

Recovery of Coded-Wire Tags from Chinook Salmon in California's Central Valley Escapement, Inland Harvest, and Ocean Harvest in 2014

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INTRODUCTION

Each year, approximately 32 million fall-run Chinook salmon (*Oncorhynchus tshawytscha*) are produced at five hatcheries in California's Central Valley (CV): Coleman National Fish Hatchery (CFH), Feather River Hatchery (FRH), Nimbus Fish Hatchery (NIM), Mokelumne River Hatchery (MOK), and Merced River Hatchery (MER). Production from these hatcheries contributes to CV escapement and sport harvest while also supporting ocean fisheries in California and Oregon. Since 2007, a constant fractional marking (CFM) program has ensured that at least 25% of all CV hatchery fish are tagged with a microscopic (≤ 1 mm) coded-wire tag (CWT). Each CWT contains a binary or alpha-numeric code that identifies a specific release group of salmon (e.g., agency, species, run, brood year, hatchery or wild stock, release size, release date(s), release location(s), number tagged and untagged). Each salmon containing a CWT is also externally marked with a clipped adipose fin (ad-clip) to allow for easy visual identification.

This is the fifth annual report on the recovery of CFM CWTs in the CV and ocean fisheries. In 2014, approximately 63,000 CWTs were recovered and successfully read from ad-clipped Chinook salmon sampled in CV fall-, winter-, spring-, and late-fall-run natural area spawning surveys, at CV hatcheries, in the CV angler sport harvest, and in ocean salmon commercial and sport fisheries south of Cape Falcon (i.e., California and Oregon).

This report will focus primarily on the results of our analyses addressing the following questions:

- What are the proportions of hatchery- and natural-origin salmon in spawner returns to CV hatcheries and natural areas, in inland harvest, and in ocean fisheries? Of the hatchery component, what proportions originated from in-basin versus out-of-basin CWT release strategies?
- What are the relative recovery and stray rates for hatchery-origin salmon released in-basin versus salmon released into the waters of the Sacramento-San Joaquin River Delta, San Francisco-San Pablo bays, or coastal areas? How do recovery and stray rates differ between salmon acclimated in net pens and their siblings released directly into the water? Are these metrics affected by transporting salmon smolts down the Sacramento River by vessel and exposing them to river water prior to release in the bay?
- What are the relative recovery and contribution rates of hatchery-origin salmon, by run and release type, to ocean and inland harvests?

Please see previous annual CFM reports (Kormos et al. 2012, Palmer and Kormos 2013, 2015, Palmer et al. 2018) for more in-depth information and discussion regarding the CFM program, CWT marking and recovery programs in California, and the methods and analyses used in this report. Additional information on salmon escapement monitoring can be found in the Central Valley Chinook Salmon Escapement Monitoring Plan (Bergman et al. 2012) and other CV salmon population reports (Killam et al. 2014).

DATA AND METHODS

Inland Escapement Monitoring

During 2014, monitoring of salmon escapement occurred at all five salmon hatcheries and on major rivers and tributaries throughout the CV. In addition, an angler creel survey was conducted on sport fisheries in the Sacramento, Feather, American, and Mokelumne river basins. It should be noted that the late-fall-run escapement in the upper Sacramento River and at CFH in this report is considered the 2015 return year, however the escapement period began in late 2014.

Sampling and estimation methods (e.g., carcass surveys, snorkel surveys, weir counts) continue to vary among natural spawner surveys throughout the CV (Table 1); however, most surveys on major rivers and tributaries in 2014 adequately sampled (sample rate $\geq 20\%$) for ad-clipped fish. The sampling rate was generally lower for smaller creeks where biodata was collected over a few days and/or limited areas.

There were almost 117,100 salmon sampled, 35,100 ad-clipped salmon observed, and over 32,800 heads collected by various CV projects. Monitoring agencies and projects included the California Department of Fish and Wildlife (CDFW), California Department of Water Resources (DWR), East Bay Municipal Utility District (EBMUD), Pacific States Marine Fisheries Commission, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service (FWS), and the Yuba Accord River Management Team (YARMT). Most heads were processed by CDFW at their Santa Rosa and Sacramento CWT labs with the exception of heads collected at CFH, which were processed by FWS staff. A few hundred heads were also collected and processed by CDFW projects in Red Bluff and La Grange.

All estimates of CV escapement or harvest and the number of salmon sampled in this report were provided by individual monitoring projects or hatcheries.

Ocean Harvest Monitoring

In 2014, California sport and commercial ocean salmon fisheries (Table 2) continued to be less constrained than in the final years of the previous decade due to an increase in the ocean abundance forecast of both Sacramento River and Klamath River fall-run Chinook salmon. CDFW field staff sampled 89,400 salmon and collected 19,600 heads that were processed by the Santa Rosa CWT lab. An additional 13,000 heads collected in Oregon ocean sport and commercial fisheries during 2014 are also included in the analyses since Sacramento River fall Chinook is the primary stock harvested in fisheries south of Cape Falcon (PFMC 2016).

Each year, CDFW validates and uploads all CWT recoveries in California, along with their respective catch-sample data, to the Regional Mark Processing Center (RMPC), which is the central repository for west coast CWT recoveries. All 2014 inland and ocean CWT recoveries are publicly available on the RMPC website at www.rmpc.org.

CWT Data Analysis

A “master” release database of CWT codes recovered in 2014 was created to determine species, brood year, run, stock origin (hatchery or natural), release site, release date(s), number of salmon CWT tagged, total number of salmon released, and any other pertinent release information (e.g., trucked, net pen acclimation, disease issues). Since almost all CV salmon recovered are between the ages of two and five, all CWT release data for Chinook salmon brood years (BY) 2009 through 2012 was downloaded from the RMPC. Approximately 142 million CV salmon were released for these brood years, of which 51 million were marked and tagged utilizing 515 unique CWT codes. Although a few thousand natural-origin salmon are trapped, marked, and tagged each year, salmon produced by hatcheries make up more than 99% of all CWT releases. In 2014, there were 295 individual CWT codes recovered in the CV, primarily from age-2, age-3, and age-4 salmon. The CWT master file was updated with any additional information obtained for special CV salmon releases (e.g., barge study) and the production factor calculated for each CWT code. The production factor, F_{prod} , is the ratio of the total number of salmon released to the total number of salmon marked containing a CWT. Thus it is the total number of salmon (i.e., tagged and untagged) represented by each CWT recovery. F_{prod} was calculated for each CWT code and is defined as,

$$F_{prod} = (\text{Ad.CWT} + \text{Ad.noCWT} + \text{noAd.CWT} + \text{noAd.noCWT}) / \text{Ad.CWT},$$

where Ad.CWT is the number of salmon released with ad-clips and CWTs, Ad.noCWT is the number of salmon released with ad-clips but without CWTs (i.e., shed tags prior to release or CWT not correctly inserted), noAd.CWT is the number of salmon released without ad-clips but with CWTs, and noAd.noCWT is the number of salmon released without ad-clips and without CWTs. F_{prod} allows expansion to total hatchery production from observed recoveries of CV CWTs.

