:

$$\hat{f} = \bar{f}_{deliv} \cdot N_{deliv} \quad (1)$$

where \bar{f}_{deliv} is the average number of days fished per sampled delivery and N_{deliv} is the number of deliveries. However, large and small boats may have been sampled at different rates, which would bias this estimate because larger boats tend to stay out for longer periods. To avoid this potential bias, we used a second method which scales effort directly by the number of salmon landed. Using all CDFG catch and sample data from 1982 through 2003, we estimated commercial effort using a ratio estimator:

$$\hat{f} = \frac{\bar{f}_{deliv}}{\bar{l}_{deliv}} \cdot \hat{L} \quad (2)$$

where, for each month and major port area, \bar{l}_{deliv} is the mean number of salmon landed by sampled boats and \hat{L} is the estimated total number of salmon landed. Total fishing effort by month and PFMC fishery management area can then be calculated by summing the effort at each major port in the area. For example, the KMZ troll effort in September would be the sum of the September effort in Oregon's KMZO major port (Brookings, Gold Beach and Port Orford) and California's KMZC major port (Eureka and Crescent City).

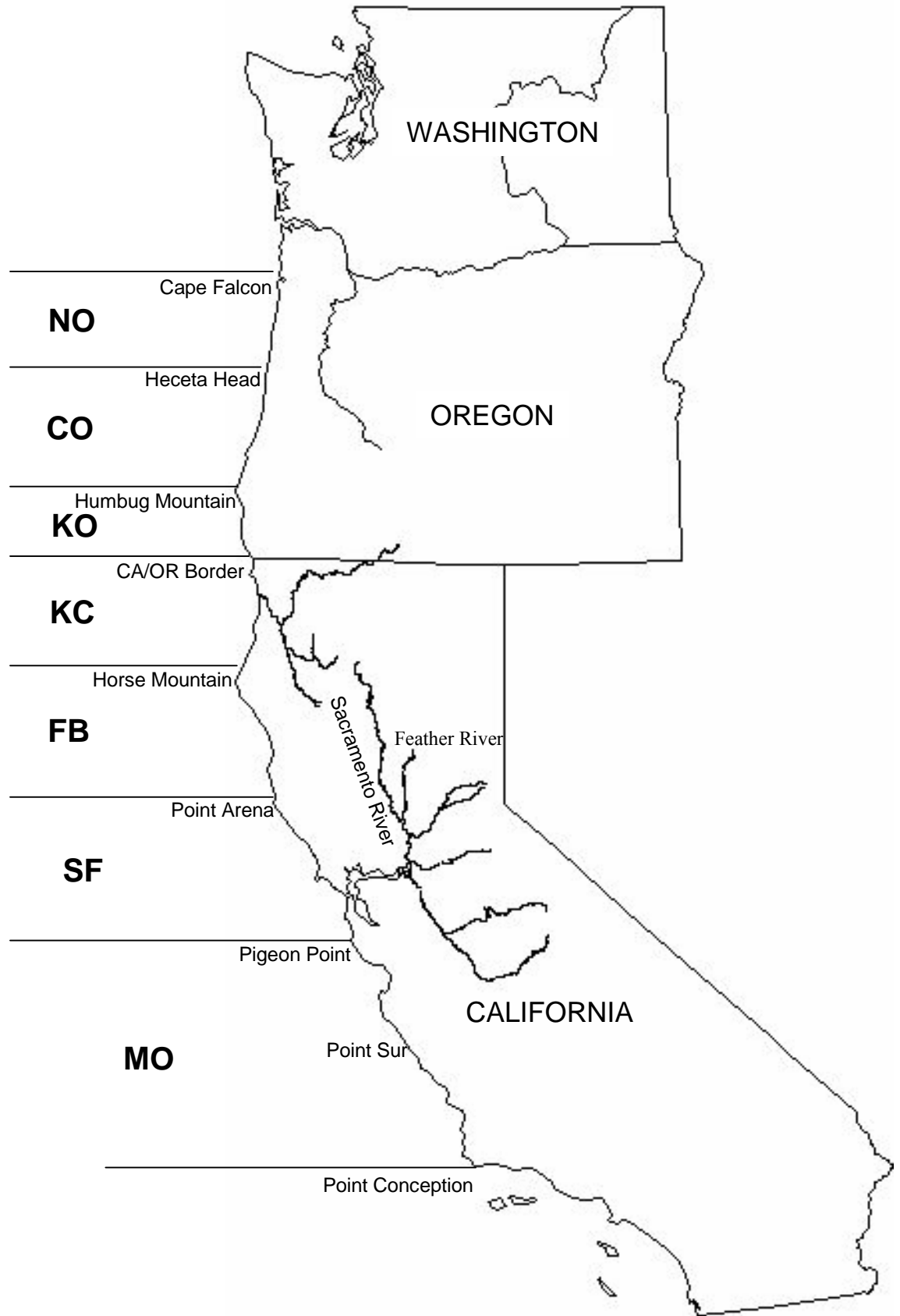


Figure 2. PFM fishery management areas used in cohort reconstruction databases and programs.

Hatchery and natural CWT recovery programs and database

It was necessary to compile data from diverse sources. The various sampling agencies in the CV are; CDFG, Department of Water Resources (DWR), U. S. Fish and Wildlife Service (USFWS), East Bay Mud (EBMD), and Jones & Stokes, they collected heads from adipose fin clipped fish that were observed in hatcheries, spawning grounds and in-river sport locations from 2000 through 2003. The major hatcheries in the CV are; Coleman National Fish Hatchery (CNFH), Feather River Hatchery (FRH), Nimbus Fish Hatchery (NFH), Mokelumne River Fish Installation (MRFI) and Merced River Fish Facility (MRFF). CNFH submitted CWT recovery data to the RMIS directly. Recoveries from CNFH were downloaded from the RMIS and appended to the Santa Rosa CWT lab recovery database for analysis. NFH and MRFI heads were processed at the CDFG CWT lab in Santa Rosa and submitted to the RMIS. MRFF processed their heads at the CDFG La Grange office, who then forwarded the CWT information to the CWT lab in Santa Rosa for submission to RMIS. The inland CWT data table, CV_INLAND.dbf, contains the 1998 brood year FRH fall chinook CWTs recovered from the Feather River Basin during 2000 through 2003. Heads from adipose fin clipped fish recovered by DWR on the Feather River and FRH were processed in CDFG's head lab in Santa Rosa and reported to the RMIS server. All other 1998 brood year FRH fall chinook CWTs recovered in the CV during 2000 through 2003 are contained in the OTHERRIVREC.dbf.

Hatcheries use a direct count method for determining the number of fish entering the hatchery. All heads and fork lengths are collected from adipose fin clipped fish. Sample expansion factors from hatcheries such as the FRH are generally 1 because all fish are observed. In run years 2000 through 2003 all fish entering hatcheries in the CV were examined and directly counted except for CNFH in 2003. Due to the large escapement back to CNFH, heads from adipose fin clipped fish were collected from the first half of their direct count per day. CNFH collected approximately 10,000 heads in the 2003 run year.

Natural spawning ground estimates are determined by mark and recapture surveys, aerial redd counts, CWT proportion surveys, ladder/weir passage and video monitoring. In the upper Sacramento River, escapement is determined from a carcass survey above Red Bluff Diversion Dam (RBDD) and is adjusted by redd distribution outside the carcass survey area. RBDD counts adipose fin clipped fish, but takes no heads from fish that pass RBDD. The fall run carcass surveys in 2000 and 2001 did not collect heads from adipose fin clipped fish. In the lower Sacramento River escapement is estimated by aerial redd count. No heads are collected from this survey. Clear and Battle creeks had mark and recapture carcass surveys performed in 2000 through 2003. All heads and fork lengths were collected from adipose fin clipped fish. Mill Creek had mark and recapture carcass surveys in 2002 and 2003, but was not surveyed 2000 or 2001. Deer Creek was surveyed for the proportion of adipose fin clipped fish, heads and fork lengths were recorded, but no population estimate was reported from 2000 through 2003. On Butte Creek mark and recapture surveys were conducted in 2001 through 2003. In 2000 a survey for adipose fin clipped fish was performed and a rough population estimate was reported. In the Mokelumne River from 2000 through 2002 population estimates were based solely on passage at the Woodbridge Irrigation District Dam (WIDD) subtracting the escapement to MRFI. A mark and recapture carcass survey was conducted in conjunction with passage estimate in 2003. In the Feather, Yuba, American, Stanislaus, Tuolumne and Merced rivers mark and recapture carcass surveys were conducted during the spawning period in run years 2000 through 2003. Sample expansion factors from carcass surveys are complex due to the

methods used in the estimation process (Mohr, 2003). These expansion factors are generally between 6 and 12 and are derived from data provided by the survey projects.

Heads collected from the Sacramento River, Clear Creek, Battle Creek, Mill Creek and Deer Creek were processed by CDFG in Red Bluff. Butte Creek heads were processed by CDFG in Chico. Feather River, Yuba River, American River, Mokelumne River heads were processed by the CWT lab in Santa Rosa. Stanislaus River, Tuolumne River and Merced River heads were processed by CDFG in La Grange. All CWT recovery information from these sources was compiled at CDFG in Santa Rosa where it was prepared for submission to the RMIS.

Recreational harvest CWT recovery program

The California Department of Fish and Game (CDFG) began the Central Valley Salmon and Steelhead Harvest Monitoring Project (CVSSHMP) in 1998 to estimate harvest of adult chinook salmon and steelhead within rivers and streams in the CV (Massa, 2003). The CVSSHMP roving creel census methodology used the stratified random sample procedure from the CDFG's Sacramento River System Sport Fish Inventory (Wixom, 1995) to estimate in-river harvest.

In 2000, the census was conducted on the Sacramento, American, Feather, Yuba, San Joaquin, Mokelumne, and Stanislaus rivers. The study area consisted of 554 miles of river divided up into 18 sections at 1 to 56 miles per section. The entire year was sampled in all sections. This year represents the largest area and time encompassed by the creel census for the 2000 through 2003 run years. In 2000, 2,951 salmon were sampled and 175 heads were recovered from adipose fin clipped fish. The 2000 estimated in-river chinook salmon harvest was 70,800 for the CV.

In 2001, the census was reduced to the Sacramento, American and Feather rivers. The study area consisted of 377 miles of river divided up into 13 sections at 1 to 56 miles per section. Sacramento River sections were sampled January and July through December. American and Feather river sections were sampled January and March through June. In 2001, 1,494 salmon were sampled and 113 heads were recovered from adipose fin clipped fish. The 2001 estimated in-river chinook salmon harvest was 46,100 for the CV. This estimate represents approximately 50% of the CV in-river sport harvest, as the American and Feather rivers were not sampled July through December.

In 2002, the census was conducted on the Sacramento, American and Feather rivers. The study area consisted of 377 miles of river divided up into 13 sections at 1 to 56 miles per section. All Sacramento River sections were sampled during chinook salmon season. All American and Feather river sections were sampled the entire year except for January. In 2002, 3,391 salmon were sampled and 275 heads were recovered from adipose fin clipped fish. The 2003 estimated in-river chinook salmon harvest was 110,900 for the CV. This estimate represents the highest harvest observed by the CVSSHMP for the 2000 through 2003 run years.

In 2003, staffing problems and budget cuts disrupted normal sampling. No significant in-river salmon estimates were calculated from the few data gathered in the CV.

Because of the small number of fish examined for CWT's relative to the annual harvest estimates, sample expansion factors were high generally in excess of 30 for each CWT observed. Additionally the 2001 and 2003 surveys were incompletely sampled requiring additional analysis to estimate

fishery impacts on the stock. These factors added uncertainty to the interpretation of the in river sport harvest data.

California ocean harvest and CWT recovery program

Since 1962, the Department's Ocean Salmon Project (OSP) has collected dockside catch and effort data from California sport and commercial ocean salmon fisheries. During the last several years, the fisheries have only been able to target chinook salmon due to the recent decline of both California and Oregon coastal coho (*Oncorhynchus kisutch*) stocks. The retention of coho salmon has been prohibited in California's fisheries since 1995.

For sampling purposes, the California coast is divided into five major port areas — Crescent City, Eureka, Fort Bragg, San Francisco, and Monterey. Each major port area is comprised into several "minorports" and sampling is stratified into half-month periods. In addition, depending on the southern distribution of salmon, the Monterey port area consists of several sub-major ports. In most years, Monterey consists of Morro Bay/Avila and Monterey proper sub-major ports, but occasionally sampling is expanded to include Santa Barbara and Ventura sub-major port areas.

In all fisheries, OSP samplers are required to visually check each salmon landed to identify species and to determine if its adipose fin is clipped; a clipped adipose fin denotes that a CWT was placed in the soft tissue of the salmon's snout when it was a juvenile. Each ad-clipped fish is measured to the nearest millimeter and its head cut off right behind the gill plate. A tag is then attached to it with a unique number that links it to a specific fishery, minorport, and date.

Minorports for the recreational skiff fishery are generally launch ramps or hoists where private skiffs are launched and landed. Minorports for the charterboat fishery are the docks within a port area where charterboats return to unload salmon anglers. At least one project sampler is assigned to each minorport.

When sampling the private skiff fishery, minorports in each major port area are randomly selected for both weekday and weekend/holidays strata sampling at a 20%+ level. The OSP sampler interviews all anglers on each private skiff that lands at the launch ramp during the assigned sample day. Information collected includes was the vessel fishing for salmon, number of anglers fishing for salmon, number of salmon landed, number of sublegal salmon released and the number of salmon lost to pinnipeds (salmon that were hooked but removed by a pinniped before the angler could land the fish).

In the commercial passenger fishing vessel (CPFV) fishery, each salmon CPFV trip constitutes a sample. The OSP sampler must sample at least 20 percent of all CPFV trips made in their assigned port during each sampling time and port stratum. For example, if there were 50 salmon CPFV trips made out of the Sausalito Marina during the first half of July, the sampler would have to sample at least 10 CPFVs. Sampling is spread out throughout the half month period.

In the commercial fishery, each commercial landing is a sample. The sampling goal is to sample 20 percent by weight of all salmon landed in the port area during each half month period. So if 100,000 pounds are landed in a port area, at least 20,000 pounds have to be sampled. During commercial sampling, 100 percent of the salmon unloaded by each vessel must be observed and counted by the

sampler. As the fish are unloaded, the heads from all ad-clipped CWT salmon are removed and tagged. The OSP sampler records the total number of salmon landed, the commercial vessel identification number, the dealer number, and the exact weight of each landing. The troller is then interviewed for other pertinent fishery information such as the area fished, number of days fished, number of sublegal salmon released, and number of salmon lost to marine mammals.

All ocean CWT heads are processed in the project's Santa Rosa laboratory. Project staff dissect heads using a cylinder metal detector to recover CWTs. Each CWT is then read under a microscope by two project staff (independently) to determine its respective binary code. If their "codes" disagree, a third read is conducted. The 6- and 10-digit codes are then entered into a database (data entry is conducted twice and databases compared to ensure proper data entry). Once the database is complete, it is compared to the Pacific States Marine Fisheries Commission Master CWT Release File to ensure that all codes are valid. An additional check is made for the codes of endangered or threatened species. All CWTs with these codes are read an additional time to ascertain that these CWTs are indeed from stocks of special concern. After final review, all CWTs are then merged into a database that includes all the pertinent fishery information collected in the field.

Approximately 95 percent of the CWTs recovered in California ocean salmon fisheries by OSP are from Central Valley hatcheries. The remaining five percent come from the Klamath Basin, California coastal rivers, and stocks from other states. A few wild stocks are also recovered.

Oregon, Washington, Alaska, and British Columbia all have similar fishery monitoring and CWT recovery programs on the west coast. Specific information regarding the methodology used by OSP to estimate California's ocean salmon landings can be found in Palmer-Zwahlen and Grover, 2003.

Age composition analysis

Age composition analysis produced estimates of age specific run size of the hatchery and natural spawning fish that entered the Feather River during run years 2000 through 2003. Age specific run size is used to rebuild the ocean abundance of the hatchery produced fish, to estimate the maturation rates and to use in reconstructing the ocean abundance of the naturally produced fish.

Total Feather River run size is the sum of hatchery returns, natural escapement, and sport harvest. The total run size for each year was determined and apportioned into age 2, age 3, age 4 and age 5 fish based on the age composition of sample and production expanded CWT's collected at FRH. FRH CWT data was used to represent the overall age structure of the river because the sporadic nature of the recreational harvest and age specific sample bias inherent in carcass surveys. The age composition analysis is used to estimate the naturally spawning fish by subtracting the number of CWT sample and production expanded fish from the total escapement at age.

In 2001, the Feather River sport harvest was only monitored for five months (Jan. and March-June) due to budget constraints. Approximately 700 chinook were landed by sport anglers during this period. Using the average proportion (.06) of total catch harvested during this same period in 2000 (.07) and in 2002 (.05), the total 2001 Feather River sport harvest was estimated to be 11,700 chinook.

Table 9. Feather River Fall Chinook Run Estimates and Age Composition, 2000-2003

2000	<u>Total Run</u> ^{a)}	<u>Age 2</u>	<u>Age 3</u>	<u>Age 4</u>	<u>Age 5</u>
FRH cwt age comp ^{b)}		38%	43%	18%	1%
Hatchery returns	21,234	8,069	9,131	3,822	212
Natural escapement	107,834	40,977	46,369	19,410	1,078
Feather inriver harvest	18,062	6,864	7,767	3,251	181
2001	<u>Total Run</u> ^{a)}	<u>Age 2</u>	<u>Age 3</u>	<u>Age 4</u>	<u>Age 5</u>
FRH cwt age comp ^{b)}		2%	84%	13%	1%
Hatchery returns	24,419	488	20,512	3,174	244
Natural escapement	178,702	3,574	150,110	23,231	1,787
Feather inriver harvest ^{c)}	11,700	234	9,828	1,521	117
2002	<u>Total Run</u> ^{a)}	<u>Age 2</u>	<u>Age 3</u>	<u>Age 4</u>	<u>Age 5</u>
FRH cwt age comp ^{b)}		17%	32%	50%	1%
Hatchery returns	20,507	3,486	6,562	10,254	205
Natural escapement	105,163	17,878	33,652	52,582	1,052
Feather inriver harvest	32,872	5,588	10,519	16,436	329
2003	<u>Total Run</u> ^{a)}	<u>Age 2</u>	<u>Age 3</u>	<u>Age 4</u>	<u>Age 5</u>
FRH cwt age comp ^{b)}		14%	55%	30%	1%
Hatchery returns	14,975	2,097	8,236	4,493	150
Natural escapement	88,820	12,435	48,851	26,646	888
Feather inriver harvest		no creel survey conducted in 2003			

^{a)} Run estimates from PFMC's "Review of 2003 Ocean Salmon Fisheries" and CDFG creel survey reports 2000-2003.

^{b)} Age composition based on CWTs collected at FRH and expanded for both sampling and production by cwtcode.

^{c)} Total sport harvest estimated; 2001 creel survey on Feather River conducted only 5 months (Jan. and Mar-Jun) and catch expanded based on average proportion (6%) of total catch observed during 2000 and 2002 during same period.

Size-at-age analysis

The size-at-age analysis gives an estimate of the size distribution of ocean fish for each month and age class. These distributions, in combination with a minimum size limit for legally caught fish, provide estimates of p_{legal} , which the proportion of fish of each age that are of legal size during a given month. This information is used in the cohort reconstruction to expand harvests to contacts. A contact is a fish of any size that encountered the gear and was brought to the boat.

In the past, ocean harvest models have assumed the proportion of fish of legal size to be an age-specific constant, regardless of the actual size limit, the month of the year, or the particular characteristics of a certain stock. This simplification has made it impossible, when shaping a fishery, to assess the effect of shifting its minimum size limit. Working with the actual size distribution makes it possible to use the size limit quantitatively as a management tool.

The size-at-age analysis uses FRH length data from the Ocean Recoveries CWT database, expanded for both sampling and production. Only CWTs recovered in west coast ocean fisheries (i.e., Alaska, Washington, Oregon, California and British Columbia) during 1998-2003 in which a minimum size limit of 20 total inches was in effect were used to reduce the bias associated with using a truncated

subset of the size distribution of the population. Fish below the legal size limits were rarely retained and are represented in the database by only two records.

Preliminary analyses showed the length distribution between INBF (n=2,208) and TRKF (n=49,970) releases to be almost identical; thus these data were combined for the size-at-age analysis. Since only 4 XHAF CWTs were recovered and their lengths smaller than INBF and TRKF, these data were removed.

The size-at-age analysis estimated the mean length and standard deviation in length for each month and age class separately. Since most catch, and thus CWT recoveries, in these fisheries occur between April and October each year, there were months where the sample size was nonexistent or too low to yield a valid, independent estimate of mean length. We derived estimates for low-recovery months by noting that the mean size during the winter is likely to lie between that of the previous fall and that of the following spring/summer. Thus the following adjustments were made:

Age 2

- January – April means: linearly interpolated between May Age 2 and an Age 1 August FRH salmon recovered in “No minimum size limit” fishery. Slope = 0.98.
- January – April standard deviation: taken from May Age 2.

Age 3

- December – April means: linearly interpolated between September through July. Growth rate constant. Slope = 0.84.
- December – April standard deviations: linearly interpolated between November through May.

Age 4

- October – April means: linearly interpolated between August Age 3 through July Age 4. Growth rate constant. Slope = 0.59.
- October – April standard deviations: linearly interpolated between September and May.

Age 5

- September – August means: linearly extrapolated from May Age 4 through August Age 4. Growth rate constant. Slope = 0.44
- September – August standard deviations: taken from August Age 4.