For this analysis, each CV Chinook salmon CWT release was classified into a “release type” based on the following criteria: hatchery or natural stock, run, release location, and holding strategy. All CV CWT codes were assigned by brood year into one of fourteen fall-run release types, two spring-run release types, one winter-run release type, and one late-fall-run release type:

Sacramento River Basin Fall-run Chinook salmon release types

CFHFh	Coleman National Fish Hatchery Fall-run h atchery releases (in-basin)
CFHFn	Coleman National Fish Hatchery Fall-run b ay n et pen releases (San Pablo Bay)
FRHFb	Feather River Hatchery Fall-run b arge study releases
FRHFe	Feather River Hatchery Fall-run experimental releases
FRHFn	Feather River Hatchery Fall-run b ay n et pen releases (San Pablo Bay)
FRHFnc	Feather River Hatchery Fall-run c oastal n et pen releases (Santa Cruz and Pillar Point)
FRHFtib	Feather River Hatchery Fall-run T iburon net pen releases (held several months)
NIMF	Nimbus Fish Hatchery Fall-run in-basin releases
NIMFn	Nimbus Fish Hatchery Fall-run b ay n et pen releases (San Pablo Bay)

San Joaquin River Basin Fall-run Chinook salmon release types

MOKF	Mokelumne River Hatchery Fall-run in-basin releases
MOKFn	Mokelumne River Hatchery Fall-run b ay n et pen releases (Sherman Island)

MOKFt	Mokelumne River Hatchery Fall-run trucked releases (no net pen acclimation)
MERF	Merced River Hatchery Fall-run in-basin releases
MERFt	Merced River Hatchery Fall-run trucked releases (no net pen acclimation)

Central Valley Spring-run Chinook salmon release types

FRHS	Feather River Hatchery Spring-run in-basin releases
FRHSSn	Feather River Hatchery Spring-run bay net pen releases (San Pablo Bay)

Sacramento River winter-run Chinook salmon release types

SacW	Sacramento River Winter-run supplementation natural production in-basin releases
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Central Valley Late-fall Chinook salmon release types

CFHLh	Coleman National Fish Hatchery Late-fall-run hatchery releases (in-basin)
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Note that not all release types occur every year and that release sites sometimes vary within a given release type (Table 3; Fig. 1). There were also a few problem CWT releases where fish were released utilizing multiple strategies (e.g., 25% of BY 2010 MOKFt acclimated in net pens prior to release, 15% of BY 2011 FRHFn released directly into bay). Thus, we urge caution when analyzing or comparing CWT recovery data from these release types.

To estimate the total escapement or harvest associated with each CWT recovery, each tag recovery was expanded by its respective F_{prod} and sample expansion factor, F_{samp} , which is defined as,

$$F_{\text{samp}} = 1 / (f_e \times f_a \times f_d),$$

where f_e is the fraction of the total salmon escapement sampled and visually examined for an ad-clip, f_a is the fraction of heads from ad-clipped salmon collected and processed, and f_d is the fraction of observed CWTs that were successfully decoded (Tables 4 and 5).

Salmon sampled in CV carcass surveys are generally classified as ‘fresh’ or ‘non-fresh’ based on criteria such as condition of the eyes (clear vs. opaque) or gills (pink vs. grey). Often the ad-clipped (marked) status of a non-fresh (i.e., decayed) salmon cannot be determined due to the deteriorating condition of the carcass. While condition criteria are somewhat ambiguous and classification may vary among surveys, the ad-clip rate of fresh salmon sampled in 2014 was generally higher than the rate observed in non-fresh fish (Appendix 1). Fresh carcass heads also contained CWTs at a slightly higher rate than heads collected from non-fresh fish. Furthermore, the sample sizes between fresh and non-fresh fish are very different; the number of non-fresh salmon sampled is greater than fresh salmon in surveys that collected fish condition.

Mohr and Satterthwaite (2013) demonstrated how the sampling differences noted above could negatively bias the estimates of hatchery contribution. However, they cautioned that using only CWT data from fresh fish could eliminate the occurrence of rare CWT codes in analyses due to the small sample sizes common with fresh carcasses in these surveys. As in previous CFM reports, the following equation developed by Mohr and Satterthwaite (2013) was used to calculate F_{samp} for carcass surveys collecting fish condition data, thus reducing the potential to

underestimate hatchery contribution while still incorporating CWT codes from both fresh and non-fresh fish:

$$F_{\text{samp}} = (N \times p_{\text{adc/fresh}} \times p_{\text{cwt/fresh,adc}}) / (n_{\text{valid cwt}}),$$

where N = estimated total escapement, $p_{\text{adc/fresh}}$ = proportion of fresh salmon sampled that were ad-clipped, $p_{\text{cwt/fresh,adc}}$ = proportion of ad-clipped fresh salmon that contained a CWT, and $n_{\text{valid cwt}}$ = total number of valid CWTs collected from fresh and decayed salmon.

To help differentiate between raw CWT recoveries, CWT recoveries expanded for production, CWTs expanded for sampling, and CWTs expanded for production and sampling, the following nomenclature is used:

CWT = Raw count CWT recoveries

CWT_{prod} = CWT recoveries expanded only by their respective production factor, F_{prod}

CWT_{samp} = CWT recoveries expanded only by their respective sample expansion factor, F_{samp}

CWT_{total} = CWT recoveries expanded by both F_{prod} and F_{samp}

Determining hatchery- and natural-origin proportions in CV escapement and harvest

To determine the contribution of hatchery- and natural-origin salmon, all CWT_{total} were summed to estimate the total number of hatchery salmon in each survey. The contribution of natural-origin salmon for each survey was then determined by subtracting the total number of hatchery salmon from the total escapement estimate, as follows:

$$\text{Estimate of natural-origin salmon} = \text{Total escapement estimate} - \sum_{i=1}^m CWT_{\text{total},i},$$

where m = total number of hatchery-origin CWT release groups identified in an escapement survey or hatchery.

Determining recovery rates of various release types in CV escapement and ocean harvest

To determine the relative CV recovery rate, R_{cwt} , of each unique CWT release group (i.e., code), all recoveries were expanded by their location-specific F_{samp} , summed over all recovery locations, and then divided by the total number of salmon tagged and released with this CWT. Since expanded recoveries for several individual CWT groups were less than 0.001% of the total number released, recovery rates are reported in recoveries per 100,000 CWT salmon released, as follows:

$$R_{\text{cwt}} = \sum_{j=1}^l CWT_{\text{samp},j} \text{ recoveries} / (\text{CWT release group size} / 100,000),$$

where $j (=1,2,3,,l)$ denotes recovery location.

Data from all CWT release groups belonging to the same brood year and release type were combined and an overall release type-specific CV recovery rate, R_{type} , was calculated as:

$$R_{\text{type}} = \sum_{j=1}^l \sum_{k=1}^n CWT_{\text{samp},j,k} / (\sum_{k=1}^n \text{release group size of CWT}_k / 100,000),$$

where $k (=1,2,3,,n)$ denotes release group.

Determining stray proportions of various release groups in CV escapement

To be consistent with previous reports (Kormos et al. 2012, Palmer-Zwahlen and Kormos 2013, 2015, Palmer-Zwahlen et al. 2018), basin-of-origin is defined as the drainage of any major river as it pertains to the geographic region of the CV where a hatchery is located. The CV is divided into five hatchery basins: upper Sacramento River (including Battle Creek), Feather River (including the Yuba River), American River, Mokelumne River, and Merced River. Hatchery-origin salmon not returning to their basin-of-origin or to streams and rivers not included in any hatchery basin (e.g., Mill Creek, Butte Creek, Stanislaus River) are considered strays.

Appendices 2 and 3 present alternative recovery and stray rates for CFH and FRH CWT releases based on the assumption that recoveries in the upper Sacramento River and Yuba River, respectively, are strays.

To determine the CV stray proportion, S_{cwt} , for each CWT code, the sum of all CWT_{samp} recoveries collected outside the basin of origin was divided by total CV CWT_{samp} recoveries for that release group, as follows:

$$S_{cwt} = \sum_{p=1}^o CWT_{samp,p} \text{ (out-of-basin locations)} / \sum_{p=1}^q CWT_{samp,p} \text{ (all CV locations)},$$

where p denotes recovery location, o denotes the number of out-of-basin recovery locations, and q denotes the total number of recovery locations.

Data from all CWT releases belonging to the same brood year and release type were combined and release type-specific CV stray proportion, S_{type} , was calculated as:

$$S_{type} = \sum_{p=1}^o \sum_{k=1}^n CWT_{samp,p,k} \text{ (out-of-basin)} / \sum_{p=1}^q \sum_{k=1}^n CWT_{samp,p,k} \text{ (all CV locations)}$$

RESULTS

General overview of 2014 CV inland recoveries and California ocean harvest

All except two of the 31,951 valid CWTs recovered in the CV during 2014 were from CV Chinook salmon releases. Most CWTs were brood year 2010 through 2012 releases (Table 6). About 90% of all CWT_{total} recoveries were fall-run, followed by spring-run (7%), and late-fall-run (3%) salmon releases. Only 0.2% of all CWT_{total} recovered were winter-run, all of which were collected in their upper Sacramento River escapement survey. The two non-CV salmon were spring-run Chinook released from Trinity River Hatchery. The majority of fall-run CWT_{total} recovered in the CV were age-3 (45%), age-4 (40%), and age-2 (15%) fish (Table 6).

Most of the 18,626 valid CWT recoveries in the 2014 California ocean harvest were CV salmon releases belonging to brood years 2010 through 2012 (Table 7). Approximately 92% of all CWT_{total} in the ocean harvest were CV fall-run, followed by CV spring-run (2%), CV late-fall-run (2%), and CV winter-run (0.1%) salmon. The remaining 4% of California ocean CWT recoveries originated from the Klamath-Trinity Basin in northern California and Oregon coastal streams. The majority of the hatchery-origin fish in the California harvest were age-3 (67%) and age-4 (25%) fish.

Like California, most of the 12,522 valid CWT recoveries in the 2014 Oregon ocean harvest were CV salmon releases (Table 8). Approximately 67% of all CWT_{total} in the ocean harvest were CV fall-run salmon and 3% were CV spring-run. Non-CV stocks made up 30% of the harvest with most originating from the Columbia River Basin, coastal streams in Oregon, and the Klamath-Trinity Basin. The majority of the hatchery fish in the Oregon harvest were age-3 (64%) and age-4 (34%) fish.

1. Proportion of Hatchery- and Natural-origin Salmon in CV Escapement

Almost 189,000 fall-run Chinook salmon returned to spawn in natural areas during 2014 (Table 4) and the proportion of hatchery-origin salmon in areas sampled varied throughout the CV. The lowest hatchery proportion occurred in Butte Creek (21%) while the highest proportion (89%) occurred in Battle Creek (Table 9, Fig. 2). It should be noted that the Battle Creek hatchery proportion is estimated using a surrogate since there has not been a carcass survey or CWT recovery program conducted in this waterway since 2005. The hatchery contribution and CWT release type composition in the Battle Creek escapement is assumed equivalent to the hatchery fall-run return sampled at CFH (K. Niemela, FWS, pers. comm.). The second highest hatchery proportion occurred in the Feather River (83%). The total fall-run hatchery proportion for all natural areas surveyed in the CV was 70%.

The hatchery proportion of the 60,200 fall-run salmon returning to the five CV hatcheries ranged from 86% to 96% (Table 9, Fig. 3). The fall-run hatchery proportion for all CV hatcheries combined was 91%. The spring-run return to FRH was almost entirely hatchery-origin fish while the late-fall-return to CFH was 98% hatchery-origin salmon.

To help differentiate the hatchery composition, all CV release types from the same stock, run, and hatchery use the same color scheme in the pie chart figures (Fig. 4): Blue = Sacramento River Basin fall-run releases, Green = San Joaquin Basin fall-run releases, Purple = Central Valley (FRH) spring-run releases, Yellow = Sacramento River winter-run releases, and Orange = Central Valley (CFH) late-fall-run releases. Additionally, select patterns are used to designate different release types. All bay net pen releases contain black dots while net pen coastal releases are designated with a criss-cross pattern. Tiburon net pen and all trucked releases are designated with black stripes.

Upper Sacramento River Basin

At CFH, sampling of the fall-run return began in early October and continued through early December 2014 (Table 10). All ad-clipped salmon were sampled during the entire run. CFH began late-fall sampling immediately following fall-run sampling and continued through mid-March 2015. Based solely on the run-timing above, 18,981 salmon returned to CFH during the “fall” run sampling period, and 6,673 salmon returned during the “late-fall” run period. However, based on the composition of CWT recoveries, FWS staff determined there was some overlap between runs, especially in late November through early December. As a result, the final escapement was adjusted to 18,840 fall-run and 6,814 late-fall-run salmon. An additional 137 late-fall salmon were trapped at CFH after spawning operations ended in mid-March.