Figure 3 shows the mean length and standard deviation in length for ocean FRH recoveries of ages 2 through 5. The apparent decline in size during August and September can be understood on the level of the population rather than the individual fish. Maturing fish (fish entering the river at this time) are generally larger than fish of the same age that are not mature and remain in the ocean. Thus fish remaining in the ocean tend to be smaller members of the population, so the mean size of the fish in the ocean declines during this time.

Given the estimated population mean and standard deviation, we then used the standard formula for the cumulative normal probability distribution to calculate the proportion of fish above any specified legal threshold. Table 10 shows the proportion legal of these data at various minimum size limits.

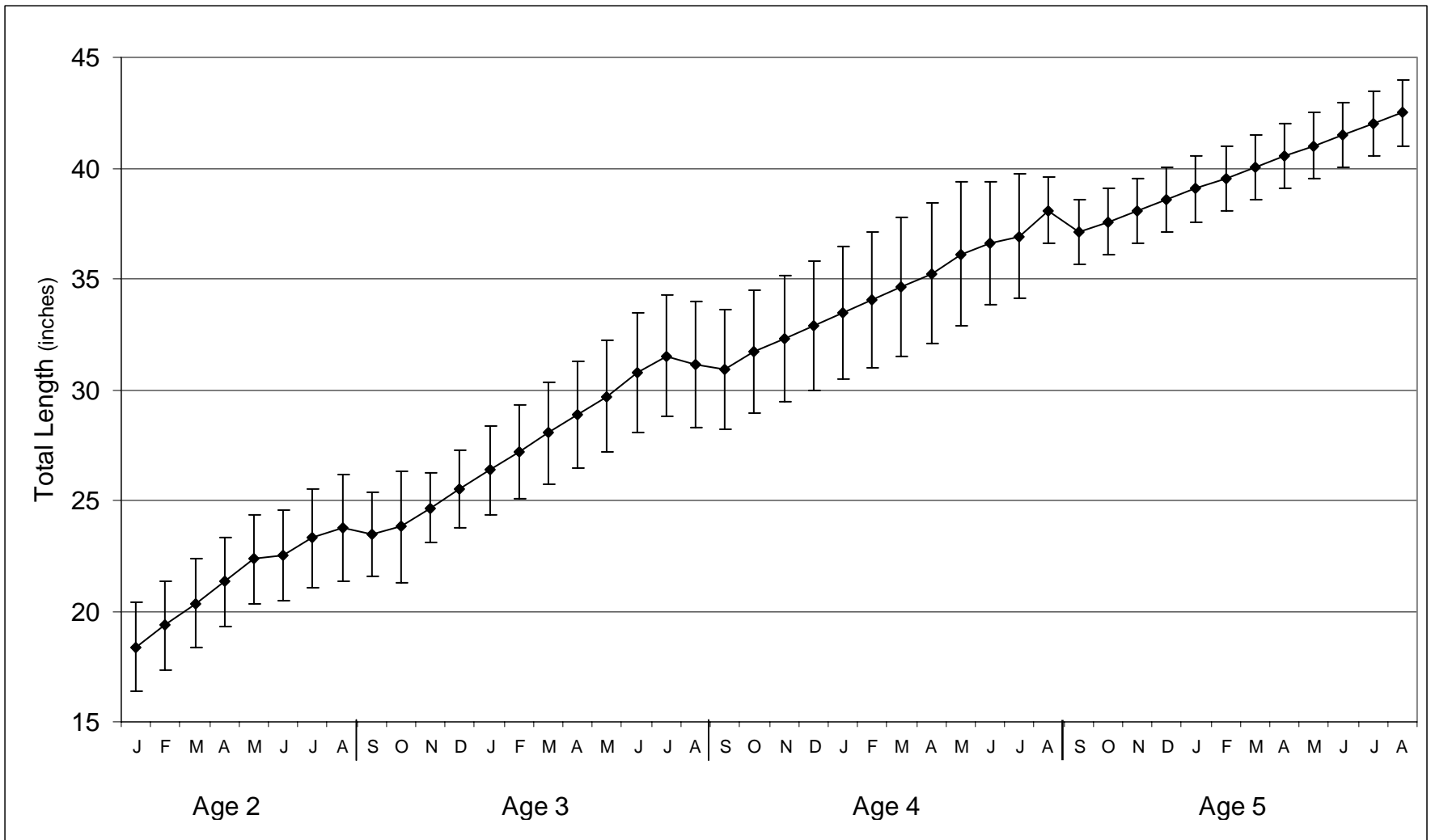


Figure 3. Mean total length and standard deviation for release types INBF and TRKF taken in 2000-2003 ocean sport fisheries with 20'' minimum by age and month, expanded for sampling and production (n=52,176).

Table 10. Mean length, standard deviation and proportion legal in ocean fisheries by minimum size limit for FRH fall chinook salmon by age and month.

Age	Month	Sample Size	Mean Length	Standard Deviation	Minimum Size Limit (inches)							
					0	20	21	22	24	26	27	28
2	Jan		18.4	2.00	1.000	0.209	0.095	0.035	0.003	0.000	0.000	0.000
2	Feb		19.4	2.00	1.000	0.375	0.206	0.094	0.010	0.000	0.000	0.000
2	Mar		20.3	2.00	1.000	0.567	0.371	0.204	0.034	0.002	0.000	0.000
2	Apr		21.3	2.00	1.000	0.745	0.563	0.367	0.090	0.010	0.002	0.000
2	May	1,167	22.3	2.00	1.000	0.879	0.749	0.568	0.204	0.034	0.010	0.002
2	June	4,027	22.5	2.02	1.000	0.894	0.774	0.601	0.232	0.042	0.013	0.003
2	July	5,737	23.3	2.19	1.000	0.933	0.851	0.721	0.372	0.108	0.045	0.016
2	Aug	4,205	23.8	2.40	1.000	0.942	0.876	0.770	0.463	0.178	0.090	0.040
2	Sept	1,362	23.5	1.90	1.000	0.965	0.902	0.778	0.386	0.090	0.031	0.008
2	Oct	691	23.8	2.55	1.000	0.932	0.864	0.760	0.469	0.194	0.105	0.050
2	Nov	285	24.7	1.58	1.000	0.998	0.990	0.955	0.665	0.200	0.070	0.017
2	Dec		25.5	1.73	1.000	0.999	0.995	0.979	0.809	0.389	0.195	0.075
3	Jan		26.4	1.98	1.000	0.999	0.997	0.986	0.883	0.570	0.372	0.203
3	Feb		27.2	2.13	1.000	1.000	0.998	0.993	0.933	0.712	0.536	0.352
3	Mar		28.0	2.28	1.000	1.000	0.999	0.996	0.961	0.814	0.675	0.505
3	Apr		28.9	2.40	1.000	1.000	0.999	0.998	0.979	0.884	0.782	0.642
3	May	3,961	29.7	2.51	1.000	1.000	1.000	0.999	0.988	0.930	0.859	0.751
3	June	6,864	30.8	2.72	1.000	1.000	1.000	0.999	0.994	0.961	0.918	0.846
3	July	13,483	31.5	2.75	1.000	1.000	1.000	1.000	0.997	0.978	0.950	0.900
3	Aug	4,382	31.1	2.86	1.000	1.000	1.000	0.999	0.994	0.963	0.925	0.862
3	Sept	912	30.9	2.71	1.000	1.000	1.000	0.999	0.995	0.965	0.925	0.858
3	Oct		31.7	2.78	1.000	1.000	1.000	1.000	0.997	0.980	0.955	0.908
3	Nov		32.3	2.85	1.000	1.000	1.000	1.000	0.998	0.986	0.968	0.934
3	Dec		32.9	2.92	1.000	1.000	1.000	1.000	0.999	0.991	0.978	0.953
4	Jan		33.5	2.99	1.000	1.000	1.000	1.000	0.999	0.994	0.985	0.966
4	Feb		34.1	3.06	1.000	1.000	1.000	1.000	0.999	0.996	0.989	0.976
4	Mar		34.7	3.13	1.000	1.000	1.000	1.000	1.000	0.997	0.993	0.983
4	Apr		35.2	3.19	1.000	1.000	1.000	1.000	1.000	0.998	0.995	0.988
4	May	999	36.1	3.25	1.000	1.000	1.000	1.000	1.000	0.999	0.997	0.994
4	June	1,495	36.6	2.79	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999
4	July	2,309	36.9	2.81	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999
4	Aug	297	38.1	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
4	Sept		37.1	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
4	Oct		37.6	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
4	Nov		38.1	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
4	Dec		38.6	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Jan		39.1	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Feb		39.6	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Mar		40.0	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Apr		40.5	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	May		41.0	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	June		41.5	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	July		42.0	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5	Aug		42.5	1.47	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Central Valley return rate and out-of-basin stray rate

Almost 6.5 million '98 brood year Feather River Hatchery fall chinook fingerlings were released between February and June 1999. Of these, 1.2 million were released within the Sacramento River basin (INBF) close to the Feather River while over 4.8 million fingerlings (TRKF) were trucked to San Francisco bay and released. An additional 400,000 hatchery fish (XHAF) were released experimentally in the Yolo bypass and San Joaquin basin.

Based on Central Valley CWT recovery data, the TRKF fingerlings trucked and released into San Francisco Bay had the highest return rate. An estimated 44,100 (0.91% TRKF releases) of these salmon returned into the Central Valley system. Almost 85% returned to the Feather River Basin and were recovered either at FRH, in the Feather River Carcass Survey or in the Feather River Sport Harvest. An additional 7% were recovered in the lower Sacramento River Sport Fishery (section of Sacramento River below Feather River mouth; cant determine if these fish would have continued into Feather River or strayed into other areas) and 8% were recovered straying into areas considered "Outside the Feather River Basin" including 1 fish recovered in an Oregon Hatchery. Straying of these fish occurred throughout the Central Valley, including the San Joaquin basin, upper Sacramento River, and American River. Although there were also several FRH salmon recovered in the Yuba River, carcass surveys and the collection of CWTs were not consistent during 2000-2003 thus these recoveries have been kept separate.

An estimated 3,750 inbasin releases (INBF) returned to the Central Valley. This represents approximately 0.31% of all INBF releases, only a third of the return rate observed with TRKF salmon. However, more of these fish (92%) did return home to their natal river. An additional 5% were picked up in the lower Sacramento River Sport Fishery while 3% were recovered outside the Feather River Basin in the upper Sacramento and American river basins. None of these releases were recovered in the Yuba River. The stray rate by age for these recoveries were used as surrogates for naturals during the cohort reconstruction due to their proximity of release site and timing.

Less than 700 (0.16%) of the extra/experimental FRH releases returned to the Central Valley during the 2000-2003. Almost half of these fish were recovered outside the Feather River Basin (Tables 1, 2). Most of these strays were taken in sport fisheries on upper Sacramento River and American River. A few were also taken at Coleman National Fish Hatchery (Battle Creek) and at Nimbus Hatchery (American River).

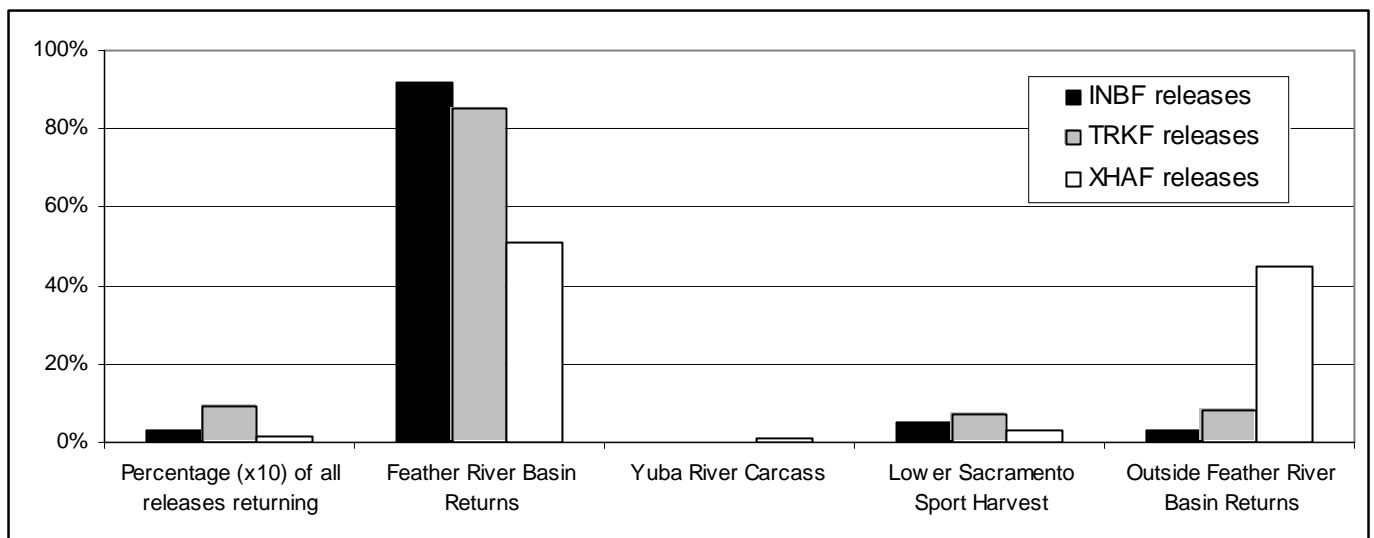


Figure 4. Return rate and percent returning by area for FRH '98 brood year releases.

FRH fall chinook hatchery contribution to ocean fisheries

An estimated 90,000 FRH '98 brood year fall chinook were harvested in the ocean fisheries during 2000-2003. Appendix 3a-3d shows the contribution of these fish to west coast salmon fisheries by age, month and major port area. The FRH '98 brood year fish first appeared by age 2 in the May 2000 sport and commercial fisheries.

FRH fingerlings trucked and released in San Francisco Bay (TRKF) had the highest contribution to both sport and commercial ocean salmon fisheries at all ages. At age 2, TRKF represented 2.4% of total sport landings during the September 1999 to August 2000 period. Inbasin fish (INBF) contributed 0.2% while XHAF fish made up 0.1% of sport landings during the same period.

Most of the FRH fishery contribution occurred as age 3. TRKF salmon represented 13.3% and 9.3% of sport and commercial salmon landings coastwide, respectively. The highest contributions to the sport fishery harvest were estimated in Monterey (25.4%), the northern Oregon port area (13.3%) and San Francisco (13.2%). The commercial contribution was also highest in these port areas: Monterey (23.1%), San Francisco (10.8%) and northern Oregon (8.1%). Contribution of INBF and XHAF salmon were much lower. Overall, age 3 INBF fish contributed 0.7% and 0.9% while XHAF landings contributed 0.1% and 0.2% to west coast sport and commercial fisheries, respectively.

At age 4, FRH releases continued to contribute to both sport and commercial fisheries, but at much reduced levels. Age 4 TRKF salmon made up only 2.1% of sport landings and 1.8% of the commercial catch. Both INBF and XHAF at age 4 contributed less than 0.1% to both fisheries.

The recovery of age 5 FRH fish occurred only in the commercial fishery and relatively few fish were taken (n=7). Almost all fish were taken in the northern Oregon port area, primarily in the fall 2002 fishery. All recoveries were TRKF except for one XHAF taken in May 2003.

Figures 5-6 show the recoveries of '98 brood year FRH fall chinook by release group, fishery and major port area. Appendix XX shows fishery contribution by individual cwtcode, release group, age, month, and major port area..

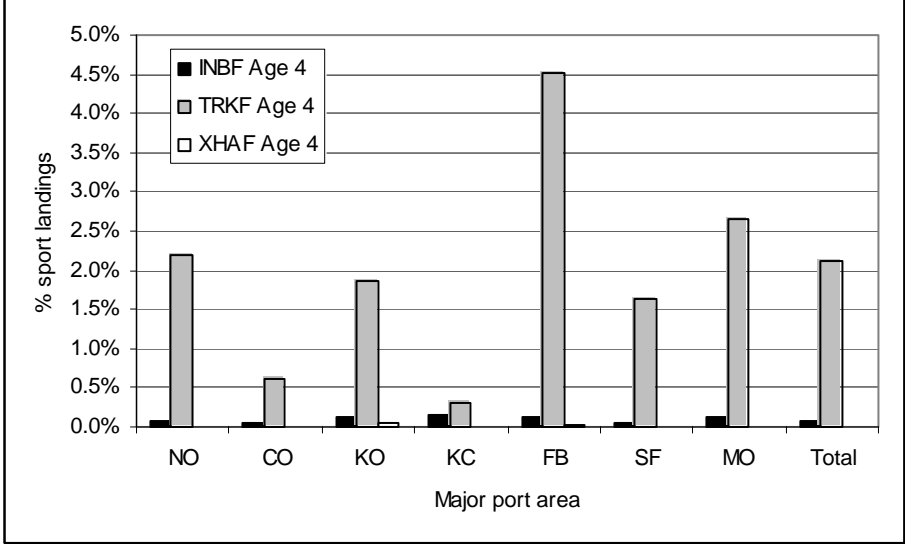
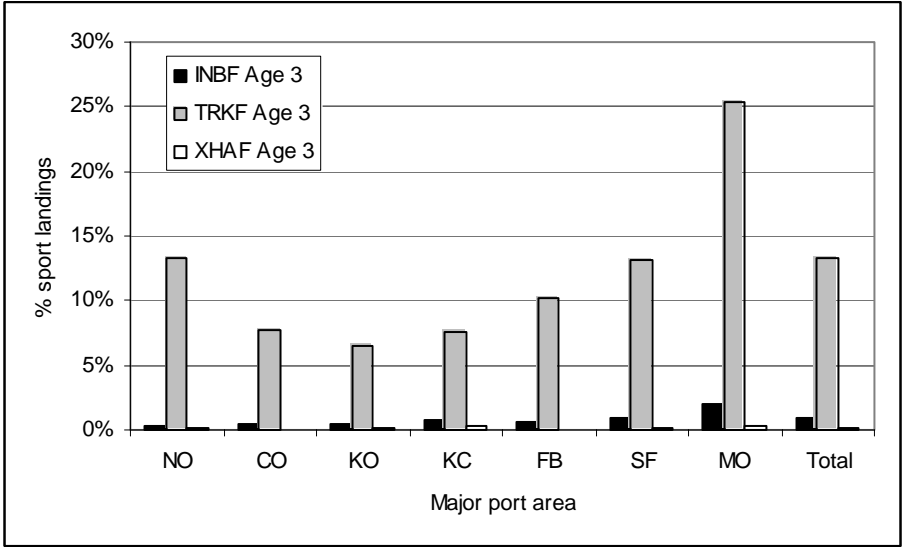
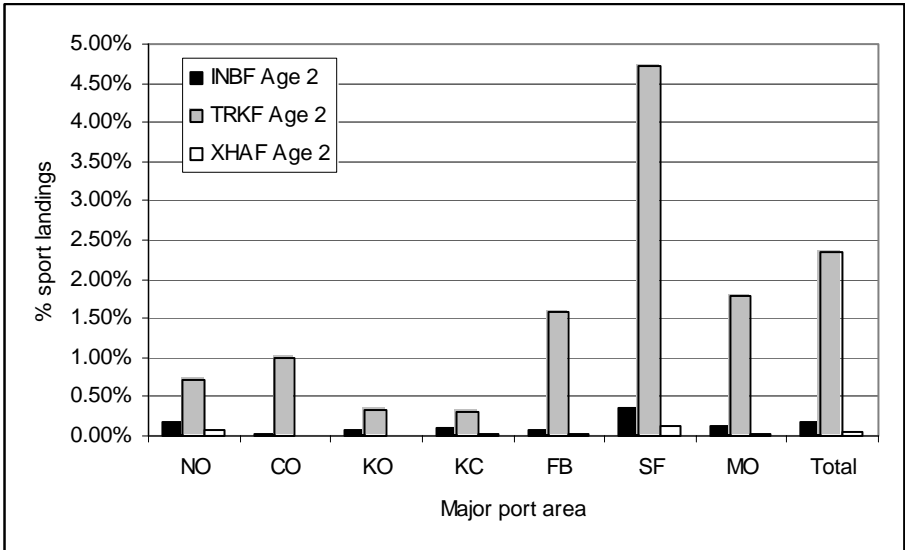


Figure 5. Contribution (% of sport landings) of '98 brood year FRH fall fingerlings to ocean salmon sport fishery by age and major port area.