Fall- and late-fall-run returns to CFH and fall spawners in most natural areas in the upper Sacramento River basin were predominantly hatchery-origin salmon with the exception of

Cottonwood and Butte creeks (Figs. 5, 6, 7). The proportion of hatchery-origin fish (prevalent release type shown in parentheses) at each of the following locations was:

- Fall-run returns CFH: 89% (CFHFh)
- Late-fall-run returns CFH: 98% (CFHLh)
- Fall-run spawners Upper Sacramento River: 54% (FRHFn)
- Fall-run spawners Clear Creek: 57% (FRHFn)
- Fall-run spawners Battle Creek: 89% (CFHFh)
- Fall-run spawners Cottonwood Creek: 41% (CFHFh)
- Fall-run spawners Paynes Creek: 54% (CFHFh)
- Fall-run spawners Mill Creek: 45% (CFHFh, FRHFn)
- Fall-run spawners Butte Creek: 21% (FRHFn)
- Winter-run spawners Upper Sacramento River: 16% (SacW)
- Spring-run spawners Butte Creek: zero hatchery fish observed
- Late-fall-run spawners Upper Sacramento River: 3% (NIMFn)

Feather River Basin

Spring- and fall-run returns to FRH, (including preseason spring-run returns that died prior to release) and spawners in the Feather River were predominantly hatchery-origin while escapement to the Yuba River above and below Daguerre Point Dam (DPD) contained more natural-origin salmon (Figs. 7, 8). The proportion of hatchery-origin fish (prevalent release type shown in parentheses) at each of the following locations was:

- Fall/spring-run spawners Yuba River above DPD: 49% (FRHFn)
- Fall/spring-run spawners Yuba River below DPD: 45% (FRHFn)
- Spring-run returns FRH: 100% (FRHS)
- Fall-run returns FRH: 95% (FRHFn)
- Fall/spring-run spawners Feather River: 83% (FRHFn)

American River Basin

Fall-run returns to NIM and spawners in the American River were predominantly of hatchery-origin (Fig. 9) while “washbacks” collected on the NIM weir were primarily natural-origin salmon. The proportion of hatchery-origin fish (prevalent release type shown in parentheses) at each of the following locations was:

- Fall-run returns NIM: 87% (NIMF)
- Fall-run spawners American River: 64% (NIMF)
- Fall-run returns NIM weir: 28% (MOKFn)

Mokelumne River Basin

Hatchery-origin salmon (Fig. 10) dominated fall-run returns to MOK and spawners in the Mokelumne River. The proportion of hatchery-origin fish (prevalent release type shown in parentheses) at each of the following locations was:

- Fall-run returns MOK: 86% (MOKFn)
- Fall-run spawners Mokelumne River: 76% (MOKFn)

Merced River and other San Joaquin Basin Tributaries

Hatchery-origin salmon dominated fall-run returns to MER and spawners in the Merced,

Stanislaus, and Tuolumne rivers (Fig. 11). The proportion of hatchery-origin fish (prevailing release type shown in parentheses) at each of the following locations was:

- Fall-run returns MER: 96% (MOKFn)
- Fall-run spawners Merced River: 58% (MOKFn)
- Fall-run spawners Stanislaus River: 65% (MOKFn)
- Fall-run spawners Tuolumne River: 65% (MOKFn)

2. Contribution of CV Release Types to Total Salmon Escapement

Approximately 73% of the total 264,200 salmon escapement to CV hatcheries and natural areas during 2014-2015 were hatchery-origin fish (Table 11). The proportion of these fish that strayed from their basin-of-origin ranged from zero to 84 percent, depending on release type:

R_type	Run	CWT _{total}	#Strays	(%)
CFHFh	Fall	47,848	4,764	(10%)
CFHFn	Fall	3,394	1,965	(58%)
FRHFb	Fall	2,073	447	(22%)
FRHFn	Fall	77,942	17,391	(22%)
FRHFnc	Fall	3,385	1,128	(33%)
FRHFtib	Fall	198	99	(50%)
NIMF	Fall	11,161	170	(2%)
NIMFn	Fall	6,748	357	(5%)
MOKF	Fall	288	24	(8%)
MOKFn	Fall	14,674	6,822	(46%)
MOKFt	Fall	1,919	1,072	(56%)
MERF	Fall	58	15	(26%)
MERFt	Fall	1,421	1,199	(84%)
FRHS	Spr	11,008	117	(1%)
FRHSn	Spr	3,662	459	(13%)
SacW	Wint	430	0	
CFHLh	Late	6,840	7	(0.1%)
	Total	193,049	36,036	(19%)

3. Hatchery Proportion and Contribution of CV Release Types to CV Sport Harvest

In 2014, approximately 74% of the 42,400 salmon harvested in the CV river sport fishery were hatchery-origin fish (Table 9; Figs. 12, 13). The proportion of hatchery-origin fish (prevailing release type shown in parentheses) in each of the following fisheries was:

- Upper Sacramento River fall-run harvest: 71% (CFHFh)
- Lower Sacramento River fall-run harvest: 63% (FRHFn)
- Feather River fall-run harvest: 72% (FRHFn)
- American River fall-run harvest: 83% (NIMF)

- Mokelumne River fall-run harvest: 98% (MOKFn)
- Upper Sacramento River late-fall-run harvest: 39% (CFHLh)

Of all hatchery release types, FRHFn contributed the most (24%) to the total CV sport harvest, followed by CFHFh (16%). Most of the CFHFh recoveries occurred in the Upper Sacramento River fall fisheries (Table 11).

Contribution of CV Release Types to CV Sport Harvest

R _{type}	Run	CWT _{total}	(% harvest)
CFHFh	Fall	6,796	(16%)
CFHFn	Fall	1,011	(2%)
FRHFb	Fall	516	(1%)
FRHFn	Fall	10,151	(24%)
FRHFnc	Fall	523	(1%)
FRHFTib	Fall	37	
NIMF	Fall	4,503	(11%)
NIMFn	Fall	1,685	(4%)
MOKF	Fall	15	
MOKFn	Fall	4,632	(11%)
MOKFt	Fall	432	(1%)
MERF	Fall	0	
MERFt	Fall	233	(1%)
FRHS	Spr	348	(1%)
FRHSn	Spr	381	(1%)
SacW	Wint	0	
CFHLh	Late	266	(1%)
Total		31,529	(74%)

4a. Relative Recovery and Stray Rates of CV Release Types in Total Escapement

Release strategies vary among hatcheries from year to year. This variability has often been in response to annual fluctuations in the abundance of certain stocks or differing policies among agencies with respect to best release practices. The 2010 through 2012 brood year releases were more consistent than release types analyzed in earlier CFM reports (Kormos et. al. 2012, Palmer-Zwahlen and Kormos 2013, 2015) and only a few “mixed strategy” releases were identified (Table 3).

Table 12 summarizes total CWT_{samp} recoveries and the escapement recovery rate, R_{type}, (in-basin and stray) for all release types collected in the CV and ocean fisheries during 2014. Recovery rates are standardized utilizing total CWT_{samp} recoveries per 100,000 tagged salmon released. All release types with less than 25,000 fish released with CWTs are noted below since a few recoveries may result in relatively large recovery and stray rate estimates. Figures 14 and 15

provide a graphical representation of R_{type} for Sacramento River fall-run salmon and other CV stocks, respectively, and include the total number of salmon released with CWTs for each release type. Fall-run salmon that were acclimated in bay and coastal net pens generally had higher CV recovery rates than their respective in-basin or trucked-only releases, but net pen and trucked release types also had higher stray proportions than their in-basin sibling releases in most cases.

Age-2 CV Escapement recovery rate; percent stray

R _{type}	Brdyr	Run	# recoveries per 100K released	% stray
CFHFh	2012	Fall	19	2%
FRHFb	2012	Fall	330	29%
FRHFe	2012	Fall	3	
FRHFn	2012	Fall	201	28%
FRHFnc	2012	Fall	195	31%
FRHFtib	2012	Fall	64	38% (<10,000 released)
NIMF	2012	Fall	32	4%
NIMFn	2012	Fall	30	7%
MOKF	2012	Fall	32	7%
MOKFn	2012	Fall	117	38%
MERFt	2012	Fall	97	84%
FRHS	2012	Spr	50	
FRHSn	2012	Spr	83	10%
SacW	2012	Wint	17	
CFHLh	2013	Late	14	

Age-3 CV Escapement recovery rate; percent stray

R _{type}	Brdyr	Run	# recoveries per 100K released	% stray
CFHFh	2011	Fall	171	5%
FRHFb	2011	Fall	362	15%
FRHFe	2011	Fall	117	(<11,500 released)
FRHFn	2011	Fall	370	24%
FRHFnc	2011	Fall	472	32%
FRHFtib	2011	Fall	243	(<7,000 released)
NIMF	2011	Fall	125	
NIMFn	2011	Fall	276	8%
MOKF	2011	Fall	168	8%
MOKFn	2011	Fall	112	48%
MOKFt	2011	Fall	255	50%
MERF	2011	Fall	7	5%

FRHS	2011	Spr	485	1%
FRHSn	2011	Spr	172	15%
SacW	2011	Wint	196	
CFHLh	2012	Late	438	0.1%

Age-4 CV Escapement recovery rate; percent stray

R_type	Brdyr	Run	# recoveries per 100K released	% stray
CFHFh	2010	Fall	214	15%
CFHFn	2010	Fall	254	58%
FRHFn	2010	Fall	312	19%
FRHFnc	2010	Fall	48	93%
FRHFTib	2010	Fall	297	58%
NIMF	2010	Fall	181	2%
NIMFn	2010	Fall	184	1%
MOKF	2010	Fall	71	10%
MOKFn	2010	Fall	42	68%
MOKFt	2010	Fall	41	64%
MERF	2010	Fall	28	36%
FRHS	2010	Spr	428	1%
FRHSn	2010	Spr	73	10%
SacW	2010	Wint	15	
CFHLh	2011	Late	199	0.05%

4b. Relative Recovery Rate of CV Release Types in the Ocean Harvest

The relative recovery rate of CV hatchery releases in 2014 ocean salmon sport and commercial fisheries varied by age and release type (Table 12). Almost all CWTs from age-2 CV salmon were recovered in the ocean sport fishery, most likely due to smaller size limits in effect compared to the commercial fishery. Fall-run net pen releases (coastal and bay) generally had the highest ocean recovery rates for all ages (Fig. 16).

Age-2 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
CFHFh	2012	Fall	3	77%
FRHFb	2012	Fall	127	92%
FRHFe	2012	Fall	0	
FRHFn	2012	Fall	87	76%
FRHFnc	2012	Fall	511	84%
FRHFTib	2012	Fall	150	59% ($<10,000$ released)

NIMF	2012	Fall	11	76%
NIMFn	2012	Fall	8	81%
MOKF	2012	Fall	0	
MOKFn	2012	Fall	38	83%
MERFt	2012	Fall	28	100%
FRHS	2012	Spr	6	100%
FRHSn	2012	Spr	22	96%
CFHLh	2013	Late	0	

Age-3 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
CFHFh	2011	Fall	202	23%
FRHFb	2011	Fall	817	22%
FRHFe	2011	Fall	67	41% ($<11,500$ released)
FRHFn	2011	Fall	763	24%
FRHFnc	2011	Fall	2,387	26%
FRHFtib	2011	Fall	492	25% ($<7,000$ released)
NIMF	2011	Fall	255	21%
NIMFn	2011	Fall	579	23%
MOKF	2011	Fall	139	39%
MOKFn	2011	Fall	274	20%
MOKFt	2011	Fall	638	20%
MERF	2011	Fall	22	24%
FRHS	2011	Spr	362	25%
FRHSn	2011	Spr	184	22%
SacW	2012	Wint	62	77%
CFHLh	2012	Late	127	31%

Age-4 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
CFHFh	2010	Fall	114	25%
CFHFn	2010	Fall	397	23%
FRHFn	2010	Fall	190	23%
FRHFnc	2010	Fall	644	26%
FRHFtib	2010	Fall	378	25%
NIMF	2010	Fall	194	16%
NIMFn	2010	Fall	257	16%

MOKF	2010	Fall	43	29%
MOKFn	2010	Fall	61	14%
MOKFt	2010	Fall	56	13%
MERF	2010	Fall	28	25%
FRHS	2010	Spr	23	34%
FRHSSn	2010	Spr	6	41%
SacW	2011	Wint	0	
CFHLh	2011	Late	120	17%

5. Hatchery Proportion and Contribution of CV Release Types to Ocean Salmon Fisheries

More than half of the 243,100 and 208,100 Chinook salmon harvested in California and Oregon fisheries, respectively, were hatchery-origin fish (Fig. 17). The majority of hatchery-origin salmon in all fisheries originated from the CV.

California ocean sport fishery

California anglers harvested more than 74,800 salmon in the ocean sport fishery during 2014. The total contribution of hatchery-origin salmon to the California ocean sport fishery was 69%, ranging from 64% to 75% of the total harvest, depending on major port area (Fig. 18). Most of the harvest occurred in San Francisco (43%) and Eureka-Crescent City (21%), followed by Monterey (19%) and Fort Bragg (17%) port areas (Table 13).

Of all hatchery release types, FRHFn contributed the most (30%) to the total California ocean sport harvest, followed by CFHFh (11%). Non-CV releases (e.g., Klamath-Trinity River Basin, Smith River, Oregon and Washington hatchery stocks) contributed 2% to the total harvest (Table 14).