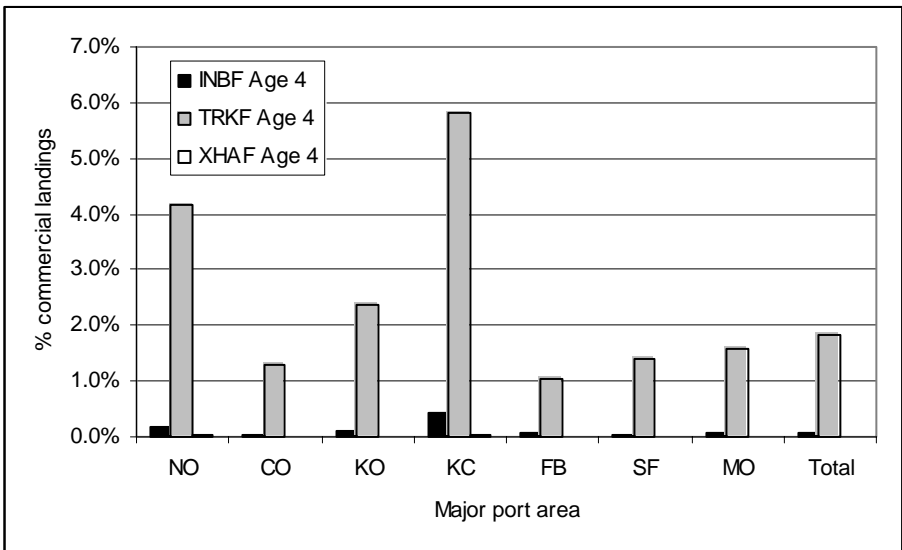
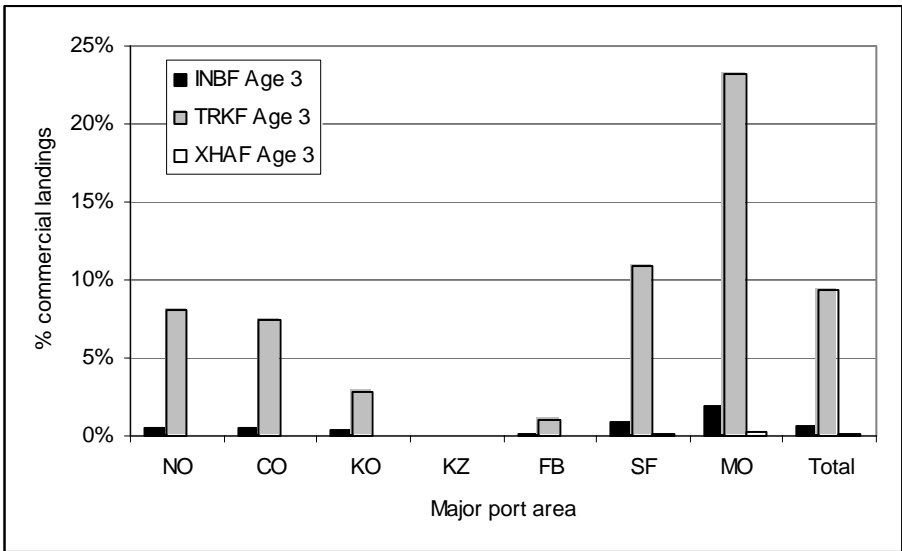
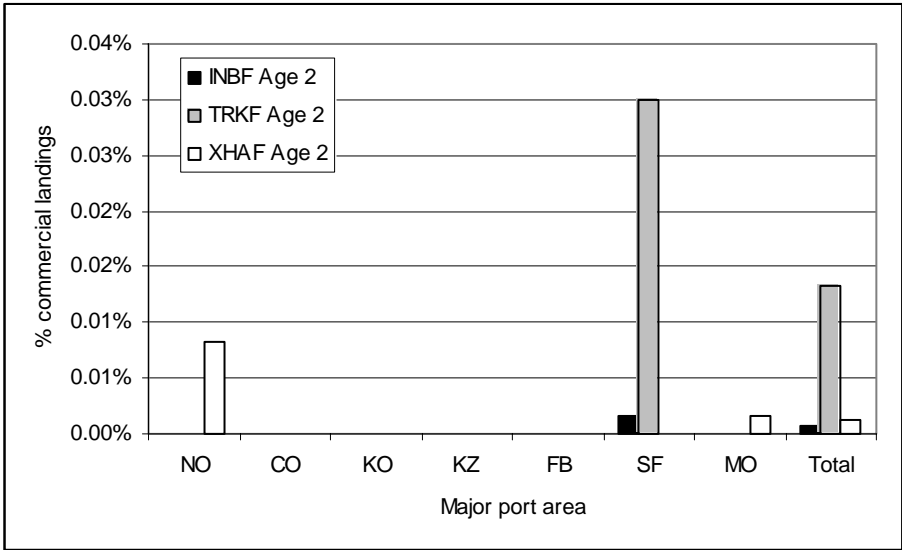


Figure 6. Contribution (% of commercial landings) of '98 brood year FRH fall fingerlings to ocean salmon commercial fishery by age and major port area.

Cohort reconstruction

The reconstruction uses catch-at-age methods similar to those of Pope (1972) and Hilborn and Walters (1992). Figure 4 shows the databases and processes that underlies the cohort reconstruction. The diagram shows that the model is not formulated in a competing risks framework, although fish are confronted simultaneously by, for instance, the possibilities of being eaten and being harvested. Instead, this model presents the risks sequentially, with fisheries first, followed by natural mortality, and then, the possibility of maturation. Because the monthly time steps are relatively short and the monthly rates low, the actual difference between the results of this formulation and those from a competing risks one are likely to be minor.

The cohort reconstruction uses a series of Microsoft Visual Foxpro databases and programs for manipulating these data. This system makes it easy to error check the many repeated calculations, to modify the formulas and to update the reconstructions as new data become available. Hard-coded parameters in the programs have been avoided where possible. Although, we focused only on reconstructing the 1998 brood year, the databases and programs are set up to reconstruct all brood years where data are available. The programs read the release and recovery data from the Pacific States Marine Fisheries Commission (PSMFC) server and reconstructs the cohorts in a single pass of the data.

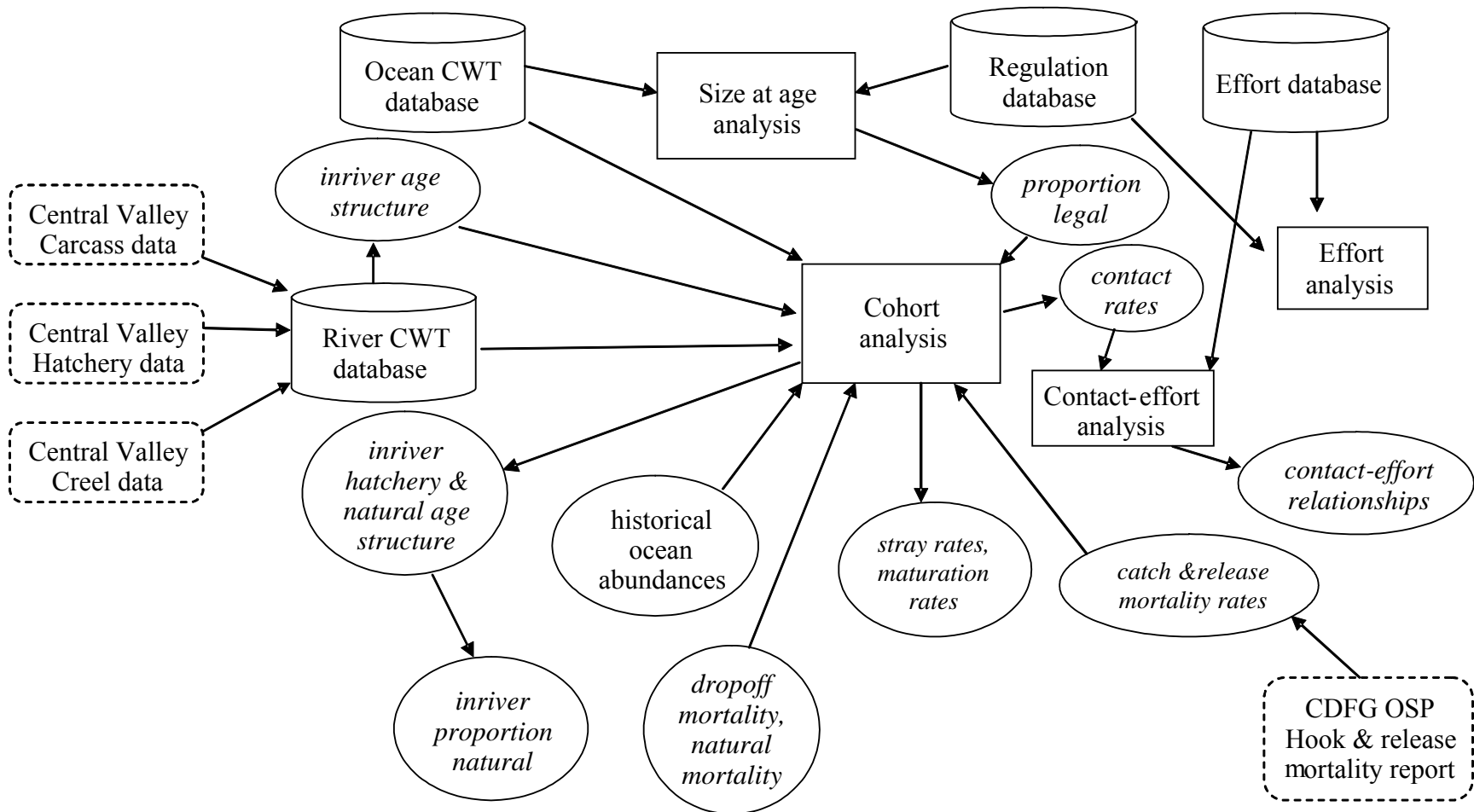


Figure 7. Overview of the databases and complex processes involved in the FRH fall chinook cohort reconstruction.

Elements of the analysis

The cohort reconstruction includes all 1998 brood year Feather River fish ages 2 through 5. For hatchery fish, each release type is treated separately (the release code-specific production factors having already been applied), and natural fish are treated separately. We generally follow Prager and Mohr (2001) in denoting rates with lower case letters and counts with upper case letters; ocean quantities with subscripted “O” and river quantities with “R”; and, among other variables, in our choice of C, H, and I to indicate contacts, harvest, and impacts respectively. Particular months are specified with an additional subscript.

The fundamental variables of the analysis are:

N_O = The number of fish in the ocean at the beginning of each month;

C_O = The number of fish contacted by fisheries in the ocean during the month;

I_O = The number of fish killed in the ocean during the month by harvest, hook-and-release mortality, and dropoff mortality;

M = The number of fish that mature and leave the ocean, whether to the Feather or as strays to other river basins;

N_R = The number of mature fish that enter the Feather River Basin;

C_R = The number of fish contacted in the Feather River Basin;

I_R = The number of fish killed in the river by harvest or dropoff mortality;

E = The number of fish that survive to spawn;

E_n = The number of fish that spawn in natural areas.

For modeling purposes, all maturing fish enter the river simultaneously at the end of August.

The parameters may be divided into those that are determined externally and those that are estimated by the cohort reconstruction. The parameters that are determined externally include:

s_O = Ocean hook-and-release (“shaker”) mortality rates (s_O), which are fishery-, time-, and area-specific. The rates used are the current rates adopted by the PFMC (STT 2000). Sport fishery recoveries in the SOC (south of Pt Arena in California) are further refined by year, major port area, and month based on the estimated relative proportion of anglers mooching and trolling during those fisheries;

d_O = The ocean dropoff mortality rate (d_O), which, according to policy that has been adopted by the PFMC (STT 2000), is 5% and is applied to the estimated contacts;

v_O = The ocean natural mortality rate (v_O), is applied as a monthly rather than an annual rate. For age 2 fish the monthly natural mortality rate is 0.0561257 (corresponding to 50% annually),

and for older fish it is 0.0184235 (corresponding to 20% annually). The annual rates are from KRTT (1986).

d_R = The river dropoff mortality rate (d_R) is 2.04% for the river sport fisheries, and is applied to the estimated harvest (KRTT 1986).

River hook-and-release mortality rates are not used at this time because all hooked fish are assumed to be harvested due to no minimum size limit for chinook salmon in the Feather River sport fishery; however this assumption is not entirely correct since there are periods when the retention of chinook salmon is prohibited and must be released. There are no data available to estimate the contact rate in these non retention fisheries. The analysis would thus be more accurate with hook and release mortality included, especially because hooking mortality studies (both freshwater and ocean) have found some evidence that a higher hooking mortality rate may apply to larger fish (STT 2000).

Depredation by sea lions is included in the ocean dropoff mortality; no attempt has been made to incorporate recent work that estimates the actual rate of loss.

The parameters that are estimated by the cohort reconstruction include:

c_O = Ocean contact rates (c_O), which are calculated as C_O / N_O , where C_O is the number of contacts in the month. Both C_O and N_O are specific to year, release type, age, and month. The numerator, and consequently the contact rate, is also management area- and fishery-specific;

h_O = Ocean harvest rates (h_O), which are calculated as H_O / N_O , where H_O is the number of fish harvested during the month. Both H_O and N_O are specific to year, release type, age, and month. The numerator, and consequently the harvest rate, is also Fishery management area- and fishery-specific;

i_O = Ocean impact rates (i_O), which are calculated as $(H_O + S_O + D_O) / N_O$, where S_O is hook-and-release mortality and D_O is dropoff mortality. The quantities are specific to the year, release type, age, and month. The numerator, and consequently the impact rate, is also Fishery management area- and fishery-specific;

m = Maturation rate (m), which is calculated as $M / (M + N_{O,sep})$, and is year-, release type-, and age-specific;

q = The straying rate (q), which is calculated as Q / M , where Q is the number of fish that mature and enter rivers other than the Feather River; it is year-, release type-, and age-specific;

h_R = Feather River fall chinook harvest rates (h_R), which are calculated as H_R / N_R , where H_R and N_R are specific to the year, release type, and age. The numerator, and consequently the harvest rate, is also fishery-specific.

Figure 5 shows the sequence of events that underlies the cohort reconstruction.

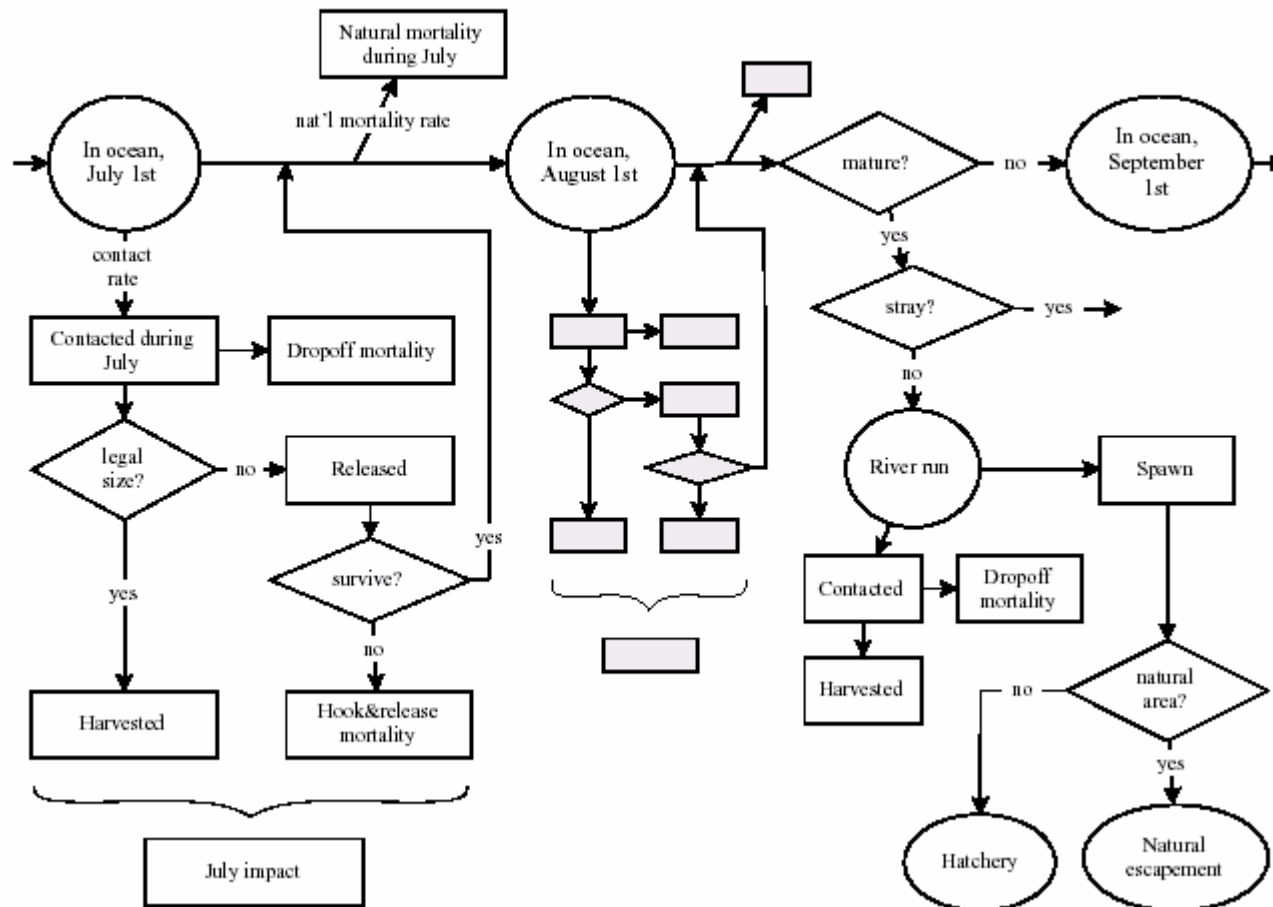


Figure 8. The sequence of events that underlies the cohort reconstruction; two monthly time-steps are shown. Along the top are the ocean populations and the natural mortality that subtracts from them. Sequences to the left are the fish that are contacted by ocean fisheries, and indicates the age- and fishery-specific factors that determine whether they survive the contact. Dropoff mortalities are additional mortalities calculated as a proportion of contacts. In the right region are August-specific factors that involve maturation of fish and their return to the Central Valley Basin at the end of August. Strays include FRH fall chinook CWTs collected at other Central Valley hatcheries and in carcass and creel surveys outside the Feather River.

The calculation sequence for hatchery fish

The cohort reconstruction of hatchery fish proceeds backwards through time, from the last appearance of any member of a cohort (usually at age 5) to the initial appearance in the ocean fisheries at age 2. To the estimated abundance of fish in the ocean at a given time, each monthly step backwards adds estimated numbers of (1) fish lost to ocean fishery impacts; (2) fish lost to natural mortality; and (3) between August and September, fish that mature and enter the river.

The following calculations are specific to a release type of hatchery fish, as well as to a given month, year, and age; some quantities are also specific to port of landing. The oceanwide abundance at the beginning of month t is estimated as follows:

$$N_{o,t} = I_{o,t} + \frac{M + N_{o,t+1}}{1 - v_o}, \quad (5)$$

where $M = N_R + Q$ is nonzero only for $t = \text{August}$. The impacts of ocean fisheries include all sources of gear-related mortality, including harvest, shaker mortality, and dropoff mortality. Harvest and shaker mortality estimates are a function of estimated contacts and plegal. Of the ocean contacts, all legal-sized fish die as harvest. Most fish smaller than the minimum legal size limit are released, but a proportion of the released fish also die because of hooking injuries. This hook-and-release mortality depends on the fishing method and gear used (STT 2000). Other fish, regardless of size, encounter the gear and escape before being landed, but die because of wounds received or because of depredation. Dropoff mortality is calculated as 5% of total contacts (STT 2000). These fish are not part of the estimated total contacts as represented in the formulas, although some kind of contact is clearly involved; this use of words leaves room for confusion, but the problem is terminological rather than conceptual. Ocean impacts are then estimated by adding these three sources of mortality:

$$\begin{aligned} I_o &= H_o + S_o + D_o \\ &= H_o + s_o \cdot (C_o - H_o) + d_o \cdot C_o. \end{aligned} \quad (6)$$

The ocean contacts are calculated by expanding the legal-sized portion of the ocean harvest, $H_{o,legal}$, by the proportion legal, p_{legal} , for that release type-, month-, and fishery-specific minimum size limit in effect:

$$C_o = \frac{H_{o,legal}}{p_{legal}}. \quad (7)$$

The difference between contacts and harvest, $(C_o - H_o)$, equals the difference between the sublegal portions of the contacts and harvest, $(C_{o,sublegal} - H_{o,sublegal})$, because every legal-sized fish is assumed to have been retained. This difference then represents the hook-and-release mortality on

sublegal fish that were released; the 100% impact rate on harvested sublegals is already included in H_o . This difference is taken to be zero in the few cases for which it would otherwise be negative.

In these few cases (when analyzed by year, month, major port, fishery, age, brood year, and release group), the number of actual sublegal recoveries exceeded the estimate of sublegal contacts as calculated with the above expansion using formula 7. These cases were probably due to small sample size, and involved only 6 fish in the older age classes, for which only a very small fraction of the estimated size distribution was below the legal limit. We resolved the discrepancies by adding the excess sublegal recoveries to the estimates of the sublegal contacts and total contacts.

To estimate ocean harvest of hatchery fish, each Feather River fall run chinook CWT recovery is expanded for sampling, production, and CWTs that were not decoded successfully (successful decoding requires that two independent readers note the same code, and that it appear in the listing of codes issued by the tag code coordinator of each state):

$$H_o = \sum_{\substack{\text{fall chinook} \\ \text{CWT recoveries}}} \left(\frac{1}{P_{\text{sampled}} \cdot P_{\text{tagged}} \cdot P_{\text{processed}} \cdot P_{\text{decoded}}} \right) \quad (8)$$

where $p_{\text{sampled}} = n_{\text{sampled}} / \hat{L}$ is the proportion of the catch sampled at the dock, and p_{tagged} is the proportion of the hatchery release group that is tagged. The quantity p_{tagged} is supplied by the hatcheries, and is specific to each release group; fish that shed tags usually do so before they are released from the hatchery. The expansion factors for hatchery production accounts for cases where sampling collects heads without tags. The factors $p_{\text{processed}}$ and p_{decoded} account for losses of CWTs between sampling at the dock and successful reading of the code, as described below.

The adjustment for cases in which the head was taken in the sample but not processed; and those in which the extracted tag was not successfully decoded (because the tag was lost during processing, because it was unreadable, or because there were unresolved discrepancies among its readings). The following quantities demarcate the relevant steps:

$$\begin{aligned} n_{\text{heads}} &= \text{number of heads taken in sample;} \\ n_{\text{processed}} &= \text{number of heads processed;} \\ n_{\text{extracted}} &= \text{number of CWTs extracted;} \\ n_{\text{decoded}} &= \text{number of CWTs that were successfully decoded.} \end{aligned} \quad (9)$$

The factor $p_{processed}$ accounts for fish that were taken at the dock but not processed:

$$p_{processed} = \frac{n_{processed}}{n_{heads}} \quad (10)$$

Fish that were not processed included some fish that would have been found to lack CWTs had they been processed. Among the heads that were processed, the tags that were extracted but not read successfully are taken into account with $p_{decoded}$, the proportion of extracted CWTs that were successfully decoded:

$$p_{decoded} = \frac{n_{decoded}}{n_{extracted}} \quad (11)$$

Assignments to release groups cannot be made for problematic CWTs, so these factors lump release groups while remaining specific to a port, month, year and fishery. Equation 8 then shows how these four factors combine in the calculation of the ocean harvest of hatchery fish, and Equation 6 shows how the harvest is incorporated in the calculation of total fishery impact.

Figure 6 shows how the cohort reconstruction brings together the quantities N_O , N_R , M , and I_O in reconstructing a single month in the history of a cohort.

The calculations for natural fish

The cohort reconstruction of natural fish also proceeds backwards through time, from the last appearance of any member of the cohort to the initial appearance in the ocean fisheries or river escapement at age 2. Because there is no production CWT data for Feather River naturals the FRH ocean impact rates are assumed. Using the age 5 natural escapement estimate and applying the natural mortality rate and ocean fishery impact rate, the ocean abundance at the start of August can be calculated. To the estimated abundance of natural fish in the ocean at a given month, each monthly time step backwards adds estimated numbers of (1) natural fish lost to ocean fishery impacts; (2) natural fish lost to natural mortality; and (3) between August and September, natural fish that mature and enter the rivers. Determining these numbers is complicated by possible differences between the hatchery and natural components. Since ocean impact, maturation, and straying rates of the natural component are not known, they must be extrapolated from the hatchery component of Feather River fall chinook.

After examining the recovery of 1998 brood year FRH CWTs within the Central Valley and by ocean fisheries, it seemed reasonable to use only FRH CWTs released within the Sacramento Basin (release group INBF) as a surrogate for the naturals since this group is released closest to the Feather River and appear to emigrate downstream at a similar time and size. Naturals and had the lowest straying rates.

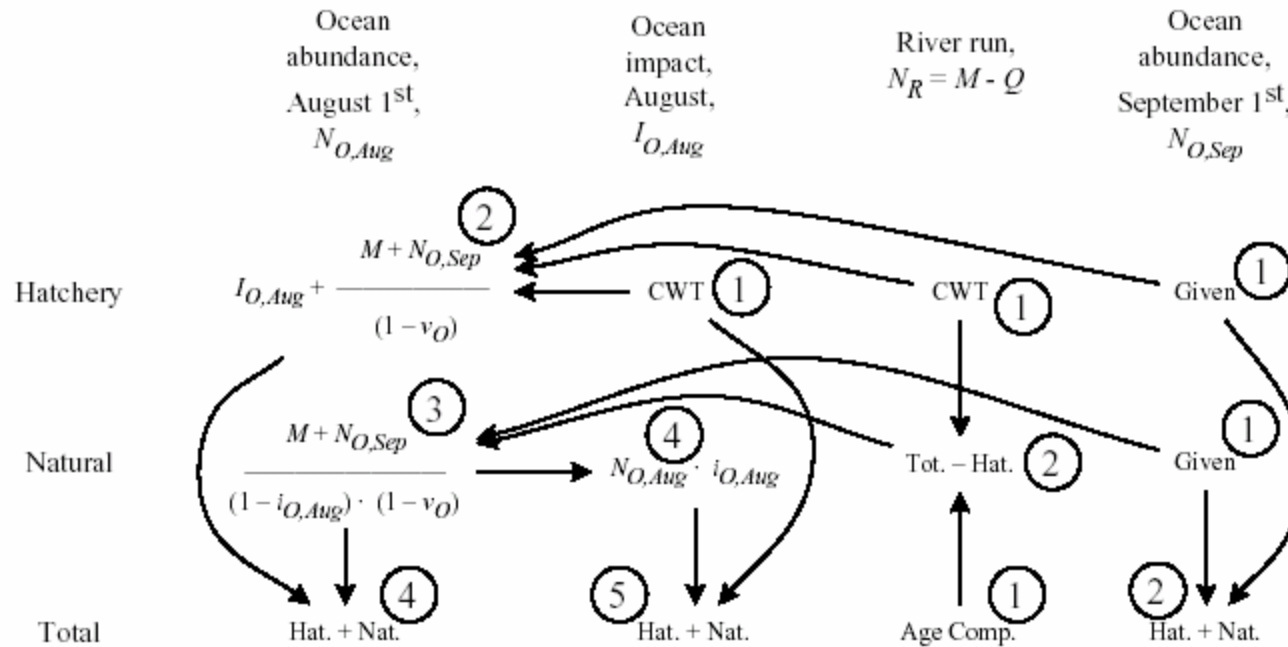


Figure 9. The sequence of calculations for one month of the cohort reconstruction (time advances left to right). The calculations iterate backwards in the order indicated by the numbers in circles; quantities with higher numbers are calculated after those with lower numbers. The span from August 1st to September 1st is shown; other months are simpler because of the absence of the river run ($N_R=M=0$). Fishery impacts occur between the columns for $N_{O,Aug}$ and $I_{O,Aug}$; natural mortality, maturation, and straying occur between the columns for $I_{O,Aug}$ and N_R . For the last appearance of a cohort, the “Given” value at the beginning of the following month is taken to be zero; for all other months the value is the result from the previous step. In the reconstruction, each hatchery release type has its own row and calculations are performed separately. CWT=number of CWT hatchery fish recovered, expanded for sampling and production; Age comp. = number of fish by age entering the Feather River as estimated by age composition analysis; v_O = natural mortality rate; $i_{O,Aug}$ = ocean fishery impact rate calculated for INBF releases and applied to naturals.

Figure 9 shows how, given an estimate of the impact and straying rates of hatchery fish, estimates of the size of the hatchery component of the inriver run, and the estimate of the total inriver run (which comes from the age composition analysis), it is possible to derive estimates of the abundance of the natural component of the ocean population and the fishery impact on that component. In particular,

$$N_{o,t} = \frac{M + N_{o,t+1}}{(1 - i_{o,t}) \cdot (1 - v_o)} \quad (13)$$

and

$$I_{o,t} = N_{o,t} \cdot i_{o,t}, \quad (14)$$

where $i_{o,t}$ is the impact rate estimated from hatchery fish and applied to the natural fish, and M is calculated as follows. For hatchery fish, $N_R = M - Q$, which can be rewritten $N_R = M \cdot (1 - q)$, and which gives the estimate of the straying rate $q = 1 - (N_R / M)$. This straying rate is then used to calculate the number of maturing natural fish, $M = N_R / (1 - q)$, which is then added to the ocean abundance at the beginning of September in the calculation of ocean abundance at the beginning of August. Once the estimates for the natural component are known, the totals for all components of the cohort can be calculated by summation.

Table 11. Cohort reconstruction of 1998 brood year Feather River Hatchery fall chinook (Age 2 – 5)

Run year	Age	Month	<u>Hatchery Fish</u>				<u>Natural Fish</u>				Outside		
			Ocean impacts	Feather R returns	Outside Basin	Hatchery population	Ocean impacts	Feather R returns	Outside basin	Natural Population	Total Population	Maturity rate	Basin strayrate
2000	2	Jan				454,862				1,199,279	1,654,141		
2000	2	Feb				429,333				1,131,969	1,561,302		
2000	2	Mar				405,236				1,068,436	1,473,672		
2000	2	Apr				382,492				1,008,469	1,390,961		
2000	2	May	19			361,024	432			951,868	1,312,893		
2000	2	Jun	1,784			340,744	5,879			898,036	1,238,780		
2000	2	Jul	2,078			319,935	3,565			842,085	1,162,020		
2000	2	Aug	1,606			300,018	3,420			791,457	1,091,474		
2000	3	Sep	656	4,277	186	277,200	691	51,632	6,724	685,451	962,651	0.06	0.11
2000	3	Oct	775			261,023	3,444			646,328	907,351		
2000	3	Nov	340			245,642	2,171			606,801	852,443		
2000	3	Dec	57			231,534				570,695	802,229		
2001	3	Jan				218,486				538,664	757,150		
2001	3	Feb				206,223				508,431	714,654		
2001	3	Mar	403			194,649	1,527			479,895	674,544		
2001	3	Apr	6,350			183,343	16,189			451,519	634,863		
2001	3	May	25,016			167,060	59,714			410,897	577,957		
2001	3	Jun	8,456			139,427	20,777			344,713	484,140		
2001	3	Jul	20,557			128,558	42,928			317,969	446,527		
2001	3	Aug	10,279			106,012	13,349			269,974	375,985		
2001	4	Sep	4,242	36,967	6,552	50,450	7,495	143,483	7,491	100,922	151,372	0.56	0.07
2001	4	Oct	946			45,357	1,805			91,707	137,063		
2001	4	Nov	78			43,593				88,246	131,839		
2001	4	Dec				42,713				86,620	129,333		
2002	4	Jan				41,926				85,024	126,950		
2002	4	Feb				41,154				83,458	124,611		
2002	4	Mar	203			40,396	88			81,920	122,316		
2002	4	Apr	1,179			39,452	2,793			80,324	119,776		
2002	4	May	3,177			37,568	4,057			76,103	113,671		
2002	4	Jun	3,572			33,758	5,415			70,719	104,477		
2002	4	Jul	2,859			29,629	3,038			64,101	93,731		
2002	4	Aug	968			26,277	1,808			59,938	86,215		
2002	5	Sep	71	23,917	623	303		55,649	140	1,270	1,573	0.98	0.01
2002	5	Oct	50			228				1,247	1,474		
2002	5	Nov				174				1,224	1,397		
2002	5	Dec				171				1,201	1,372		
2003	5	Jan				167				1,179	1,346		
2003	5	Feb				164				1,157	1,322		
2003	5	Mar				161				1,136	1,297		
2003	5	Apr				158				1,115	1,273		
2003	5	May	3			155				1,094	1,250		
2003	5	Jun				150				1,074	1,224		
2003	5	Jul				147				1,055	1,202		
2003	5	Aug	17			144				1,035	1,179		
2003	5	Sep		22	103			1,016				1.00	0.09

Conclusion and recommendations

The cohort reconstruction of the FRH 1998 brood year fall run chinook has helped identify the following problems and recommendations:

- Identification of the data gaps in the Central Valley CWT recovery program. Since CWTs are not being collected in many areas, the return and stray rates of FRH fall chinook are most likely being underestimated and thus, the entire population is reduced throughout the cohort reconstruction. A consistent inland CWT recovery program is needed throughout the Central Valley to estimate total returns by cwt groups.
- Age composition analysis methodology was accomplished in the absence of scale age verification; however significant data gaps in the CV CWT recovery program also required the use of only Feather River Hatchery CWTs to determine the age structure of all hatchery salmon recovered in the Feather River Basin (i.e, carcass surveys and sport harvest). Scale-age verification is important to determine the age structure of Feather River fall chinook run spawning in natural areas.
- The simple statistics used in our size-at-age analysis may overestimate the actual mean and underestimate the standard deviation of the whole population. It is recommended that future analysis is conducted to determine p_{legal} based on maximum likelihood methodology.
- Hatchery stray rates are estimated by release types (and individual cwtcodes) showing relative percent of releases returning to the Central Valley and the proportion straying outside the Feather River Basin. These data, along with ocean fisheries contribution rates, may be used in the future to determine which release strategies work best to meet certain goals and requirements.
- Future analyses should include comparisons between population parameters of the FRH '98 brood year fall chinook cohort reconstruction with the CNFH '98 brood year fall chinook and the FRH '99 brood year fall chinook.
- FRH should tag with CWTs a representative proportion of all production designed to contribute to the ocean and spawning populations.
- Develop ocean harvest model for FRH fall chinook based on the inputs and outputs provided by the cohort reconstruction. The databases and analyses described in this paper provide the biological foundation for a future harvest model; however several years of complete ocean and inland CWT data are needed for this to occur.

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Appendix 1. 1996-2001 FRH Fall Chinook CWT Releases by Release Group and Location

Brood Year	<u>INBF</u>		<u>TRKF</u>		<u>XHAF</u>	
	Tagged	Untagged	Tagged	Untagged	Tagged	Untagged
1996	10	1	6	22	6	
1997	12	3	9		10	
1998	18	5	10	50	16	
1999	17	4	5	63	12	
2000	24		10	27	12	
2001	15		7	45	18	
Total	96	13	47	207	74	

Total	437
Tagged	217
Untagged	220

Release Group

- INBF In Sacramento River Basin Releases -Fingerlings
- TRKF Transported to SF Bay Releases -Fingerlings
- XHAF Experimental San Joaquin Basin & Yolo Releases -Fingerlings

Appendix 1a. 1996 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
1996	INBF	0601060211	19970415	19970415	Miller Park	G	25,642	1,123	0	1.04	249,401	10.77	0.249	
1996	INBF	0601060212	19970415	19970415	Miller Park	G	25,032	1,097	0	1.04	243,468	10.77	0.243	
1996	INBF	0601060213	19970415	19970415	Miller Park	V	25,829	1,048	0	1.04	251,220	10.77	0.251	
1996	INBF	0601060214	19970415	19970415	Miller Park	V	26,315	1,068	0	1.04	255,947	10.77	0.256	
							102,818	4,336		1.04	1,000,037	10.77	1.000	
1996	INBF	Untagged	19970315	19970315	Feather River	G		1,000,037						
1996	INBF	062541	19970424	19970424	Feather River	V	52,669	911	0		0	1.02		
1996	INBF	062542	19970424	19970424	Feather River	V	52,597	909	0		0	1.02		
1996	INBF	062543	19970424	19970424	Feather River	V	50,756	3,217	0		0	1.06		
1996	INBF	062544	19970424	19970424	Feather River	V	48,562	3,077	0		0	1.06		
1996	INBF	0601060209	19970515	19970515	Miller Park	V	25,152	1,296	0		0	1.05		
1996	INBF	0601060210	19970515	19970515	Miller Park	V	25,069	1,291	0		0	1.05		
							254,805	10,701						
1996	TRKF	0601060215	19970505	19970505	Port Chicago	V	24,766	3,764	0	1.15	58,514	3.51	0.510	
1996	TRKF	0601060301	19970505	19970505	Port Chicago	V	23,772	3,613	0	1.15	56,166	3.51	0.490	
							48,538	7,377		1.15	114,680	3.51	1.000	
1996	TRKF	Untagged	19970505	19970505	Benecia	V		25,200						
1996	TRKF	Untagged	19971515	19971515	Wickland Oil Net Pens	V		36,830						
1996	TRKF	Untagged	19971515	19971515	Tiburon Net Pens	V		52,650						
								114,680						
1996	TRKF	0601060312	19970609	19970609	San Francisco Maj.pt	V	52,408	530	0	1.01	869,216	17.60	0.250	
1996	TRKF	0601060313	19970609	19970609	San Francisco Maj.pt	V	51,042	516	0	1.01	846,560	17.60	0.243	
1996	TRKF	0601060314	19970609	19970609	San Francisco Maj.pt	V	54,728	553	0	1.01	907,694	17.60	0.261	
1996	TRKF	0601060315	19970609	19970609	San Francisco Maj.pt	V	51,824	523	0	1.01	859,530	17.60	0.247	
							210,002	2,122		1.01	3,483,000	17.60	1.000	
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		131,100						
1996	TRKF	Untagged	19970609	19970609	San Francisco Maj. Pt. Area	V		93,800						
1996	TRKF	Untagged	19970609	19970609	San Francisco Maj. Pt. Area	V		62,100						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		222,400						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		168,200						
1996	TRKF	Untagged	19970609	19970609	Benecia	V		66,700						
1996	TRKF	Untagged	19970609	19970609	Benecia	V		80,500						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		55,000						
1996	TRKF	Untagged	19970609	19970609	Benecia	V		105,300						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		210,600						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		239,200						
1996	TRKF	Untagged	19970609	19970609	Benecia	V		177,100						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		67,500						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		542,800						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		487,600						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		121,900						
1996	TRKF	Untagged	19970609	19970609	San Francisco Maj. Pt. Area	V		135,700						
1996	TRKF	Untagged	19970609	19970609	Benecia	V		121,900						
1996	TRKF	Untagged	19970609	19970609	Wickland Oil Net Pens	V		393,600						
								3,483,000						
1996	XHAF	0601060302	19970428	19970428	Stewart Road	V	23,701	3,083	0		0	1.13		
1996	XHAF	0601060303	19970428	19970428	Stewart Road	V	25,073	3,261	0		0	1.13		
1996	XHAF	0601060304	19970429	19970429	Dos Reis Road	V	25,084	1,975	0		0	1.08		
1996	XHAF	0601060305	19970429	19970429	Dos Reis Road	V	24,746	1,949	0		0	1.08		
1996	XHAF	0601060207	19970502	19970502	Jersey Pt.,san Joaq,r	V	24,812	2,453	0		0	1.10		
1996	XHAF	0601060208	19970502	19970502	Jersey Pt.,san Joaq,r	V	25,049	2,477	0		0	1.10		
							148,465	15,198				1.10		

Appendix 1b. 1997 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
1997	INBF	0601060410	19980302	19980302	Fremont Weir	G	25,835	1,690	0	1.07	74,652	3.96	0.248	POSSIBLY IHN INFECTED
1997	INBF	0601060411	19980302	19980302	Fremont Weir	G	25,708	1,682	0	1.07	74,285	3.96	0.247	POSSIBLY IHN INFECTED
1997	INBF	0601060412	19980302	19980302	Elkhorn Boat Ramp	G	25,701	636	0	1.02	74,265	3.91	0.246	POSSIBLY IHN INFECTED
1997	INBF	0601060413	19980302	19980302	Elkhorn Boat Ramp	G	27,027	669	0	1.02	78,097	3.91	0.259	POSSIBLY IHN INFECTED
							104,271	4,677		1.04	301,300	3.93	1.000	
1997	INBF	Untagged	19980301	19980301	Feather River	G		100,800						
1997	INBF	Untagged	19980307	19980307	Feather River	G		100,000						
1997	INBF	Untagged	19980315	19980315	Feather River	G		100,500						
								301,300						
1997	INBF	0601060507	19980415	19980415	West Sacramento	G	21,380	131	0		0	1.01		POSSIBLY IHN INFECTED
1997	INBF	0601060508	19980415	19980415	West Sacramento	G	21,556	133	0		0	1.01		POSSIBLY IHN INFECTED
1997	INBF	0601060513	19980430	19980430	Verona	G	37,791	1,169	0		0	1.03		IHN INFECTED
1997	INBF	0601060514	19980430	19980430	Verona	G	38,116	1,179	0		0	1.03		IHN INFECTED
1997	INBF	0601060614	19980430	19980430	Gridley	G	42,987	538	0		0	1.01		IHN INFECTED
1997	INBF	0601060615	19980430	19980430	Gridley	G	40,687	538	0		0	1.01		IHN INFECTED
1997	INBF	0601060509	19980515	19980515	West Sacramento	V	17,830	110	0		0	1.01		IHN INFECTED
1997	INBF	0601060510	19980515	19980515	West Sacramento	V	16,498	102	0		0	1.01		IHN INFECTED
							236,845	3,900						
1997	TRKF	0601060607	19980504	19980623	Wickland Oil Net Pens	V	17,989	578,060	403	33.16	575,806	33.03	0.142	IHN INFECTED
1997	TRKF	0601060608	19980504	19980623	Wickland Oil Net Pens	V	19,139	578,060	429	31.23	612,616	33.03	0.151	IHN INFECTED
1997	TRKF	0601060609	19980504	19980623	Wickland Oil Net Pens	V	17,525	578,060	393	34.01	560,954	33.03	0.139	IHN INFECTED
1997	TRKF	0601060610	19980504	19980623	Wickland Oil Net Pens	V	17,836	578,060	400	33.43	570,908	33.03	0.141	IHN INFECTED
1997	TRKF	0601060611	19980504	19980623	Wickland Oil Net Pens	V	18,027	578,060	404	33.09	577,022	33.03	0.143	IHN INFECTED
1997	TRKF	0601060612	19980504	19980623	Wickland Oil Net Pens	V	18,123	578,060	407	32.92	580,095	33.03	0.143	IHN INFECTED
1997	TRKF	0601060613	19980504	19980623	Wickland Oil Net Pens	V	17,777	578,060	399	33.54	569,020	33.03	0.141	IHN INFECTED
							126,416	4,046,420	2,835	33.03	4,046,420	33.03	1.000	
1997	TRKF	0601060501	19980507	19980507	Benicia	G	15,275	156	0		0	1.01	0.500	IHN INFECTED
1997	TRKF	0601060502	19980507	19980507	Benicia	G	15,283	156	0		0	1.01	0.500	IHN INFECTED
							30,558	312	0				1.000	
1997	XHAF	0601060505	19980423	19980423	Mossdale	G	15,537	259	0		0	1.02		IHN INFECTED
1997	XHAF	0601060506	19980423	19980423	Mossdale	G	18,365	305	0		0	1.02		IHN INFECTED
1997	XHAF	0601140606	19980424	19980424	Dos Reis Road	G	23,927	450	0		0	1.02		POSSIBLY IHN INFECTED
1997	XHAF	0601140607	19980424	19980424	Dos Reis Road	G	24,330	457	0		0	1.02		POSSIBLY IHN INFECTED
1997	XHAF	0601060511	19980427	19980427	Mokelumne R, Mouth	G	21,312	520	0		0	1.02		POSSIBLY IHN INFECTED
1997	XHAF	0601060512	19980427	19980427	Mokelumne R, Mouth	G	22,856	558	0		0	1.02		POSSIBLY IHN INFECTED
1997	XHAF	0601060503	19980428	19980428	Jersey Pt,san Joaq,r	G	15,334	126	0		0	1.01		IHN INFECTED
1997	XHAF	0601060504	19980428	19980428	Jersey Pt,san Joaq,r	G	15,909	131	0		0	1.01		IHN INFECTED
1997	XHAF	0601060414	19980506	19980506	Mossdale	G	21,405	309	0		0	1.01		IHN INFECTED
1997	XHAF	0601060415	19980506	19980506	Mossdale	G	21,180	306	0		0	1.01		IHN INFECTED
							200,155	3,421						