Contribution of CV Release Types to Ocean Salmon Sport Fishery

R _{type}	Run	CWT _{total}	(% harvest)
CFHFh	Fall	8,195	(11%)
CFHFn	Fall	1,016	(1%)
FRHFb	Fall	828	(1%)
FRHFn	Fall	22,435	(30%)
FRHFnc	Fall	5,371	(7%)
FRHFtib	Fall	62	
NIMF	Fall	2,440	(3%)
NIMFn	Fall	2,050	(3%)
MOKF	Fall	69	
MOKFn	Fall	4,572	(6%)
MOKFt	Fall	550	(1%)
MERF	Fall	18	
MERFt	Fall	385	(1%)

FRHS	Spr	1,048	(1%)
FRHSn	Spr	576	(1%)
SacW	Wint	87	
CFHLh	Late	611	(1%)
NonCV		1,200	(2%)
	Total	51,512	(69%)

California ocean commercial fishery

California trollers harvested almost 168,300 salmon in the ocean commercial fishery during 2014. The total contribution of hatchery-origin salmon to the California ocean commercial fishery was 59%, ranging from 56% to 75% of the total harvest, depending on major port area (Fig. 19). Most of the harvest occurred in San Francisco (49%) and Fort Bragg (46%), followed by Monterey (9%) and Eureka-Crescent City (<1%) port areas (Table 15).

Of all hatchery release types, FRHFn contributed the most (26%) to the total California commercial harvest, followed by CFHFh (11%). Non-CV releases (e.g., Klamath-Trinity River Basin, Smith River, Oregon and Washington hatchery stocks) contributed 3% to the total harvest (Table 16).

Contribution of CV Release Types to Ocean Salmon Commercial Fishery

R_type	Run	CWT _{total}	(% harvest)
CFHFh	Fall	18,111	(11%)
CFHFn	Fall	2,647	(2%)
FRHFb	Fall	1,087	(1%)
FRHFn	Fall	43,028	(26%)
FRHFnc	Fall	6,025	(4%)
FRHFtib	Fall	156	
NIMF	Fall	6,377	(4%)
NIMFn	Fall	5,196	(3%)
MOKF	Fall	103	
MOKFn	Fall	7,723	(5%)
MOKFt	Fall	1,560	(1%)
MERF	Fall	42	
MERFt	Fall	0	
FRHS	Spr	1,215	(1%)
FRHSn	Spr	543	(0%)
SacW	Wint	28	
CFHLh	Late	1,706	(1%)
NonCV		4,377	(3%)
	Total	99,925	(59%)

6. Relative Recovery and Stray Rates of Experimental and Net Pen Release Types

New coastal net pen and barge study release types were recovered in both CV escapement and ocean sport harvest for a second year in 2014. In addition, CWTs from an experimental rice field study were recovered for the first time in 2014. Approximately 92,000 BY 2012 FRH fall-run salmon were released into rice fields in the Yolo Bypass with an additional 46,000 released in conjunction at Elkhorn Boat Ramp on the Sacramento River (just below the northern entrance to the Yolo Bypass). The intention of these paired releases was to evaluate survival and recovery rates of juveniles reared in rice fields compared to siblings released in the mainstem Sacramento River. These experimental releases are differentiated into the following release types:

FRHFbb	Feather River Hatchery Fall-run barge study: trucked and released in SF bay
FRHFbg	Feather River Hatchery Fall-run barge study: barged to SF Bay and released
FRHFbr	Feather River Hatchery Fall-run barge study: released in-river (Feather River mouth)
FRHFnp	Feather River Hatchery Fall-run net pen coastal releases – Pillar Point
FRHFns	Feather River Hatchery Fall-run net pen coastal releases – Santa Cruz
FRHFkc	Feather River Hatchery Fall-run rice field study: Elkhorn Boat Ramp (Knaggs control group)
FRHFkr	Feather River Hatchery Fall-run rice field study: Yolo Bypass (Knaggs Ranch)

The CV escapement recovery rate and percent stray for other fall-run experimental and net pen releases are included below to allow direct comparison among these release types (Table 17, Fig. 20).

Age-2 CV Escapement recovery rate; percent stray

R_type	Brdyr	Run	# recoveries per 100K released	% stray
FRHFbb	2012	Fall	432	34%
FRHFbg	2012	Fall	536	26%
FRHFbr	2012	Fall	15	
FRHFnp	2012	Fall	277	32%
FRHFns	2012	Fall	53	29%
FRHFkc	2012	Fall	9	
FRHFkr	2012	Fall	0	
FRHFn	2012	Fall	201	28%
FRHFTib	2012	Fall	64	38% (<10,000 released)
NIMFn	2012	Fall	30	7%
MOKFn	2012	Fall	117	38%

Age-3 CV Escapement recovery rate; percent stray

R_type	Brdyr	Run	# recoveries per 100K released	% stray
FRHFbb	2011	Fall	338	27%
FRHFbg	2011	Fall	416	14%
FRHFbr	2011	Fall	332	4%

FRHFnp	2011	Fall	991	30%
FRHFn	2011	Fall	73	48%
FRHFe	2011	Fall	117	(<11,500 released)
FRHFn	2011	Fall	370	24%
FRHTib	2011	Fall	243	(<7,000 released)
NIMFn	2011	Fall	276	8%
MOKFn	2011	Fall	112	48%

Age-4 CV Escapement recovery rate; percent stray

R_type	Brdyr	Run	# recoveries per 100K released	% stray
FRHFn	2010	Fall	48	93%
FRHFn	2010	Fall	312	19%
FRHTib	2010	Fall	297	58%
CFHFn	2010	Fall	254	58%
NIMFn	2010	Fall	184	1%
MOKFn	2010	Fall	42	68%

The ocean harvest recovery rate and proportion taken in the sport fishery for other fall-run experimental and net pen releases are included below to allow direct comparison among these release types (Table 17, Fig. 21).