Appendix 1c. 1998 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
1998	INBF	0601060403	19990302	19990302	Isleton	F	49,715	1,803	0	1.04	83,246	2.71	0.162	
1998	INBF	0601060404	19990302	19990302	Isleton	F	50,864	1,845	0	1.04	85,170	2.71	0.165	
1998	INBF	0601060907	19990322	19990322	Verona	G	53,987	0	0	1.00	90,399	2.67	0.176	
1998	INBF	0601060908	19990322	19990322	Verona	G	50,989	0	0	1.00	85,379	2.67	0.166	
1998	INBF	0601060909	19990322	19990322	Verona	G	50,804	307	0	1.01	85,069	2.68	0.165	
1998	INBF	0601060910	19990322	19990322	Verona	G	51,202	309	0	1.01	85,736	2.68	0.166	
							307,561	4,264		1.01	515,000	2.69	1.000	
1998	INBF	Untagged	19990218	19990218	Feather River	G		108,000						
1998	INBF	Untagged	19990218	19990218	Feather River	G		108,000						
1998	INBF	Untagged	19990219	19990219	Feather River	G		99,200						
1998	INBF	Untagged	19990305	19990305	Feather River	G		64,200						
1998	INBF	Untagged	19990305	19990305	Feather River	G		135,600						
								515,000						
1998	INBF	0501020714	19990331	19990331	Ryde-koket	G	25,873	130	0		0	1.01		
1998	INBF	0501020715	19990331	19990331	Ryde-koket	G	25,133	126	0		0	1.01		
1998	INBF	052416	19990415	19990415	West Sacramento	G	25,621	390	0		0	1.02		
1998	INBF	052417	19990415	19990415	West Sacramento	G	26,174	399	0		0	1.02		
1998	INBF	052414	19990428	19990428	Ryde-koket	G	26,489	133	0		0	1.01		
1998	INBF	052415	19990428	19990428	Ryde-koket	G	25,814	130	0		0	1.01		
1998	INBF	052324	19990430	19990430	West Sacramento	G	25,695	129	0		0	1.01		
1998	INBF	052325	19990430	19990430	West Sacramento	G	25,977	131	0		0	1.01		
1998	INBF	0501020706	19990504	19990504	West Sacramento	G	25,585	337	0		0	1.01		
1998	INBF	0501020707	19990504	19990504	West Sacramento	G	25,633	338	0		0	1.01		
1998	INBF	0601060814	19990511	19990511	Live Oak	G	51,144	1,258	0		0	1.02		
1998	INBF	0601060815	19990511	19990511	Live Oak	G	51,043	1,255	0		0	1.02		
							360,181	4,756						
1998	INBY	Untagged	20000204	20000204	Feather River	Y	9,900							
1998	INBY	Untagged	20000204	20000204	Feather River	Y	4,500							
1998	INBY	Untagged	20000204	20000204	Feather River	Y	9,000							
							23,400 (un-expandable production)							
1998	TRKF	052326	19990426	19990426	Port Chicago	V	25,576	337	0	1.01	244,649	10.58	0.056	
1998	TRKF	052327	19990426	19990426	Port Chicago	V	25,518	336	0	1.01	244,095	10.58	0.056	
1998	TRKF	062631	19990607	19990611	Crockett	V	50,877	1,038	0	1.02	486,668	10.59	0.111	
1998	TRKF	062632	19990607	19990611	Crockett	V	50,893	1,039	0	1.02	486,821	10.59	0.111	
1998	TRKF	062633	19990607	19990611	Crockett	V	51,964	1,060	0	1.02	497,066	10.59	0.114	
1998	TRKF	062634	19990607	19990611	Crockett	V	50,928	1,039	0	1.02	487,156	10.59	0.111	
1998	TRKF	062635	19990607	19990611	Crockett	V	50,883	1,038	0	1.02	486,726	10.59	0.111	
1998	TRKF	062636	19990607	19990611	Crockett	V	50,932	1,039	0	1.02	487,195	10.59	0.111	
1998	TRKF	062637	19990607	19990611	Crockett	V	49,140	1,003	0	1.02	470,053	10.59	0.107	
1998	TRKF	062638	19990607	19990611	Crockett	V	50,827	1,037	0	1.02	486,190	10.59	0.111	
							457,538	8,966		1.02	4,376,620	10.59	1.000	
1998	TRKF	Untagged	19990518	19990518	Wickland Oil Net Pens	V		56,700						
1998	TRKF	Untagged	19990518	19990518	Wickland Oil Net Pens	V		56,700						
1998	TRKF	Untagged	19990518	19990518	Wickland Oil Net Pens	V		56,700						
1998	TRKF	Untagged	19990519	19990519	Wickland Oil Net Pens	V		64,860						
1998	TRKF	Untagged	19990520	19990520	Wickland Oil Net Pens	V		66,700						
1998	TRKF	Untagged	19990524	19990524	Wickland Oil Net Pens	V		62,100						
1998	TRKF	Untagged	19990525	19990525	Wickland Oil Net Pens	V		55,430						
1998	TRKF	Untagged	19990527	19990527	Wickland Oil Net Pens	G		80,500						
1998	TRKF	Untagged	19990527	19990527	Wickland Oil Net Pens	V		64,400						
1998	TRKF	Untagged	19990527	19990527	Wickland Oil Net Pens	G		87,400						
1998	TRKF	Untagged	19990528	19990528	Wickland Oil Net Pens	G		71,300						
1998	TRKF	Untagged	19990528	19990528	Wickland Oil Net Pens	G		69,000						
1998	TRKF	Untagged	19990601	19990601	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990601	19990601	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990601	19990601	Wickland Oil Net Pens	V		64,400						
1998	TRKF	Untagged	19990602	19990602	Wickland Oil Net Pens	G		35,200						

Appendix 1c. 1998 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
1998	TRKF	Untagged	19990602	19990602	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990602	19990602	Wickland Oil Net Pens	G		38,400						
1998	TRKF	Untagged	19990602	19990602	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990602	19990602	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990603	19990603	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990603	19990603	Wickland Oil Net Pens	G		73,600						
1998	TRKF	Untagged	19990604	19990604	Wickland Oil Net Pens	G		36,850						
1998	TRKF	Untagged	19990609	19990609	Wickland Oil Net Pens	G		112,700						
1998	TRKF	Untagged	19990614	19990614	Wickland Oil Net Pens	G		62,400						
1998	TRKF	Untagged	19990614	19990614	Wickland Oil Net Pens	G		133,400						
1998	TRKF	Untagged	19990614	19990614	Wickland Oil Net Pens	G		103,500						
1998	TRKF	Untagged	19990614	19990614	Wickland Oil Net Pens	G		58,000						
1998	TRKF	Untagged	19990615	19990615	Wickland Oil Net Pens	G		115,000						
1998	TRKF	Untagged	19990615	19990615	Wickland Oil Net Pens	G		105,800						
1998	TRKF	Untagged	19990615	19990615	Wickland Oil Net Pens	G		115,000						
1998	TRKF	Untagged	19990616	19990616	Wickland Oil Net Pens	G		128,800						
1998	TRKF	Untagged	19990616	19990616	Wickland Oil Net Pens	G		108,100						
1998	TRKF	Untagged	19990616	19990616	Wickland Oil Net Pens	G		123,510						
1998	TRKF	Untagged	19990617	19990617	Wickland Oil Net Pens	G		128,800						
1998	TRKF	Untagged	19990617	19990617	Wickland Oil Net Pens	G		128,800						
1998	TRKF	Untagged	19990617	19990617	Wickland Oil Net Pens	G		128,800						
1998	TRKF	Untagged	19990618	19990618	Wickland Oil Net Pens	G		105,800						
1998	TRKF	Untagged	19990618	19990618	Wickland Oil Net Pens	G		105,800						
1998	TRKF	Untagged	19990618	19990618	Wickland Oil Net Pens	G		100,970						
1998	TRKF	Untagged	19990621	19990621	Wickland Oil Net Pens	G		94,300						
1998	TRKF	Untagged	19990621	19990621	Wickland Oil Net Pens	G		94,300						
1998	TRKF	Untagged	19990621	19990621	Wickland Oil Net Pens	G		94,300						
1998	TRKF	Untagged	19990622	19990622	Wickland Oil Net Pens	G		92,000						
1998	TRKF	Untagged	19990622	19990622	Wickland Oil Net Pens	G		73,500						
1998	TRKF	Untagged	19990622	19990622	Wickland Oil Net Pens	G		80,500						
1998	TRKF	Untagged	19990623	19990623	Wickland Oil Net Pens	G		131,100						
1998	TRKF	Untagged	19990623	19990623	Wickland Oil Net Pens	G		131,100						
1998	TRKF	Untagged	19990624	19990624	Wickland Oil Net Pens	G		116,600						
1998	TRKF	Untagged	19990624	19990624	Wickland Oil Net Pens	G		121,900						
								4,376,620						
1998	XHAF	0601060701	19990211	19990211	Yolo Bypass Road 16	G	25,241	754	0		0	1.03		
1998	XHAF	0601060702	19990211	19990211	Yolo Bypass Road 16	G	27,699	827	0		0	1.03		
1998	XHAF	0601060703	19990211	19990211	Yolo Bypass Road 16	G	25,262	754	0		0	1.03		
1998	XHAF	0601060704	19990211	19990211	Yolo Bypass Road 16	G	25,269	755	0		0	1.03		
1998	XHAF	0601060705	19990211	19990211	Yolo Bypass Elkhorn	G	26,316	159	0		0	1.01		
1998	XHAF	0601060706	19990211	19990211	Yolo Bypass Elkhorn	G	25,845	156	0		0	1.01		
1998	XHAF	0601060707	19990211	19990211	Yolo Bypass Elkhorn	G	26,029	157	0		0	1.01		
1998	XHAF	0601060708	19990211	19990211	Yolo Bypass Elkhorn	G	25,692	155	0		0	1.01		
1998	XHAF	0501020708	19990301	19990301	Mokelumne R, Mouth	F	25,414	387	0		0	1.02		
1998	XHAF	0501020709	19990301	19990301	Mokelumne R, Mouth	F	25,649	391	0		0	1.02		
1998	XHAF	0501020710	19990301	19990301	Mokelumne R, Mouth	F	27,943	426	0		0	1.02		
1998	XHAF	0501020711	19990301	19990301	Mokelumne R, Mouth	F	24,721	376	0		0	1.02		
1998	XHAF	0501020712	19990330	19990330	Georgianna Slough	G	26,330	266	0		0	1.01		
1998	XHAF	0501020713	19990330	19990330	Georgianna Slough	G	26,248	244	0		0	1.01		
1998	XHAF	0501020801	19990427	19990427	Georgianna Slough	G	22,577	113	0		0	1.01		
1998	XHAF	0501020802	19990427	19990427	Georgianna Slough	G	27,393	138	0		0	1.01		
							413,628	6,058						FULL-TAG LENGTHS USED FOR 9,389 FISH

Appendix 1d. 1999 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original	Additional	New	Proportion	Hatchery notes
										Production factor	untagged	Production factor	originally tagged	
1999	INBF	0601061005	20000215	20000215	Isleton	G	24,857	1,036	0	1.04	119,360	5.84	0.239	
1999	INBF	0601061006	20000215	20000215	Isleton	G	26,436	1,101	0	1.04	126,942	5.84	0.254	
1999	INBF	0501020809	20000229	20000229	Isleton	G	26,837	135	0	1.01	128,867	5.81	0.258	
1999	INBF	0501020810	20000229	20000229	Isleton	G	26,033	131	0	1.01	125,007	5.81	0.250	
							104,163	2,403		1.02	500,176	5.82	1.000	
1999	INBF	Untagged	20000127	20000127	Feather River	G		100,100						
1999	INBF	Untagged	20000127	20000127	Feather River	G		100,100						
1999	INBF	Untagged	20000128	20000128	Feather River	G		100,100						
1999	INBF	Untagged	20000209	20000209	Feather River	G		199,876						
								500,176						
1999	INBF	0601061105	20000322	20000322	Verona	G	101,115	3,127	0		0	1.03		
1999	INBF	062657	20000322	20000322	Verona	G	103,165	1,571	0		0	1.02		
1999	INBF	0501020805	20000329	20000329	Ryde-koket	G	23,042	303	0		0	1.01		
1999	INBF	0501020806	20000329	20000329	Ryde-koket	G	23,468	309	0		0	1.01		
1999	INBF	062655	20000410	20000410	West Sacramento	G	25,005	253	0		0	1.01		
1999	INBF	062656	20000410	20000410	West Sacramento	G	25,011	253	0		0	1.01		
1999	INBF	0501020807	20000428	20000428	Ryde-koket	G	21,419	282	0		0	1.01		FISH HAD IHN DISEASE
1999	INBF	0501020808	20000428	20000428	Ryde-koket	G	21,395	282	0		0	1.01		FISH HAD IHN DISEASE
1999	INBF	062653	20000501	20000501	West Sacramento	G	20,926	211	0		0	1.01		FISH HAD IHN DISEASE
1999	INBF	062654	20000501	20000501	West Sacramento	G	20,613	208	0		0	1.01		FISH HAD IHN DISEASE
1999	INBF	062649	20000515	20000515	West Sacramento	G	17,416	319	0		0	1.02		FISH HAD IHN DISEASE
1999	INBF	062650	20000515	20000515	West Sacramento	G	17,064	313	0		0	1.02		FISH HAD IHN DISEASE
1999	INBF	062660	20000607	20000607	Live Oak	V	42,275	775	0		0	1.02		FISH HAD IHN DISEASE
							461,914	8,206						
1999	TRKF	053829	20000412	20000412	Port Chicago	G	23,582	780	0	1.03	357,450	16.19	0.063	FISH HAD IHN DISEASE
1999	TRKF	053830	20000412	20000412	Port Chicago	G	23,352	772	0	1.03	353,964	16.19	0.063	FISH HAD IHN DISEASE
1999	TRKF	062651	20000503	20000503	Port Chicago	G	15,770	289	0	1.02	239,038	16.18	0.042	FISH HAD IHN DISEASE
1999	TRKF	062652	20000503	20000503	Port Chicago	G	15,541	285	0	1.02	235,567	16.18	0.042	FISH HAD IHN DISEASE
1999	TRKF	062658	20000620	20000627	Wickland Oil Net Pen	V	294,362	7,238	0	1.02	4,461,871	16.18	0.790	FISH HAD IHN DISEASE
							372,607	9,364		1.03	5,647,890	16.18	1.0000	
1999	TRKF	Untagged	20000407	20000407	Wickland Oil Net Pens	G		218,400						
1999	TRKF	Untagged	20000407	20000407	Wickland Oil Net Pens	G		218,400						
1999	TRKF	Untagged	20000410	20000410	Rodeo Minor Port	G		200,100						
1999	TRKF	Untagged	20000410	20000410	Rodeo Minor Port	G		143,000						
1999	TRKF	Untagged	20000410	20000410	Rodeo Minor Port	G		143,000						
1999	TRKF	Untagged	20000412	20000412	Wickland Oil Net Pens	G		211,200						
1999	TRKF	Untagged	20000412	20000412	Wickland Oil Net Pens	G		211,200						
1999	TRKF	Untagged	20000511	20000511	Wickland Oil Net Pens	V		61,600						
1999	TRKF	Untagged	20000511	20000511	Wickland Oil Net Pens	V		36,400						
1999	TRKF	Untagged	20000512	20000512	Wickland Oil Net Pens	G		105,600						
1999	TRKF	Untagged	20000512	20000512	Wickland Oil Net Pens	G		101,200						
1999	TRKF	Untagged	20000525	20000525	Wickland Oil Net Pens	G		73,600						
1999	TRKF	Untagged	20000525	20000525	Rodeo Minor Port	G		68,540						
1999	TRKF	Untagged	20000525	20000525	Rodeo Minor Port	G		68,540						
1999	TRKF	Untagged	20000605	20000605	Wickland Oil Net Pens	G		67,850						
1999	TRKF	Untagged	20000605	20000605	Wickland Oil Net Pens	G		67,850						
1999	TRKF	Untagged	20000606	20000606	Wickland Oil Net Pens	V		61,600						
1999	TRKF	Untagged	20000606	20000606	Wickland Oil Net Pens	G		59,000						
1999	TRKF	Untagged	20000606	20000606	Wickland Oil Net Pens	G		67,850						
1999	TRKF	Untagged	20000607	20000607	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000607	20000607	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000607	20000607	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000608	20000608	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000608	20000608	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000609	20000609	Wickland Oil Net Pens	G		110,400						
1999	TRKF	Untagged	20000609	20000609	Wickland Oil Net Pens	G		101,200						
1999	TRKF	Untagged	20000612	20000612	Wickland Oil Net Pens	G		105,800						
1999	TRKF	Untagged	20000612	20000612	Wickland Oil Net Pens	G		105,800						
1999	TRKF	Untagged	20000613	20000613	Wickland Oil Net Pens	G		112,700						

Appendix 1d. 1999 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
1999	TRKF	Untagged	20000613	20000613	Wickland Oil Net Pens	G		112,700						
1999	TRKF	Untagged	20000613	20000613	Wickland Oil Net Pens	G		73,100						
1999	TRKF	Untagged	20000613	20000613	Wickland Oil Net Pens	G		29,700						
1999	TRKF	Untagged	20000614	20000614	Wickland Oil Net Pens	V		43,700						
1999	TRKF	Untagged	20000614	20000614	Wickland Oil Net Pens	G		111,090						
1999	TRKF	Untagged	20000614	20000614	Wickland Oil Net Pens	G		111,090						
1999	TRKF	Untagged	20000614	20000614	Wickland Oil Net Pens	G		82,800						
1999	TRKF	Untagged	20000615	20000615	Wickland Oil Net Pens	G		115,000						
1999	TRKF	Untagged	20000615	20000615	Wickland Oil Net Pens	G		115,000						
1999	TRKF	Untagged	20000615	20000615	Wickland Oil Net Pens	V		30,400						
1999	TRKF	Untagged	20000615	20000615	Wickland Oil Net Pens	G		35,000						
1999	TRKF	Untagged	20000616	20000616	Wickland Oil Net Pens	G		103,730						
1999	TRKF	Untagged	20000616	20000616	Wickland Oil Net Pens	G		77,000						
1999	TRKF	Untagged	20000616	20000616	Wickland Oil Net Pens	G		39,600						
1999	TRKF	Untagged	20000616	20000616	Wickland Oil Net Pens	G		101,200						
1999	TRKF	Untagged	20000619	20000619	Wickland Oil Net Pens	G		102,900						
1999	TRKF	Untagged	20000619	20000619	Wickland Oil Net Pens	G		115,000						
1999	TRKF	Untagged	20000619	20000619	Wickland Oil Net Pens	G		115,000						
1999	TRKF	Untagged	20000620	20000620	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000620	20000620	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000621	20000621	Wickland Oil Net Pens	G		67,850						
1999	TRKF	Untagged	20000621	20000621	Wickland Oil Net Pens	G		67,850						
1999	TRKF	Untagged	20000622	20000622	Wickland Oil Net Pens	G		71,300						
1999	TRKF	Untagged	20000623	20000623	Wickland Oil Net Pens	G		72,000						
1999	TRKF	Untagged	20000623	20000623	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000623	20000623	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000623	20000623	Wickland Oil Net Pens	G		71,300						
1999	TRKF	Untagged	20000626	20000626	Wickland Oil Net Pens	V		66,700						
1999	TRKF	Untagged	20000626	20000626	Wickland Oil Net Pens	V		66,700						
1999	TRKF	Untagged	20000626	20000626	Wickland Oil Net Pens	V		66,700						
1999	TRKF	Untagged	20000627	20000627	Wickland Oil Net Pens	G		72,000						
1999	TRKF	Untagged	20000627	20000627	Wickland Oil Net Pens	G		86,250						
1999	TRKF	Untagged	20000627	20000627	Wickland Oil Net Pens	G		69,000						
1999	TRKF	Untagged	20000628	20000628	Wickland Oil Net Pens	G		14,400						
								5,647,890						
1999	TRKY	062940	20000826	20000826	Tiburon Net Pens	Y	28,888	500	0		0	1.02		FISH HAD IHN DISEASE
1999	XHAF	0601061104	20000204	20000204	Yolo Bypass	G	100,901	4,810	0		0	1.05		
1999	XHAF	0601061003	20000214	20000214	Mokelumne R, Mouth	G	26,302	647	0		0	1.02		
1999	XHAF	0601061004	20000214	20000214	Mokelumne R, Mouth	G	24,059	592	0		0	1.02		
1999	XHAF	0601061007	20000222	20000222	Yolo Bypass	G	27,250	415	0		0	1.02		COMBINED WITH 0601061008
1999	XHAF	0601061008	20000222	20000222	Yolo Bypass	G	27,302	416	0		0	1.02		COMBINED WITH 0601061007
1999	XHAF	0601061107	20000222	20000222	Yolo Bypass Elkhorn	G	52,886	0	0		0	1.00		
1999	XHAF	0601060912	20000228	20000228	Mokelumne R, Mouth	G	27,514	705	0		0	1.03		FISH HAD IHN DISEASE
1999	XHAF	0601060913	20000228	20000228	Mokelumne R, Mouth	G	25,459	653	0		0	1.03		
1999	XHAF	0501020803	20000328	20000328	Georgianna Slough	G	24,571	476	0		0	1.02		
1999	XHAF	0501020804	20000328	20000328	Georgianna Slough	G	25,253	489	0		0	1.02		
1999	XHAF	0601061109	20000427	20000427	Georgianna Slough	G	19,471	177	0		0	1.01		
1999	XHAF	0601061110	20000427	20000427	Georgianna Slough	G	19,665	179	0		0	1.01		FISH HAD IHN DISEASE
							400,633	9,559						

Appendix 1e. 2000 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
2000	INBF	0601070205	20010215	20010215	Elkhorn Boat Ramp	G	9,149	405	0		0	1.04		
2000	INBF	0601070206	20010215	20010215	Elkhorn Boat Ramp	G	9,507	421	0		0	1.04		
2000	INBF	0601070207	20010215	20010215	Elkhorn Boat Ramp	G	9,508	421	0		0	1.04		
2000	INBF	0601070208	20010215	20010215	Elkhorn Boat Ramp	G	9,359	414	0		0	1.04		
2000	INBF	0601070209	20010215	20010215	Elkhorn Boat Ramp	G	9,000	399	0		0	1.04		
2000	INBF	0601070302	20010217	20010227	Elkhorn Boat Ramp	G	9,806	149	0		0	1.02		
2000	INBF	0601061206	20010226	20010226	Feather River	G	26,077	641	0		0	1.02		
2000	INBF	0601061207	20010226	20010226	Feather River	G	25,679	631	0		0	1.02		
2000	INBF	0601061208	20010226	20010226	Feather River	G	26,280	646	0		0	1.02		
2000	INBF	0601061209	20010226	20010226	Feather River	G	25,947	638	0		0	1.02		
2000	INBF	0601061210	20010226	20010226	Feather River	G	27,042	665	0		0	1.02		
2000	INBF	0601061211	20010226	20010226	Feather River	G	25,574	629	0		0	1.02		
2000	INBF	0601061212	20010226	20010226	Feather River	G	25,464	626	0		0	1.02		
2000	INBF	0601061213	20010226	20010226	Feather River	G	26,921	662	0		0	1.02		
2000	INBF	0601070300	20010227	20010227	Elkhorn Boat Ramp	G	10,241	156	0		0	1.02		
2000	INBF	0601070301	20010227	20010227	Elkhorn Boat Ramp	G	9,915	151	0		0	1.02		
2000	INBF	0601070303	20010227	20010227	Elkhorn Boat Ramp	G	9,745	145	0		0	1.01		
2000	INBF	0601070304	20010227	20010227	Elkhorn Boat Ramp	G	9,544	145	0		0	1.02		
2000	INBF	0601070000	20010302	20010302	Isleton	G	24,556	759	0		0	1.03		
2000	INBF	0601070001	20010302	20010302	Isleton	G	21,924	678	0		0	1.03		
2000	INBF	062710	20010503	20010503	Feather River	V	20,258	102	0		0	1.01		
2000	INBF	062711	20010503	20010503	Feather River	V	20,398	102	0		0	1.01		
2000	INBF	062712	20010503	20010503	Feather River	V	19,810	100	0		0	1.01		
2000	INBF	062713	20010503	20010503	Feather River	V	20,129	101	0		0	1.01		
							431,833	9,786						
2000	TRKF	062664	20010415	20010430	Wickland Oil Net Pen	V	202,096	719,407	732	4.56		4.56	0.587	MASS MARKING DEMONSTRATION
2000	TRKF	062665	20010423	20010531	Wickland Oil Net Pen	V	142,204	719,713	1,038	6.07		6.07	0.413	MASS MARKING DEMONSTRATION
							344,300	1,439,120	1,770	5.18		5.18	1.000	
2000	TRKF	062676	20010327	20010327	Rodeo Minor Port	V	44,021	3,010	0	1.07	187,957	5.34	0.139	FISH INFECTED W/ IHN
2000	TRKF	062672	20010329	20010424	Rodeo Minor Port	G	42,003	2,872	0	1.07	179,341	5.34	0.132	FISH INFECTED W/ IHN
2000	TRKF	062673	20010329	20010423	Rodeo Minor Port	G	46,642	3,189	0	1.07	199,148	5.34	0.147	FISH INFECTED W/ IHN
2000	TRKF	062674	20010329	20010426	Rodeo Minor Port	V	47,369	3,239	0	1.07	202,252	5.34	0.149	FISH INFECTED W/ IHN
2000	TRKF	062675	20010329	20010426	Rodeo Minor Port	V	42,704	2,920	0	1.07	182,334	5.34	0.134	FISH INFECTED W/ IHN
2000	TRKF	062669	20010501	20010522	Rodeo Minor Port	V	32,082	2,194	0	1.07	136,981	5.34	0.101	FISH INFECTED W/ IHN
2000	TRKF	062670	20010501	20010522	Rodeo Minor Port	V	31,384	2,146	0	1.07	134,001	5.34	0.099	FISH INFECTED W/ IHN
2000	TRKF	062671	20010501	20010522	Rodeo Minor Port	V	31,575	2,159	0	1.07	134,816	5.34	0.099	FISH INFECTED W/ IHN
							317,780	21,729		1.07	1,356,830	5.34	1.000	
2000	TRKF	Untagged	20010425	20010425	San Pablo Bay	G		170,200						
2000	TRKF	Untagged	20010426	20010426	San Pablo Bay	G		138,000						
2000	TRKF	Untagged	20010430	20010430	San Pablo Bay	G		138,000						
2000	TRKF	Untagged	20010430	20010430	San Pablo Bay	G		121,900						
2000	TRKF	Untagged	20010501	20010501	San Pablo Bay	G		69,600						
2000	TRKF	Untagged	20010502	20010502	Rodeo Minor Port	G		46,200						
2000	TRKF	Untagged	20010507	20010507	San Pablo Bay	G		115,000						
2000	TRKF	Untagged	20010507	20010507	San Pablo Bay	G		115,000						
2000	TRKF	Untagged	20010509	20010509	San Pablo Bay	G		44,250						
2000	TRKF	Untagged	20010509	20010509	San Pablo Bay	G		115,000						
2000	TRKF	Untagged	20010510	20010510	San Pablo Bay	G		117,300						
2000	TRKF	Untagged	20010510	20010510	San Pablo Bay	G		117,300						
2000	TRKF	Untagged	20010511	20010511	San Pablo Bay	G		117,300						
2000	TRKF	Untagged	20010511	20010511	San Pablo Bay	G		117,300						
2000	TRKF	Untagged	20010515	20010515	Rodeo Minor Port	G		34,300						
2000	TRKF	Untagged	20010521	20010521	San Pablo Bay	V		29,000						
2000	TRKF	Untagged	20010521	20010521	San Pablo Bay	G		135,700						
2000	TRKF	Untagged	20010521	20010521	San Pablo Bay	V		64,400						
2000	TRKF	Untagged	20010522	20010522	San Pablo Bay	G		47,200						
2000	TRKF	Untagged	20010524	20010524	San Pablo Bay	G		117,300						
2000	TRKF	Untagged	20010525	20010525	San Pablo Bay	G		112,700						
2000	TRKF	Untagged	20010525	20010525	San Pablo Bay	G		112,700						

Appendix 1e. 2000 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
2000	TRKF	Untagged	20010525	20010525	San Pablo Bay	G		112,700						
2000	TRKF	Untagged	20010611	20010611	San Pablo Bay	G		121,900						
2000	TRKF	Untagged	20010611	20010611	San Pablo Bay	G		121,900						
2000	TRKF	Untagged	20010612	20010612	San Pablo Bay	G		121,900			2,795,950			Tot. Non Tagged
2000	TRKF	Untagged	20010612	20010612	San Pablo Bay	G		121,900			1,439,120			Tot. Non Tagged from Mass Marking
								2,795,950			1,356,830			Difference
2000	TRKY	062941	20010825	20010825	Tiburon Net Pens	Y	41,819	12	0		0	1.00		
2000	XHAF	0601070200	20010215	20010215	Yolo Bypass	G	9,419	372	0		0	1.04		
2000	XHAF	0601070201	20010215	20010215	Yolo Bypass	G	9,732	384	0		0	1.04		
2000	XHAF	0601070202	20010215	20010215	Yolo Bypass	G	9,448	373	0		0	1.04		
2000	XHAF	0601070203	20010215	20010215	Yolo Bypass	G	9,526	376	0		0	1.04		
2000	XHAF	0601070204	20010215	20010215	Yolo Bypass	G	9,166	362	0		0	1.04		
2000	XHAF	0601070305	20010227	20010227	Yolo Bypass	G	10,179	315	0		0	1.03		
2000	XHAF	0601070306	20010227	20010227	Yolo Bypass	G	9,134	283	0		0	1.03		
2000	XHAF	0601070307	20010227	20010227	Yolo Bypass	G	10,141	314	0		0	1.03		
2000	XHAF	0601070308	20010227	20010227	Yolo Bypass	G	8,921	276	0		0	1.03		
2000	XHAF	0601070309	20010227	20010227	Yolo Bypass	G	9,884	306	0		0	1.03		
2000	XHAF	0601070002	20010302	20010302	Lighthouse Marina	G	23,271	1,860	0		0	1.08		
2000	XHAF	0601070003	20010302	20010302	Lighthouse Marina	G	22,919	1,832	0		0	1.08		
							141,740	7,053						

Appendix 1f. 2001 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwtcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
2001	INBF	0601070006	20020205	20020205	Elkhorn Boat Ramp	G	26,380	561	0		0	1.02		
2001	INBF	0601070007	20020205	20020205	Elkhorn Boat Ramp	G	24,566	523	0		0	1.02		
2001	INBF	0601070605	20020221	20020221	Elkhorn Boat Ramp	G	9,652	48	0		0	1.00		
2001	INBF	0601070606	20020221	20020221	Elkhorn Boat Ramp	G	10,426	52	0		0	1.00		
2001	INBF	0601070607	20020221	20020221	Elkhorn Boat Ramp	G	10,389	52	0		0	1.01		
2001	INBF	0601070608	20020221	20020221	Elkhorn Boat Ramp	G	11,192	56	0		0	1.01		
2001	INBF	0601070609	20020221	20020221	Elkhorn Boat Ramp	G	8,751	44	0		0	1.01		
2001	INBF	0601070702	20020222	20020222	Isleton	G	25,462	707	0		0	1.03		
2001	INBF	0601070703	20020222	20020222	Isleton	G	25,276	701	0		0	1.03		
2001	INBF	0601070704	20020313	20020313	Isleton	G	24,138	1,321	0		0	1.05		
2001	INBF	0601070705	20020313	20020313	Isleton	G	24,319	1,331	0		0	1.05		
2001	INBF	062695	20020402	20020402	West Sacramento	G	44,563	541	0		0	1.01		
2001	INBF	062699	20020404	20020404	Ryde-koket	G	43,789	1,123	0		0	1.03		
2001	INBF	062697	20020417	20020417	West Sacramento	G	45,972	1,179	0		0	1.03		
2001	INBF	062698	20020418	20020418	Ryde-koket	G	43,676	2,154	0		0	1.05		
							378,551	10,393						
2001	TRKF	062090	20020410	20020507	Wickland Oil Net Pen	G	263,768	221,050	6,832	1.86		1.86	0.499	MASS MARKING DEMONSTRATION.
2001	TRKF	062091	20020410	20020507	Wickland Oil Net Pen	G	264,738	221,050	6,962	1.86		1.86	0.501	MASS MARKING DEMONSTRATION.
							528,506	442,100	13,794	1.86		1.86	1.000	
2001	TRKF	062737	20020412	20020412	Wickland Oil Net Pen	V	107,348	3,853	0	1.04	969,419	10.07	0.228	
2001	TRKF	062738	20020412	20020423	Wickland Oil Net Pen	V	105,753	3,796	0	1.04	955,015	10.07	0.224	
2001	TRKF	062696	20020426	20020426	Port Chicago	G	44,789	682	0	1.02	404,472	10.05	0.095	
2001	TRKF	062735	20020502	20020503	Wickland Oil Net Pen	V	106,870	3,305	0	1.03	965,102	10.06	0.227	
2001	TRKF	062736	20020503	20020506	Wickland Oil Net Pen	V	106,336	3,289	0	1.03	960,280	10.06	0.226	
							471,096	14,925	0	1.03	4,254,288	10.06	1.000	
2001	TRKF	Untagged	20020328	20020328	San Pablo Bay	G		162,800						
2001	TRKF	Untagged	20020408	20020408	San Pablo Bay	G		184,000						
2001	TRKF	Untagged	20020409	20020409	San Pablo Bay	G		207,000						
2001	TRKF	Untagged	20020409	20020409	San Pablo Bay	G		179,400						
2001	TRKF	Untagged	20020410	20020410	San Pablo Bay	G		184,000						
2001	TRKF	Untagged	20020411	20020411	San Pablo Bay	G		163,800						
2001	TRKF	Untagged	20020412	20020412	San Pablo Bay	G		184,000						
2001	TRKF	Untagged	20020422	20020422	San Pablo Bay	G		163,300						
2001	TRKF	Untagged	20020422	20020422	San Pablo Bay	G		158,700						
2001	TRKF	Untagged	20020423	20020423	San Pablo Bay	G		70,800						
2001	TRKF	Untagged	20020423	20020423	San Pablo Bay	G		149,500						
2001	TRKF	Untagged	20020424	20020424	San Pablo Bay	G		135,700						
2001	TRKF	Untagged	20020424	20020424	San Pablo Bay	G		135,700						
2001	TRKF	Untagged	20020425	20020425	San Pablo Bay	G		59,000						
2001	TRKF	Untagged	20020425	20020425	San Pablo Bay	G		17,700						
2001	TRKF	Untagged	20020426	20020426	San Pablo Bay	G		149,500						
2001	TRKF	Untagged	20020426	20020426	San Pablo Bay	G		99,400						
2001	TRKF	Untagged	20020429	20020429	San Pablo Bay	G		79,200						
2001	TRKF	Untagged	20020429	20020429	San Pablo Bay	G		151,800						
2001	TRKF	Untagged	20020430	20020430	San Pablo Bay	G		93,338						
2001	TRKF	Untagged	20020430	20020430	San Pablo Bay	G		80,400						
2001	TRKF	Untagged	20020430	20020430	San Pablo Bay	G		127,300						
2001	TRKF	Untagged	20020501	20020501	San Pablo Bay	G		60,200						
2001	TRKF	Untagged	20020501	20020501	San Pablo Bay	G		98,900						
2001	TRKF	Untagged	20020502	20020502	San Pablo Bay	G		114,000						
2001	TRKF	Untagged	20020509	20020509	Rodeo Minor Port Area	G		32,200						
2001	TRKF	Untagged	20020515	20020515	Rodeo Minor Port Area	G		22,000						
2001	TRKF	Untagged	20020515	20020515	San Pablo Bay	G		48,400						
2001	TRKF	Untagged	20020516	20020516	San Pablo Bay	G		119,600						
2001	TRKF	Untagged	20020516	20020516	San Pablo Bay	G		119,600						
2001	TRKF	Untagged	20020517	20020517	San Pablo Bay	G		138,000						
2001	TRKF	Untagged	20020517	20020517	San Pablo Bay	G		138,000						
2001	TRKF	Untagged	20020521	20020521	San Pablo Bay	G		138,000						
2001	TRKF	Untagged	20020521	20020521	San Pablo Bay	G		138,000						

Appendix 1f. 2001 Feather River Hatchery fall chinook releases

Brood Year	Release Group	cwcode	1st release date	Last release date	Release Site	Release Stage	# CWT tagged	# fish untagged	# fish shedtag	Original Production factor	Additional untagged	New Production factor	Proportion originally tagged	Hatchery notes
2001	TRKF	Untagged	20020523	20020523	Rodeo Minor Port Area	G		27,000						
2001	TRKF	Untagged	20020529	20020529	San Pablo Bay	G		108,100						
2001	TRKF	Untagged	20020606	20020606	Rodeo Minor Port Area	G		36,000						
2001	TRKF	Untagged	20020610	20020610	San Pablo Bay	G		66,000						
2001	TRKF	Untagged	20020611	20020611	San Pablo Bay	G		55,000						
2001	TRKF	Untagged	20020612	20020612	San Pablo Bay	G		52,800						
2001	TRKF	Untagged	20020617	20020617	San Pablo Bay	G		57,600						
2001	TRKF	Untagged	20020618	20020618	San Pablo Bay	G		55,200						
2001	TRKF	Untagged	20020619	20020619	San Pablo Bay	G		56,250						
2001	TRKF	Untagged	20020620	20020620	San Pablo Bay	G		51,600			4,696,388			Tot. Non Tagged
2001	TRKF	Untagged	20020621	20020621	San Pablo Bay	G		27,600			442,100			Tot. Non Tagged from Mass Marking
								4,696,388			4,254,288			Difference
2001	XHAF	0601070004	20020205	20020205	Yolo Bypass	G	23,922	251	0		0	1.01		
2001	XHAF	0601070005	20020205	20020205	Yolo Bypass	G	25,744	270	0		0	1.01		
2001	XHAF	0601070600	20020221	20020221	Yolo Bypass	G	9,664	224	0		0	1.02		
2001	XHAF	0601070601	20020221	20020221	Yolo Bypass	G	10,375	240	0		0	1.02		
2001	XHAF	0601070602	20020221	20020221	Yolo Bypass	G	9,839	228	0		0	1.02		
2001	XHAF	0601070603	20020221	20020221	Yolo Bypass	G	10,838	251	0		0	1.02		
2001	XHAF	0601070604	20020221	20020221	Yolo Bypass	G	8,937	207	0		0	1.02		
2001	XHAF	0601070700	20020222	20020222	Lighthouse Marina	G	26,104	617	0		0	1.02		
2001	XHAF	0601070701	20020222	20020222	Lighthouse Marina	G	25,728	606	0		0	1.02		
2001	XHAF	0601070706	20020313	20020313	Lighthouse Marina	G	26,463	1,218	0		0	1.05		
2001	XHAF	0601070707	20020313	20020313	Lighthouse Marina	G	22,337	1,028	0		0	1.05		
2001	XHAF	062724	20020404	20020404	Georgianna Slough	G	22,883	587	0		0	1.03		
2001	XHAF	062725	20020404	20020404	Georgianna Slough	G	22,436	575	0		0	1.03		
2001	XHAF	062726	20020404	20020404	Georgianna Slough	G	23,630	606	0		0	1.03		
2001	XHAF	062730	20020405	20020405	Georgianna Slough	G	44,565	224	0		0	1.01		
2001	XHAF	062727	20020418	20020418	Georgianna Slough	G	22,705	346	0		0	1.02		
2001	XHAF	062728	20020418	20020418	Georgianna Slough	G	22,714	346	0		0	1.02		
2001	XHAF	062729	20020418	20020418	Georgianna Slough	G	22,695	346	0		0	1.02		
							381,579	8,170						

Appendix 2a. Feather River Hatchery '98 brood year fall chinook recoveries by Central Valley area

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Number recovered					Total Returns	% total Release	% of total recovered			
						Feather Basin	Yuba Carcass	Lower Sac Sport	Outside Basin	Feather Basin			Yuba Carcass	Lower Sac Sport	Outside Basin	
In-basin FRH releases																
0601060403	Isleton	19990302	49,715	134,764	2.71	5				5	0.00%	100%				
0601060404	Isleton	19990302	50,864	137,879	2.71	3				3	0.00%	100%				
			100,579	272,643	2.71	8				8	0.00%	100%				
0601060814	Live Oak	19990511	51,144	52,402	1.02	226		55		281	0.54%	80%		20%		
0601060815	Live Oak	19990511	51,043	52,298	1.02	246				246	0.47%	100%				
			102,187	104,700	1.02	472		55		527	0.50%	90%		10%		
0501020714	Ryde-koket	19990331	25,873	26,003	1.01	32		80	12	124	0.48%	26%		65%	10%	
0501020715	Ryde-koket	19990331	25,133	25,259	1.01	31			17	48	0.19%	65%			35%	
052414	Ryde-koket	19990428	26,489	26,622	1.01	228			21	249	0.94%	92%			8%	
052415	Ryde-koket	19990428	25,814	25,944	1.01	344			8	351	1.35%	98%			2%	
			103,309	103,828	1.01	635		80	57	772	0.74%	82%		10%	7%	
0601060907	Verona	19990322	53,987	144,386	2.67	472			21	493	0.34%	96%			4%	
0601060908	Verona	19990322	50,989	136,368	2.67	408			5	413	0.30%	99%			1%	
0601060909	Verona	19990322	50,804	136,180	2.68	247				247	0.18%	100%				
0601060910	Verona	19990322	51,202	137,247	2.68	274				274	0.20%	100%				
			206,982	554,181	2.68	1,400			26	1,426	0.26%	98%			2%	
0501020706	West Sacramento	19990504	25,585	25,922	1.01	159		21	3	183	0.71%	87%		11%	2%	
0501020707	West Sacramento	19990504	25,633	25,971	1.01	101			8	109	0.42%	93%			7%	
052324	West Sacramento	19990430	25,695	25,824	1.01	237				237	0.92%	100%				
052325	West Sacramento	19990430	25,977	26,108	1.01	93			5	99	0.38%	95%			5%	
052416	West Sacramento	19990415	25,621	26,011	1.02	120			1	121	0.46%	99%			1%	
052417	West Sacramento	19990415	26,174	26,573	1.02	232		21	6	259	0.98%	89%		8%	2%	
			154,685	156,409	1.01	942		42	24	1,008	0.64%	94%		4%	2%	
In-basin FRH releases totals			667,742	1,191,761	1.78	3,457		177	107	3,741	0.31%	92%		5%	3%	
Trucked FRH releases																
052326	Port Chicago	19990426	25,576	270,562	10.58	974			11	985	0.36%	99%			1%	
052327	Port Chicago	19990426	25,518	269,949	10.58	1,404		623	11	2,038	0.75%	69%		31%	1%	
			51,094	540,511	10.58	2,378		623	21	3,023	0.56%	79%		21%	1%	
062631	Wickland Oil Net Pen	19990607	50,877	538,583	10.59	4,648	85	1248	101	6,082	1.13%	76%	1%	21%	2%	
062632	Wickland Oil Net Pen	19990607	50,893	538,753	10.59	3,469	21	217	112	3,820	0.71%	91%	1%	6%	3%	
062633	Wickland Oil Net Pen	19990607	51,964	550,090	10.59	5,224	21	217	189	5,651	1.03%	92%	0%	4%	3%	
062634	Wickland Oil Net Pen	19990607	50,928	539,123	10.59	4,312	21		1,090	5,422	1.01%	80%	0%		20%	
062635	Wickland Oil Net Pen	19990607	50,883	538,647	10.59	4,991		624	488	6,103	1.13%	82%		10%	8%	
062636	Wickland Oil Net Pen	19990607	50,932	539,166	10.59	4,505			775	5,281	0.98%	85%			15%	
062637	Wickland Oil Net Pen	19990607	49,140	520,196	10.59	3,305		217	461	3,983	0.77%	83%		5%	12%	
062638	Wickland Oil Net Pen	19990607	50,827	538,054	10.59	4,654	21		86	4,761	0.88%	98%	0%		2%	
			406,444	4,302,612	10.59	35,109	169	2,523	3,303	41,104	0.96%	85%	0%	6%	8%	
Trucked FRH releases totals			457,538	4,843,123	10.59	37,487	169	3,146	3,324	44,126	0.91%	85%	0%	7%	8%	