Age-2 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
FRHFbb	2012	Fall	251	92%
FRHFbg	2012	Fall	128	94%
FRHFbr	2012	Fall	0	
FRHFnp	2012	Fall	536	83%
FRHFn	2012	Fall	467	85%
FRHFkc	2012	Fall	0	
FRHFkr	2012	Fall	0	
FRHFn	2012	Fall	87	76%
FRHTib	2012	Fall	150	59% (<10,000 released)
NIMFn	2012	Fall	8	81%
MOKFn	2012	Fall	38	83%

Age-3 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
FRHFbb	2011	Fall	954	21%
FRHFbg	2011	Fall	775	28%
FRHFbr	2011	Fall	725	18%

FRHFnp	2011	Fall	2,722	27%
FRHFn	2011	Fall	2,130	25%
FRHFe	2011	Fall	0	(<11,500 released)
FRHFn	2011	Fall	763	24%
FRHFTib	2011	Fall	492	25% (<7,000 released)
NIMFn	2011	Fall	579	23%
MOKFn	2011	Fall	274	20%

Age-4 Ocean Harvest recovery rate; percent taken in sport harvest

R_type	Brdyr	Run	# recoveries per 100K released	% sport
FRHFn	2010	Fall	644	26%
FRHFn	2010	Fall	190	23%
FRHFTib	2010	Fall	378	25%
CFHFn	2010	Fall	397	23%
NIMFn	2010	Fall	257	16%
MOKFn	2010	Fall	61	14%

2014 CFM ANALYSES KEY POINTS

- Hatchery escapement was predominately hatchery-origin fish. The majority of hatchery-origin fish returning to each hatchery was comprised primarily of its respective releases with the exception of Merced River Hatchery, which was mostly net pen MOKFn releases.
- Rivers and creeks with hatchery installations generally had the highest proportions of hatchery-origin spawners in natural areas. Most of the hatchery proportion consisted of release types from their respective hatcheries with the exception of hatchery-origin spawners in the Merced River, which were primarily net pen MOKFn releases.
- Fall-run escapement into the Upper Sacramento River and its sampled tributaries was predominately hatchery-origin salmon with the exception of Cottonwood and Mill creeks. Hatchery CFHFh and net pen FRHFn were the hatchery release types most often observed in these rivers and creeks.
- Fall-run escapement into Butte Creek and the Yuba River was predominantly natural-origin salmon. Hatchery-origin fish were primarily net pen FRHFn releases.
- Fall-run escapement into the Feather River was predominantly hatchery-origin salmon, primarily net pen FRHFn, along with spring-run FRHS and FRHSn releases.
- Fall-run escapement into the American River was predominantly hatchery-origin salmon, primarily in-basin NIMF, along with net pen NIMFn, and MOKFn releases.
- Fall-run escapement into all sampled tributaries of the San Joaquin Basin was predominantly hatchery-origin salmon, the vast majority of which were net pen MOKFn releases. Trucked

MOKFt and MERFt, along with net pen FRHFn and NIMFn, also contributed to hatchery-origin returns.

- Approximately three-fourths of the total 2014-2015 CV salmon escapement (all run-types) were hatchery-origin fish. Net pen FRHFn and hatchery CFHFh releases contributed the most to total escapement. Trucked MERFt and MOKFt, along with net pen CFHFn and MOKFn releases, had the highest stray proportions.
- For age-2 fall-run salmon, experimental barge study FRHFb, net pen FRHFn and coastal net pen FRHFnc releases had the highest CV recovery rates for their cohort. Trucked MERFt and net pen MOKFn had the highest stray proportions observed for age-2 releases.
- For age-3 fall-run salmon, coastal net pen FRHFnc, net pen FRHFn, and experimental barge study FRHFb releases had the highest CV recovery rates for their cohort. Trucked MOKFt and net pen MOKFn had the highest stray proportions observed for age-3 release types.
- For age-4 fall-run salmon, net pen FRHFn and CFHFn had the highest CV recovery rates for their cohort. Coastal net pen FRHFnc, net pen MOKFn and CFHFn, and trucked MOKFt releases had the highest stray proportions observed for age-4 release types. Tiburon net pen FRHFtib releases also had high recovery and stray rates but only 56,000 fish were released.
- Approximately three-fourths and one half of the inland and ocean harvest, respectively, were hatchery-origin fish. Net pen FRHFn and hatchery CFHFh releases contributed the most to sport (inland and ocean) and commercial salmon fisheries.
- Coastal net pen FRHFnc releases had the highest ocean recovery rates for all release types and ages. Their recovery rate was several times greater than that for other net pen releases of the same cohort and nearly an order of magnitude greater than that of most in-basin releases for the same age. The age-2 and age-3 ocean recovery rates for coastal net pen Pillar Point FRHFnp and Santa Cruz FRHFns releases were very similar.
- Pillar Point coastal net pen FRHFnp releases had highest CV recovery rates for all age-2 and age-3 net pen releases whereas relatively few coastal net pen releases from Santa Cruz FRHFns returned to the CV. The majority of Pillar Point FRHFnp recoveries occurred in the Feather River Basin whereas most of the few Santa Cruz FRHFns recovered in the CV strayed into the upper Sacramento River Basin.
- Age-2 salmon barged down the Sacramento River (FRHFbg) had the highest CV recovery rate in their cohort with moderate straying. Fish released directly into San Francisco Bay (FRHFbb) strayed the most among the three barge study release types as both age-2 and age-3 fish but were also recovered at higher rates in the ocean fisheries. Age-2 and age-3 salmon released in the Sacramento River at the mouth of the Feather River (FRHFbr) had the lowest CV recovery rate among the study releases but seldom strayed. The ocean recovery rate for all barge study releases, with the exception of age-2 FRHFbr releases, was generally higher than other bay net pen releases for the same cohort.

CONCLUSION

A primary goal of this report is to provide information that will be useful in California salmon management, including CV hatchery assessment. This report contains the data and analyses needed to determine the contribution of hatchery- and natural-origin salmon to hatchery and natural areas throughout the CV, evaluate hatchery release strategies and programs, improve California ocean and river salmon fisheries management, evaluate the effectiveness of habitat restoration, and determine if other goals of the CFM program are being met. Although there is no discussion section as in the 2010, 2011, and 2012 CFM reports, the authors hope to begin the process of analyzing these data for complete broods over their respective life spans in the future. This will allow resource managers to determine the total contribution of various release strategies to CV escapement and to ocean and inland fisheries by time and area.

We believe the CFM program should be continued with the current design to provide comparable, consistent data needed for hatchery and harvest management. Efforts are still on going to secure permanent funding for this program, which will allow critical data to be available by February of each year to manage CV salmon stocks, hatchery production, and California ocean and river fisheries in real-time, similar to the Klamath River fall-run salmon management process.

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LIST OF ACRONYMS AND ABBREVIATIONS

Ad-clipped	clipped adipose fin
BOR	U.S. Bureau of Reclamation
BY	Brood year
CFM	Constant Fractional Marking
CFH	Coleman National Fish Hatchery
CV	California Central Valley
CWT	coded-wire tag
CDFW	California Department of Fish and Wildlife
DPD	Daguerre Point Dam (Yuba River)
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utilities District
FRH	Feather River Hatchery
FWS	U.S. Fish and Wildlife Service
MER	Merced River Hatchery
MOK	Mokelumne River Hatchery
NMFS	National Marine Fisheries Service
NIM	Nimbus Fish Hatchery
OSP	Ocean Salmon Project
PFMC	Pacific Fishery Management Council
PSMFC	Pacific States Marine Fisheries Commission
RMPG	Regional Mark Processing Center
SJ	San Joaquin
TL	Total length
WD	Woodbridge Dam (Mokelumne River)
YARMT	Yuba Accord River Management Team

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Table 1a. Estimation and sampling methods used for the 2014 CV Chinook hatchery escapement.