Appendix 2a. Feather River Hatchery '98 brood year fall chinook recoveries by Central Valley area

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Number recovered				Total Returns	% total Release	% of total recovered			
						Feather Basin	Yuba Carcass	Lower Sac Sport	Outside Basin			Feather Basin	Yuba Carcass	Lower Sac Sport	Outside Basin
Extra/experimental FRH releases															
0501020712	Georgianna Slough	19990330	26,330	26,596	1.01	34			41	75	0.28%	45%			55%
0501020713	Georgianna Slough	19990330	26,248	26,492	1.01	63	2		2	67	0.25%	94%	3%		3%
0501020801	Georgianna Slough	19990427	22,577	22,690	1.01	72			42	114	0.50%	63%			37%
0501020802	Georgianna Slough	19990427	27,393	27,531	1.01	119			45	164	0.60%	73%			27%
			102,548	103,309	1.01	288	2		130	420	0.41%	69%	0%		31%
0501020708	Mokelumne R, Mouth	19990301	25,414	25,801	1.02	1			2	3	0.01%	34%			66%
0501020709	Mokelumne R, Mouth	19990301	25,649	26,040	1.02	2				2	0.01%	100%			
0501020710	Mokelumne R, Mouth	19990301	27,943	28,369	1.02				104	104	0.37%				100%
0501020711	Mokelumne R, Mouth	19990301	24,721	25,097	1.02										
			103,727	105,307	1.02	3			106	109	0.10%	3%			97%
0601060705	Yolo Bypass Elkhorn	19990211	26,316	26,475	1.01	5				5	0.02%	100%			
0601060706	Yolo Bypass Elkhorn	19990211	25,845	26,001	1.01	10				10	0.04%	100%			
0601060707	Yolo Bypass Elkhorn	19990211	26,029	26,186	1.01	9			39	48	0.18%	19%			81%
0601060708	Yolo Bypass Elkhorn	19990211	25,692	25,847	1.01	11			1	12	0.05%	92%			8%
0601060701	Yolo Bypass Road 16	19990211	25,241	25,995	1.03	8			4	12	0.05%	65%			35%
0601060702	Yolo Bypass Road 16	19990211	27,699	28,526	1.03	6			9	15	0.05%	41%			59%
0601060703	Yolo Bypass Road 16	19990211	25,262	26,016	1.03	2			10	12	0.05%	17%			83%
0601060704	Yolo Bypass Road 16	19990211	25,269	26,024	1.03	6	2	21	8	37	0.14%	17%	6%	57%	20%
			207,353	211,070	1.02	58	2	21	71	152	0.07%	38%	1%	14%	46%
Extra/experimental FRH releases totals			413,628	419,686	1.01	349	4	21	307	682	0.16%	51%	1%	3%	45%

Appendix 2b. Feather River Hatchery '98 brood year fall chinook recoveries in Feather River Basin & adjacent areas. *

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Feather River			Total	Yuba Carcass	Lower Sac Sport	% of total releases			% combined	
						Hatchery	Carcass	Sport				Hatchery	Carcass	Sport	Feather	Yuba+spt
In-basin FRH releases																
0601060403	Isleton	19990302	49,715	134,764	2.71	5			5			0.00%			0.00%	
0601060404	Isleton	19990302	50,864	137,879	2.71	3			3			0.00%			0.00%	
			100,579	272,643	2.71	8			8			0.00%			0.00%	
0601060814	Live Oak	19990511	51,144	52,402	1.02	111	49	65	226		55	0.21%	0.09%	0.12%	0.43%	0.11%
0601060815	Live Oak	19990511	51,043	52,298	1.02	133	50	64	246			0.25%	0.10%	0.12%	0.47%	
			102,187	104,700	1.02	244	99	129	472		55	0.23%	0.09%	0.12%	0.45%	0.05%
0501020714	Ryde-koket	19990331	25,873	26,003	1.01	30	2		32		80	0.11%	0.01%		0.12%	0.31%
0501020715	Ryde-koket	19990331	25,133	25,259	1.01	26	6		31			0.10%	0.02%		0.12%	
052414	Ryde-koket	19990428	26,489	26,622	1.01	119	77	32	228			0.45%	0.29%	0.12%	0.86%	
052415	Ryde-koket	19990428	25,814	25,944	1.01	126	90	128	344			0.48%	0.35%	0.49%	1.32%	
			103,309	103,828	1.01	300	175	159	635		80	0.29%	0.17%	0.15%	0.61%	0.08%
0601060907	Verona	19990322	53,987	144,386	2.67	197	191	83	472			0.14%	0.13%	0.06%	0.33%	
0601060908	Verona	19990322	50,989	136,368	2.67	213	195		408			0.16%	0.14%		0.30%	
0601060909	Verona	19990322	50,804	136,180	2.68	190	57		247			0.14%	0.04%		0.18%	
0601060910	Verona	19990322	51,202	137,247	2.68	155	35	84	274			0.11%	0.03%	0.06%	0.20%	
			206,982	554,181	2.68	755	478	167	1,400			0.14%	0.09%	0.03%	0.25%	
0501020706	West Sacramento	19990504	25,585	25,922	1.01	76	51	32	159		21	0.30%	0.20%	0.12%	0.61%	0.08%
0501020707	West Sacramento	19990504	25,633	25,971	1.01	72	29		101			0.28%	0.11%		0.39%	
052324	West Sacramento	19990430	25,695	25,824	1.01	92	113	32	237			0.36%	0.44%	0.12%	0.92%	
052325	West Sacramento	19990430	25,977	26,108	1.01	74	19		93			0.29%	0.07%		0.36%	
052416	West Sacramento	19990415	25,621	26,011	1.02	72	48		120			0.28%	0.18%		0.46%	
052417	West Sacramento	19990415	26,174	26,573	1.02	82	87	63	232		21	0.31%	0.33%	0.24%	0.87%	0.08%
			154,685	156,409	1.01	470	346	126	942		42	0.30%	0.22%	0.08%	0.60%	0.03%
In-basin FRH releases totals			667,742	1,191,761	1.78	1,777	1,099	582	3,457		177	0.15%	0.09%	0.05%	0.29%	0.01%
Trucked FRH releases																
052326	Port Chicago	19990426	25,576	270,562	10.58	545	429		974			0.20%	0.16%		0.36%	
052327	Port Chicago	19990426	25,518	269,949	10.58	706	351	348	1,404		623	0.26%	0.13%	0.13%	0.52%	0.23%
			51,094	540,511	10.58	1,251	780	348	2,378		623	0.23%	0.14%	0.06%	0.44%	0.12%
062631	Wickland Oil Net Pen	19990607	50,877	538,583	10.59	2,076	1,580	992	4,648	85	1248	0.39%	0.29%	0.18%	0.86%	0.25%
062632	Wickland Oil Net Pen	19990607	50,893	538,753	10.59	1,883	1,586		3,469	21	217	0.35%	0.29%		0.64%	0.04%
062633	Wickland Oil Net Pen	19990607	51,964	550,090	10.59	1,712	2,851	662	5,224	21	217	0.31%	0.52%	0.12%	0.95%	0.04%
062634	Wickland Oil Net Pen	19990607	50,928	539,123	10.59	1,776	1,874	662	4,312	21		0.33%	0.35%	0.12%	0.80%	0.00%
062635	Wickland Oil Net Pen	19990607	50,883	538,647	10.59	1,701	1,636	1,654	4,991		624	0.32%	0.30%	0.31%	0.93%	0.12%
062636	Wickland Oil Net Pen	19990607	50,932	539,166	10.59	2,044	1,138	1,323	4,505			0.38%	0.21%	0.25%	0.84%	
062637	Wickland Oil Net Pen	19990607	49,140	520,196	10.59	1,220	1,424	662	3,305		217	0.23%	0.27%	0.13%	0.64%	0.04%
062638	Wickland Oil Net Pen	19990607	50,827	538,054	10.59	1,658	2,647	348	4,654	21		0.31%	0.49%	0.06%	0.86%	0.00%
			406,444	4,302,612	10.59	14,070	14,736	6,303	35,109	169	2,523	0.33%	0.34%	0.15%	0.82%	0.06%
Trucked FRH releases totals			457,538	4,843,123	10.59	15,321	15,515	6,651	37,487	169	3,146	0.32%	0.32%	0.14%	0.77%	0.07%

Appendix 2b. Feather River Hatchery '98 brood year fall chinook recoveries in Feather River Basin & adjacent areas. *

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Feather River			Total	Yuba	Lower Sac	% of total releases			% combined	
						Hatchery	Carcass	Sport		Carcass	Sport	Hatchery	Carcass	Sport	Feather	Yuba+spt
Extra/experimental FRH releases																
0501020712	Georgianna Slough	19990330	26,330	26,596	1.01	27	8		34			0.10%	0.03%		0.13%	
0501020713	Georgianna Slough	19990330	26,248	26,492	1.01	26	6	32	63	2		0.10%	0.02%	0.12%	0.24%	
0501020801	Georgianna Slough	19990427	22,577	22,690	1.01	63	8		72			0.28%	0.04%		0.32%	
0501020802	Georgianna Slough	19990427	27,393	27,531	1.01	85	35		119			0.31%	0.13%		0.43%	
			102,548	103,309	1.01	200	57	32	288	2		0.19%	0.05%	0.03%	0.28%	
0501020708	Mokelumne R, Mouth	19990301	25,414	25,801	1.02	1			1			0.00%			0.00%	
0501020709	Mokelumne R, Mouth	19990301	25,649	26,040	1.02		2		2				0.01%		0.01%	
0501020710	Mokelumne R, Mouth	19990301	27,943	28,369	1.02											
0501020711	Mokelumne R, Mouth	19990301	24,721	25,097	1.02											
			103,727	105,307	1.02	1	2		3			0.00%	0.00%		0.00%	
0601060705	Yolo Bypass Elkhorn	19990211	26,316	26,475	1.01	5			5			0.02%			0.02%	
0601060706	Yolo Bypass Elkhorn	19990211	25,845	26,001	1.01	10			10			0.04%			0.04%	
0601060707	Yolo Bypass Elkhorn	19990211	26,029	26,186	1.01	9			9			0.04%			0.04%	
0601060708	Yolo Bypass Elkhorn	19990211	25,692	25,847	1.01	11			11			0.04%			0.04%	
0601060701	Yolo Bypass Road 16	19990211	25,241	25,995	1.03	5	3		8			0.02%	0.01%		0.03%	
0601060702	Yolo Bypass Road 16	19990211	27,699	28,526	1.03	3	3		6			0.01%	0.01%		0.02%	
0601060703	Yolo Bypass Road 16	19990211	25,262	26,016	1.03	2			2			0.01%			0.01%	
0601060704	Yolo Bypass Road 16	19990211	25,269	26,024	1.03	4	2		6	2	21	0.02%	0.01%		0.02%	
			207,353	211,070	1.02	50	8		58	2	21	0.02%	0.00%		0.03%	
						251	66	32	349	4	21	0.06%	0.02%	0.01%	0.08%	
Extra/experimental FRH releases totals			413,628	419,686	1.01	251	66	32	349	4	21	0.06%	0.02%	0.01%	0.08%	

Appendix 2c. Feather River Hatchery '98 brood year fall chinook recoveries outside Feather River Basin.

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Sacramento River Basin						San Joaquin River Basin				Oregon	Out of Basin	
						Coleman Hatchery	Up Sac R & Tribs Sport Carcass		American Hatchery Carcass Sport		Mokelumne River Hatchery Carcass	Stanislaus R. Carcass	Merced River Hatchery Carcass		Hatchery	Total count	% of release	
In-basin FRH releases																		
0601060403	Isleton	19990302	49,715	134,764	2.71													
0601060404	Isleton	19990302	50,864	137,879	2.71													
			100,579	272,643	2.71													
0601060814	Live Oak	19990511	51,144	52,402	1.02													
0601060815	Live Oak	19990511	51,043	52,298	1.02													
			102,187	104,700	1.02													
0501020714	Ryde-koket	19990331	25,873	26,003	1.01	3	9										12	0.05%
0501020715	Ryde-koket	19990331	25,133	25,259	1.01	2	15										17	0.07%
052414	Ryde-koket	19990428	26,489	26,622	1.01	2	18	1									21	0.08%
052415	Ryde-koket	19990428	25,814	25,944	1.01		7	1									8	0.03%
			103,309	103,828	1.01	7	48	2									57	0.05%
0601060907	Verona	19990322	53,987	144,386	2.67		21										21	0.01%
0601060908	Verona	19990322	50,989	136,368	2.67	5											5	0.00%
0601060909	Verona	19990322	50,804	136,180	2.68													
0601060910	Verona	19990322	51,202	137,247	2.68													
			206,982	554,181	2.68	5	21										26	0.00%
0501020706	West Sacramento	19990504	25,585	25,922	1.01	3											3	0.01%
0501020707	West Sacramento	19990504	25,633	25,971	1.01		3	2	3								8	0.03%
052324	West Sacramento	19990430	25,695	25,824	1.01													
052325	West Sacramento	19990430	25,977	26,108	1.01		3	2									5	0.02%
052416	West Sacramento	19990415	25,621	26,011	1.02			1									1	0.00%
052417	West Sacramento	19990415	26,174	26,573	1.02		3	3									6	0.02%
			154,685	156,409	1.01	3	10	8	3								24	0.02%
In-basin FRH releases totals			667,742	1,191,761	1.78	15	79	10	3								107	0.01%
Trucked FRH releases																		
052326	Port Chicago	19990426	25,576	270,562	10.58	11											11	0.00%
052327	Port Chicago	19990426	25,518	269,949	10.58	11											11	0.00%
			51,094	540,511	10.58	21											21	0.00%
062631	Wickland Oil Net Pen	19990607	50,877	538,583	10.59	11	59	11					11		11		101	0.02%
062632	Wickland Oil Net Pen	19990607	50,893	538,753	10.59	21	70	11		11							112	0.02%
062633	Wickland Oil Net Pen	19990607	51,964	550,090	10.59	74	94	11					11				189	0.03%
062634	Wickland Oil Net Pen	19990607	50,928	539,123	10.59	11	653	374	21	32							1,090	0.20%
062635	Wickland Oil Net Pen	19990607	50,883	538,647	10.59	21	94	374									488	0.09%
062636	Wickland Oil Net Pen	19990607	50,932	539,166	10.59	11	198	374					193				775	0.14%
062637	Wickland Oil Net Pen	19990607	49,140	520,196	10.59	32	287			11				132			461	0.09%
062638	Wickland Oil Net Pen	19990607	50,827	538,054	10.59	11	23	21		11				21			86	0.02%
			406,444	4,302,612	10.59	191	1,476	1,121	74	64		193	21	153	11		3,303	0.08%
Trucked FRH releases totals			457,538	4,843,123	10.59	212	1,476	1,121	74	64	193	21	153	11			3,324	0.07%

Appendix 2c. Feather River Hatchery '98 brood year fall chinook recoveries outside Feather River Basin.

Cwtcode	Release Site	Release date	# CWT tagged	Total # released	Prod Factor	Sacramento River Basin					San Joaquin River Basin				Oregon	Out of Basin	
						Coleman Hatchery	Up Sac R & Tribs Sport	Carcass	American Hatchery	Carcass	Sport	Mokelumne River Hatchery	Carcass	Stanislaus R. Carcass	Merced River Hatchery	Carcass	Hatchery
Extra/experimental FRH releases																	
0501020712	Georgianna Slough	19990330	26,330	26,596	1.01		6	36								41	0.16%
0501020713	Georgianna Slough	19990330	26,248	26,492	1.01	2										2	0.01%
0501020801	Georgianna Slough	19990427	22,577	22,690	1.01	1	6	36								42	0.19%
0501020802	Georgianna Slough	19990427	27,393	27,531	1.01	2	6		1	36						45	0.16%
			102,548	103,309	1.01	5	17	71	1	36						130	0.13%
0501020708	Mokelumne R, Mouth	19990301	25,414	25,801	1.02	2										2	0.01%
0501020709	Mokelumne R, Mouth	19990301	25,649	26,040	1.02												
0501020710	Mokelumne R, Mouth	19990301	27,943	28,369	1.02	1	103									104	0.37%
0501020711	Mokelumne R, Mouth	19990301	24,721	25,097	1.02												
			103,727	105,307	1.02	3	103									106	0.10%
0601060705	Yolo Bypass Elkhorn	19990211	26,316	26,475	1.01												
0601060706	Yolo Bypass Elkhorn	19990211	25,845	26,001	1.01												
0601060707	Yolo Bypass Elkhorn	19990211	26,029	26,186	1.01		39									39	0.15%
0601060708	Yolo Bypass Elkhorn	19990211	25,692	25,847	1.01	1										1	0.00%
0601060701	Yolo Bypass Road 16	19990211	25,241	25,995	1.03	1	3									4	0.02%
0601060702	Yolo Bypass Road 16	19990211	27,699	28,526	1.03		9									9	0.03%
0601060703	Yolo Bypass Road 16	19990211	25,262	26,016	1.03		10									10	0.04%
0601060704	Yolo Bypass Road 16	19990211	25,269	26,024	1.03	4	3									8	0.03%
			207,353	211,070	1.02	6	64									71	0.03%
Extra/experimental FRH releases totals			413,628	419,686	1.01	14	184	71	1	36						307	0.07%

Appendix 3a. Contribution of age 2 FRH fall chinook (brood year 1998) to ocean salmon sport fishery by release group, time, and port area.

Release	Major	FRH '98 brood year fall chinook recoveries										FRH '98 brood year fall chinook contribution to fishery									
Group	Age	Port	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	
INBF	2	NO							5		5							0.6%		0.2%	
INBF	2	CO							1	1	3							0.0%	0.1%	0.0%	
INBF	2	KO								9	9								0.1%	0.1%	
INBF	2	KC							4	8	12							0.1%	0.1%	0.1%	
INBF	2	FB						18	3		21					0.3%	0.0%			0.1%	
INBF	2	SF						105	53	39	197						0.6%	0.6%	0.5%	0.3%	
INBF	2	MO						5	29	25	34	93				0.0%	0.2%	0.2%	1.1%	0.1%	
		Total						5	151	93	92	340				0.0%	0.4%	0.2%	0.3%	0.2%	

Group	Age	Port	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total
TRKF	2	NO							21		21							2.4%		0.7%
TRKF	2	CO							78	19	96							1.1%	0.7%	1.0%
TRKF	2	KO								36	36								0.5%	0.3%
TRKF	2	KC								40	40								0.6%	0.3%
TRKF	2	FB						216	137	36	388					3.8%	1.7%	0.5%	1.6%	
TRKF	2	SF						936	883	853	2,671					5.7%	10.4%	11.8%	4.7%	
TRKF	2	MO						341	686	398	1,425					2.6%	6.4%	13.3%	1.8%	
		Total						1,493	1,804	1,381	4,678					3.9%	4.4%	3.9%	2.4%	

Group	Age	Port	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total
XHAF	2	NO							2		2							0.2%		0.1%
XHAF	2	CO																		
XHAF	2	KO																	0.1%	0.0%
XHAF	2	KC								4	4									
XHAF	2	FB						7			7					0.1%				0.0%
XHAF	2	SF					3	7	32	25	68				0.03%	0.04%	0.38%	0.35%	0.12%	
XHAF	2	MO						4	19	6	29						0.03%	0.18%	0.20%	0.04%
		Total					3	18	53	35	110					0.0%	0.0%	0.1%	0.1%	0.1%

Total all releases 5,129

Sport Fishery Ocean Salmon Landings

Major Port Area	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	
NO (north of Falcon)	700	500		50	100	100	900	600	2,950							3.2%		1.0%	
CO (Coos Bay)	10			50	50	50	7,000	2,600	9,760							1.1%	0.8%	1.0%	
KO (KMZ Oregon)	500	300			50	400	2,100	8,000	11,350									0.6%	0.4%
KC- KMZ (California)	200				300	2,300	3,800	6,500	13,100							0.1%	0.8%	0.4%	
FB (Fort Bragg)	200				700	2,700	5,700	8,100	24,700						4.2%	1.7%	0.5%	1.7%	
SF (San Francisco)	6,200	2,600		5,700	10,200	16,300	8,500	7,200	56,700					0.0%	6.4%	11.4%	12.7%	5.2%	
MO (Monterey)	100			33,900	19,200	13,300	10,800	3,000	80,300					0.0%	2.8%	6.8%	14.6%	1.9%	
		Total	7,910	3,400		40,400	32,600	38,150	41,200	35,200	198,860				0.0%	4.4%	4.7%	4.3%	2.6%

Appendix 3b. Contribution of age 2 FRH fall chinook (brood year 1998) to ocean salmon commercial fishery by release group, time, and port area.

Release Group	Age	Major Port	FRH '98 brood year fall chinook recoveries									Total	FRH '98 brood year fall chinook contribution to fishery									Total
			Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-99		Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00			
INBF	2	NO																				
INBF	2	CO																				
INBF	2	KO																				
INBF	2	KZ																				
INBF	2	FB																				
INBF	2	SF						4			4						0.0%			0.0%		
INBF	2	MO																				
Total								4			4						0.0%			0.0%		
TRKF	2	NO																				
TRKF	2	CO																				
TRKF	2	KO																				
TRKF	2	KZ																				
TRKF	2	FB																				
TRKF	2	SF						34			36						0.0%		0.1%	0.0%		
TRKF	2	MO																				
Total								34			36						0.0%		0.0%	0.0%		
XHAF	2	NO									3								0.0%	0.0%		
XHAF	2	CO																				
XHAF	2	KO																				
XHAF	2	KZ																				
XHAF	2	FB																				
XHAF	2	SF																				
XHAF	2	MO						3			3						0.0%			0.0%		
Total								3			3						0.0%		0.0%	0.0%		

Total all releases 80

Commercial Fishery Ocean Salmon Landings

Major Port Area	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total	Sep-99	Oct-99	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Total
NO (north of Falcon)	700	1,010		700	4,600	9,600	5,000	20,000	41,610								0.0%	0.0%
CO (Coos Bay)	1,100	2,700		600	1,500	1,900	14,800	27,200	49,800									
KO (KMZ Oregon)	30	400			50			1,400	1,880									
KC- KMZ (California)	2,900								2,900									
FB (Fort Bragg)	2,400								2,400									
SF (San Francisco)	12,200				83,000	76,100	36,100	25,700	233,100					0.0%	0.0%		0.1%	0.0%
MO (Monterey)	1,000				121,800	62,200	11,200	1,300	197,500					0.0%				0.0%
Total	20,330	4,110		1,300	210,950	149,800	67,100	75,600	529,190					0.0%	0.0%		0.1%	0.0%

Appendix 3c. Contribution of age 3 FRH fall chinook (brood year 1998) to ocean salmon sport fishery by release group, time, and port area.

Release		Major	FRH '98 brood year fall chinook recoveries									FRH '98 brood year fall chinook contribution to fishery								
Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
INBF	3	NO							20	2	22							0.9%	0.1%	0.3%
INBF	3	CO	2					10	28		40	0.5%					0.7%	0.5%		0.4%
INBF	3	KO		2				10	2	14	37		0.3%			1.2%	0.2%	1.1%	0.3%	0.5%
INBF	3	KC	4					45	32	13	95	0.7%				2.4%	0.8%	0.5%		0.8%
INBF	3	FB			5	2	6	56	81	35	185			0.9%	0.5%	0.2%	0.9%	0.8%	0.7%	0.7%
INBF	3	SF	9	66		39	62	30	183	41	430	0.1%	0.8%		1.2%	1.0%	1.9%	1.6%	0.6%	0.9%
INBF	3	MO	4		38	288	76		17		424	0.2%		4.8%	2.0%	2.5%		1.1%		2.0%
Total			19	68	43	329	199	130	356	86	1232	0.1%	0.7%	3.3%	1.8%	1.3%	0.8%	1.0%	0.4%	0.9%

Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
TRKF	3	NO							476	454	930							20.7%	17.5%	13.3%
TRKF	3	CO	25					60	606	68	758	4.9%					4.3%	11.0%	3.1%	7.7%
TRKF	3	KO	36				79	124	168	63	471	7.3%				9.9%	12.4%	14.0%	2.1%	6.5%
TRKF	3	KC	44					189	469	138	889	7.3%				9.9%	11.2%	5.3%	1.9%	7.5%
TRKF	3	FB				27	263	820	1,491	161	2,761				5.3%	9.7%	13.0%	14.3%	3.0%	10.2%
TRKF	3	SF	308	721		696	668	256	2,425	967	6,042	3.8%	8.3%		21.1%	10.8%	16.0%	21.7%	14.4%	13.2%
TRKF	3	MO	171		336	3,810	1,036	37	91		5,481	10.1%		42.0%	26.8%	34.5%	18.6%	5.7%		25.4%
Total			584	721	336	4532	2235	1766	5396	1761	17331	4.3%	7.1%	25.8%	25.2%	15.1%	11.5%	15.5%	7.9%	13.3%

Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
XHAF	3	NO	4						4		7	0.5%						0.2%		0.1%
XHAF	3	CO							2		2							0.0%		0.0%
XHAF	3	KO					8	3	2		13					1.0%	0.3%	0.2%		0.2%
XHAF	3	KC						9	23	9	41					0.5%	0.5%	0.3%		0.4%
XHAF	3	FB							5	15	20							0.0%	0.3%	0.1%
XHAF	3	SF	4	18		3	16		34	13	87	0.1%	0.2%		0.1%	0.3%		0.3%	0.2%	0.2%
XHAF	3	MO	8			54	15				78	0.5%			0.4%	0.5%				0.4%
Total			17	18		57	48	26	56	28	249	0.1%	0.2%		0.3%	0.3%	0.2%	0.2%	0.1%	0.2%

Total all releases 18,812

Sport Fishery Ocean Salmon Landings

Major Port Area	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	
NO (north of Falcon)	800	600			100	600	2,300	2,600	7,000	0.5%						21.7%	17.5%	13.7%	
CO (Coos Bay)	500	100			100	1,400	5,500	2,200	9,800	5.4%					5.0%	11.6%	3.1%	8.2%	
KO (KMZ Oregon)	500	800			800	1,000	1,200	3,000	7,300	7.3%	0.3%			12.1%	12.9%	15.3%	2.4%	7.1%	
KC- KMZ (California)	600				1,900	4,200	2,600	2,500	11,800	8.0%				12.8%	12.5%	6.2%	1.9%	8.7%	
FB (Fort Bragg)	1,300		500	500	2,700	6,300	10,400	5,300	27,000			0.9%	5.8%	10.0%	13.9%	15.2%	4.0%	11.0%	
SF (San Francisco)	8,100	8,700		3,300	6,200	1,600	11,200	6,700	45,800	4.0%	9.3%		22.4%	12.0%	17.9%	23.6%	15.2%	14.3%	
MO (Monterey)	1,700		800	14,200	3,000	200	1,600	100	21,600	10.8%		46.7%	29.2%	37.6%	18.6%	6.8%		27.7%	
Total		13,500	10,200	1,300	18,000	14,800	15,300	34,800	22,400	130,300	4.6%	7.9%	29.1%	27.3%	16.8%	12.6%	16.7%	8.4%	14.4%

Appendix 3d. Contribution of age 3 FRH fall chinook (brood year 1998) to ocean salmon commercial fishery by release group, time, and port area.

Release		FRH '98 brood year fall chinook recoveries										FRH '98 brood year fall chinook contribution to fishery								
Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
INBF	3	NO	2	29		65	290	213	134	114	846	0.0%	0.3%		0.7%	0.6%	0.6%	0.6%	0.2%	0.5%
INBF	3	CO		10		57	106	51	106	43	372		0.2%		0.6%	0.7%	0.5%	0.7%	0.3%	0.5%
INBF	3	KO		2				2		10	13		0.2%				0.5%		0.7%	0.3%
INBF	3	KZ																		
INBF	3	FB	3				20				23	0.0%				0.5%				0.1%
INBF	3	SF					504	108	595	125	1332					1.3%	1.3%	1.0%	0.9%	0.9%
INBF	3	MO					582	94	17		694					1.9%	2.8%	0.7%		1.9%
Total			5	40		122	1502	468	852	291	3280	0.0%	0.3%		0.7%	1.1%	0.9%	0.8%	0.4%	0.7%

Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
TRKF	3	NO	27	64		621	3,356	2,703	2,900	5,268	14,939	0.2%	0.7%		6.9%	7.2%	8.2%	12.4%	11.1%	8.1%
TRKF	3	CO	55	54		302	1,280	1,103	2,133	991	5,918	0.4%	1.0%		3.3%	9.0%	10.9%	15.0%	7.5%	7.4%
TRKF	3	KO						21		94	115						5.3%		7.2%	2.9%
TRKF	3	KZ																		
TRKF	3	FB					374				374					8.7%				1.1%
TRKF	3	SF					7,031	960	7,220	1,115	16,326					18.2%	11.8%	11.9%	8.0%	10.8%
TRKF	3	MO					7,142	747	419		8,308					23.8%	22.0%	17.5%		23.1%
Total			82	118		922	19182	5534	12673	7468	45,979	0.1%	0.8%		5.1%	14.3%	10.1%	12.6%	9.8%	9.3%

Group	Age	Port	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total
XHAF	3	NO	4	3		12	12	17	11	21	81	0.0%	0.0%		0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
XHAF	3	CO	4				11	10	11	4	41	0.0%				0.1%	0.1%	0.1%	0.0%	0.1%
XHAF	3	KO		2							2		0.2%							0.0%
XHAF	3	KZ																		
XHAF	3	FB	1				2				3	0.0%				0.0%				0.0%
XHAF	3	SF					123	20	103	13	260					0.3%	0.2%	0.2%	0.1%	0.2%
XHAF	3	MO					96	10	6		111					0.3%	0.3%	0.2%		0.3%
Total			10	5		12	244	57	131	39	498	0.0%	0.0%		0.1%	0.2%	0.1%	0.1%	0.1%	0.1%

Total all releases 49,757

Commercial Fishery Ocean Salmon Landings

Major Port Area	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total	Sep-00	Oct-00	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Total		
NO (north of Falcon)	16,400	8,950		9,000	46,300	32,800	23,300	47,500	184,250	0.2%	1.1%		7.8%	7.9%	8.9%	13.1%	11.4%	8.6%		
CO (Coos Bay)	13,900	5,350		9,200	14,300	10,100	14,200	13,200	80,250	0.4%	1.2%		3.9%	9.8%	11.5%	15.8%	7.9%	7.9%		
KO (KMZ Oregon)	1,200	900			200	400		1,300	4,000		0.3%				5.8%		8.0%	3.3%		
KC- KMZ (California)	2,100								2,100											
FB (Fort Bragg)	30,700				4,300				35,000	0.0%				9.2%				1.1%		
SF (San Francisco)	29,000				38,700	8,100	60,700	14,000	150,500					19.8%	13.4%	13.0%	9.0%	11.9%		
MO (Monterey)					30,000	3,400	2,400	100	35,900					26.1%	25.0%	18.4%		25.4%		
Total			93,300	15,200		18,200	133,800	54,800	100,600	76,100	492,000	0.1%	1.1%		5.8%	15.6%	11.1%	13.6%	10.2%	10.1%

Appendix 3e. Contribution of age 4 FRH fall chinook (brood year 1998) to ocean salmon sport fishery by release group, time, and port area.

Release		Major		FRH '98 brood year fall chinook recoveries							Total	FRH '98 brood year fall chinook contribution to fishery								Total	
Group	Age	Port	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02		Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02		
INBF	4	NO	7					3			10	0.4%				1.1%				0.1%	
INBF	4	CO				5			4		9			5.1%				0.0%		0.0%	
INBF	4	KO	3						6		9	1.0%					0.2%			0.1%	
INBF	4	KC	14					5	4		24	1.0%			0.2%	0.1%				0.2%	
INBF	4	FB					8	19	13		40				0.2%	0.2%	0.1%			0.1%	
INBF	4	SF					5	21	16	9	51				0.0%	0.1%	0.0%	0.1%		0.1%	
INBF	4	MO			2	54				4	60			0.1%	0.2%			0.1%		0.1%	
Total			24		2	60	18	55	36	9	202	0.2%		0.1%	0.2%	0.1%	0.1%	0.1%	0.0%	0.1%	
Group	Age	Port	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	
TRKF	4	NO	88				63	66	54		271	5.2%				62.7%	22.0%	0.9%		2.2%	
TRKF	4	CO							113		113							1.1%		0.6%	
TRKF	4	KO		30			37	62			129		3.3%		7.4%	2.5%				1.9%	
TRKF	4	KC						47			47					0.9%				0.3%	
TRKF	4	FB				190	482	330	390	31	1,422			7.6%	12.0%	3.8%	3.4%	0.7%		4.5%	
TRKF	4	SF	37			73	173	428	697	134	1,541	0.6%		1.5%	1.3%	2.4%	2.0%	1.0%		1.6%	
TRKF	4	MO			191	659	212	85	124		1,270			6.8%	2.2%	4.4%	2.2%	2.3%		2.7%	
Total			124	30	191	922	966	1017	1378	165	4793	1.1%	0.5%	6.3%	2.4%	3.8%	2.4%	2.0%	0.5%		2.1%
Group	Age	Port	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	
XHAF	4	NO																			
XHAF	4	CO																			
XHAF	4	KO		3							3		0.3%							0.0%	
XHAF	4	KC																			
XHAF	4	FB						5			5					0.1%				0.0%	
XHAF	4	SF																			
XHAF	4	MO																			
Total				3				5			8		0.0%				0.0%			0.0%	

Total all releases 5,003

Sport Fishery Ocean Salmon Landings

Major Port Area	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total									
NO (north of Falcon)	1,700	620		20	100	300	6,400	3,200	12,340	5.5%				62.7%	23.1%	0.9%		2.3%									
CO (Coos Bay)	300	10		100	200	4,800	10,200	2,800	18,410				5.1%			1.1%		0.7%									
KO (KMZ Oregon)	300	900			500	2,500	40	2,700	6,940	1.0%	3.6%			7.4%	2.7%			2.0%									
KC- KMZ (California)	1,500				2,500	5,200	600	5,900	15,700	1.0%				0.2%	1.0%			0.5%									
FB (Fort Bragg)	400	20	210	2,500	4,000	8,600	11,600	4,200	31,530				7.6%	12.2%	4.1%	3.5%	0.7%	4.7%									
SF (San Francisco)	6,600	4,300		5,000	13,200	18,000	34,300	13,100	94,500	0.6%			1.5%	1.3%	2.5%	2.1%	1.1%	1.7%									
MO (Monterey)	100		2,800	30,300	4,800	3,800	5,400	600	47,800			6.9%	2.4%	4.4%	2.2%	2.4%		2.8%									
Total										10,900	5,850	3,010	37,920	25,300	43,200	68,540	32,500	227,220	1.4%	0.6%	6.4%	2.6%	3.9%	2.5%	2.1%	0.5%	2.2%

Appendix 3f. Contribution of age 4 FRH fall chinook (brood year 1998) to ocean salmon commercial fishery by release group, time, and port area.

Release Group	Age	Major Port	FRH '98 brood year fall chinook recoveries								Total	FRH '98 brood year fall chinook contribution to fishery								Total
			Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02		Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	
INBF	4	NO	73	43		4	21	3	3	2	150	0.3%	0.4%		0.1%	0.2%	0.0%	0.0%	0.0%	0.2%
INBF	4	CO	28			3		7			38	0.5%			0.0%		0.0%			0.0%
INBF	4	KO	4								4	0.4%								0.1%
INBF	4	KZ	34								34	0.6%								0.4%
INBF	4	FB	14						8	18	41	0.1%						0.0%	0.0%	0.1%
INBF	4	SF					47	40	22	14	123					0.1%	0.1%	0.0%	0.1%	0.0%
INBF	4	MO					11	24	4		38					0.1%	0.1%	0.0%		0.1%
Total			153	43		7	79	75	37	35	429	0.3%	0.2%		0.1%	0.1%	0.0%	0.0%	0.0%	0.1%

TRKF	4	NO	2,463	660		68	216	202	98	37	3,746	10.1%	5.8%		1.6%	1.6%	1.7%	1.4%	0.3%	4.2%
TRKF	4	CO	394	202		63	118	405	32	61	1,275	6.3%	4.0%		1.0%	1.2%	0.8%	0.6%	0.4%	1.3%
TRKF	4	KO	81	23							105	8.1%	3.3%							2.4%
TRKF	4	KZ	442								442	8.0%								5.8%
TRKF	4	FB	189						218	328	735	1.8%						1.2%	0.8%	1.0%
TRKF	4	SF	105				1,174	1,124	780	287	3,469	0.9%				1.8%	1.6%	0.9%	2.1%	1.4%
TRKF	4	MO					454	509	140		1,103					2.1%	2.1%	0.7%		1.6%
Total			3,673	885		131	1,962	2,241	1,268	713	10,874	6.2%	4.2%		1.2%	1.8%	1.5%	0.9%	0.8%	1.8%

XHAF	4	NO	9	9							18	0.0%	0.1%							0.0%
XHAF	4	CO				3		4			7				0.1%		0.0%			0.0%
XHAF	4	KO																		0.0%
XHAF	4	KZ	4								4	0.1%								0.0%
XHAF	4	FB																		0.0%
XHAF	4	SF						6	4		10							0.0%	0.0%	0.0%
XHAF	4	MO																		0.0%
Total			13	9		3		10	4		39	0.0%	0.0%		0.0%		0.0%	0.0%		0.0%

Total all releases 11,342

Commercial Fishery Ocean Salmon Landings

Major Port Area	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total	Sep-01	Oct-01	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Total		
NO (north of Falcon)	24,300	11,440	4,100	4,400	13,500	12,100	6,800	13,000	89,640	10.5%	6.2%		1.7%	1.8%	1.7%	1.5%	0.3%	4.4%		
CO (Coos Bay)	6,200	5,000	2,600	6,200	9,900	47,800	5,500	15,300	98,500	6.8%	4.0%		1.1%	1.2%	0.9%	0.6%	0.4%	1.3%		
KO (KMZ Oregon)	1,000	700	10	100	100		1,000	1,500	4,410	8.6%	3.3%							2.5%		
KC- KMZ (California)	5,500							2,100	7,600	8.7%								6.3%		
FB (Fort Bragg)	10,700						18,600	40,800	70,100	1.9%						1.2%	0.8%	1.1%		
SF (San Francisco)	11,400	3,700			64,600	68,800	88,100	13,600	250,200	0.9%				1.9%	1.7%	0.9%	2.2%	1.4%		
MO (Monterey)	30				21,600	24,400	21,300	2,500	69,830					2.2%	2.2%	0.7%		1.6%		
Total			59,130	20,840	6,710	10,700	109,700	153,100	141,300	88,800	590,280	6.5%	4.5%		1.3%	1.9%	1.5%	0.9%	0.8%	1.9%

Appendix 3g. Contribution of age 5 FRH fall chinook (brood year 1998) to ocean salmon commercial fishery by release group, time, and port area.

Release Group	Major Age	Port	FRH '98 brood year fall chinook recoveries									Total	FRH '98 brood year fall chinook contribution to fishery									Total
			Sep-02	Oct-02	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-02		Oct-02	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03			
INBF	5	NO																				
INBF	5	CO																				
INBF	5	KO																				
INBF	5	KZ																				
INBF	5	FB																				
INBF	5	SF																				
INBF	5	MO																				
Total																						
TRKF	5	NO	47	48							16	111	0.1%	0.1%							0.1%	0.1%
TRKF	5	CO																				
TRKF	5	KO																				
TRKF	5	KC	21									21	0.2%									0.2%
TRKF	5	FB																				
TRKF	5	SF																				
TRKF	5	MO																				
Total			68	48							16	132	0.1%	0.1%							0.0%	0.0%
XHAF	5	NO					3					3				0.0%						0.0%
XHAF	5	CO																				
XHAF	5	KO																				
XHAF	5	KZ																				
XHAF	5	FB																				
XHAF	5	SF																				
XHAF	5	MO																				
Total							3					3				0.0%						0.0%
Total all releases											135											
Commercial Fishery Ocean Salmon Landings																						
Major Port Area	Sep-02	Oct-02	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Total	Sep-02	Oct-02	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Total				
NO (north of Falcon)	41,900	66,610	1,000	9,000	38,700	23,900	13,900	23,600	218,610	0.1%	0.1%			0.0%				0.1%	0.1%			
CO - Coos Bay	16,900	17,970	2,200	49,900	34,800	7,900	5,600	13,000	148,270													
KO- KMZ Oregon	1,300	2,800		100	600	500	1,100	1,100	7,500													
KC- KMZ CA	10,600								10,600	0.2%									0.2%			
FB (Fort Bragg)	5,900				30,300		70,500	83,800	190,500													
SF (San Francisco)	7,400	500			31,800	94,400	39,300	26,100	199,500													
MO (Monterey)	100				11,100	9,500	13,700	800	35,200													
Total	84,100	87,880	3,200	59,000	147,300	136,200	144,100	148,400	810,180	0.1%	0.1%			0.0%				0.0%	0.0%			