Sampling Location	Estimation and Sampling Methods	Agency
Hatchery Spawners		
Coleman National Fish Hatchery (CFH) Fall and Late-Fall (2015)	Direct count. All fish examined and bio-sampled ^{a/} for fin-clips, tags, marks. Access upstream of the hatchery closed Aug 1-Sep 30. Fall-run period: Oct 2-Dec 4, Late-fall-run period: Dec 5-Mar 17. All ad-clipped fish sampled. Fish returning to CFH from mid-Nov through early Dec parsed into run-type based on CWT code recoveries and total run-type proportions by date. Grilse cutoff: 700 mm fall, 600 mm late-fall.	FWS
CFH Late-Fall Fish Trap	Direct count. All fish examined and bio-sampled for fin-clips, tags, marks. All unmarked untagged-phenotypic late-fall fish released into Battle Creek above CFH Dec 9-Apr 21. All ad-clipped fish sampled and heads collected for CWT recovery Mar 13-31 (after CFH spawning operations cease). Late-fall data from video weir Mar 31-Jun 30 added. Grilse cutoff: 600mm.	FWS
Feather River Hatchery (FRH) Spring and Fall	Direct count. All fish examined for fin-clips, tags, marks. Fish arriving at the hatchery May 1-Jun 27 (\sim 7,300) were considered "spring-run" and marked with uniquely-numbered dart tags prior to release back into the Feather River. Only fish marked with dart tags returning to FRH in fall were spawned as spring-run. All remaining fish were considered fall-run. FRH fish ladder opened Sep 15 and spring spawning began Sep 19. All spring-run fish bio-sampled. Fall spawning began Oct 8 with systematic random bio-sample ~10% of all fish. All ad-clipped fish were sampled and heads collected for CWT recovery. Grilse cutoff: 650 mm spring and fall.	CDFW
FRH Trap Spring	Direct count of salmon that died during early processing of "spring-run" salmon returning to FRH during May-June. All fish examined for fin-clips, tags, marks. All ad-clipped fish were sampled and heads collected for CWT recovery. These fish are not included in FRH spring escapement. Grilse cutoff: 650 mm.	DWR
Nimbus Fish Hatchery (NIM) Fall	Direct count. NIM ladder open Nov 3-Dec 17. All fish examined for fin-clips, tags, marks. Systematic random bio-sample ~20% of total fish returning. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 700 mm.	CDFW
Mokelumne River Hatchery (MOK) Fall	Direct count. MOK open Oct 14-Feb 12. All fish examined for fin-clips, tags, marks. Systematic random bio-sample ~10% of total fish returning. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 650 mm females, 700 mm males.	CDFW
Merced River Hatchery (MER) Fall	Direct count. MER open Nov 6-Dec 31. All fish examined for fin-clips, tags, marks. All ad-clipped fish were sampled and heads processed for CWT recovery. Grilse cutoff: 660 mm females, 740 mm males.	CDFW

^{a/} Biological sampling ("bio-samples" or "bio-data") of live fish or carcasses may include observed tags or marks, sex, fork length, scales, carcass condition, spawning condition, and heads collected from ad-clipped fish for CWT recovery.

Table 1b. Estimation and sampling methods used for the 2014 CV Chinook natural escapement. (page 1 of 2)

Sampling Location	Estimation and Sampling Methods	Agency
Natural Spawners		
Upper Sacramento River Mainstem Winter, Fall, and Late-Fall (2015)	<p>Population estimate for each run produced utilizing five-step process: 1) Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate using all females within carcass survey area (Balls Ferry Bridge to Keswick Dam). 2) Total female escapement estimate in upper Sacramento River is derived using expansions for females spawning outside of the survey area (Princeton to Balls Ferry) through aerial redd surveys. 3) Adult male escapement estimated using adult sex ratio of live fish counts at CFH or Keswick Trap. 4) Grilse escapement estimated using survey ratio of fresh adult males to fresh grilse. 5) Addition of any fish removed for hatchery brood stock purposes. All fish in carcass survey examined for fin-clips, tags, marks, and condition (e.g., fresh, non-fresh, skeleton). Bio-data^{a/} collected from all fresh fish. Systematic random bio-sample may occur if carcass counts expected to be high. All ad-clipped fish (fresh and non-fresh), including "unknown" ad-clipped status, were sexed, measured and heads collected for CWT recovery. Grilse cutoff: 540 mm females, 645 mm males winter; 640 mm females, 670 mm males fall; 610 mm females, 610 mm males late-fall.</p>	CDFW, FWS
Clear Creek Fall	Video weir count adjacent to Redding City Wastewater Treatment Plant used to determine total escapement. DIDSON camera used during turbid periods to determine passage. Weekly bio-sampling surveys to supplement video escapement data. Carcasses examined for fin-clips, tags, marks, and condition (e.g., fresh, non-fresh, skeleton). Bio-data collected from all fresh fish. All ad-clipped fish (fresh and non-fresh), including "unknown" ad-clipped status, were sampled and heads collected for CWT recovery. Grilse cutoff: 625 mm females, 700 mm males.	CDFW, FWS
Cow Creek Fall	Video weir count in lower creek used to determine total escapement. DIDSON camera used during turbid periods to determine passage. One kayak survey conducted to collect bio-data from fresh fish. Approximately 1% of total escapement sampled; opportunistic collection of CWTs. Grilse cutoff: 640 mm females, 670 mm males.	CDFW
Battle Creek Fall	Video weir count (Aug 20 - Nov 21) in lower creek used to determine total fall escapement. Natural fall escapement into Battle Creek calculated by subtracting CFH fall return from total run. Surrogate CWTs based on hatchery proportion and CWT composition of CFH fall return. Grilse cutoff: 700 mm fall.	CDFW
Cottonwood Creek Fall	Video weir count (Sep 15-Dec 15) in lower creek used to determine total escapement. Kayak surveys conducted to collect bio-data from fresh fish. All ad-clipped fish (fresh and non-fresh), including "unknown" ad-clipped status, were sampled and heads collected for CWT recovery. Grilse cutoff: 610 mm females, 680 mm males.	FWS, CDFW
Paynes Creek Fall	Raw carcass count to determine total escapement. One late-season walking survey was conducted to count redds and collect bio-data from fresh fish. All ad-clipped fish, including "unknown" ad-clipped status, were sampled and heads collected for CWT recovery. Grilse cutoff: 610 mm females, 700 mm males.	CDFW
Mill Creek Fall	Video counts at Ward Dam in lower Mill Creek plus expanded redd count between Ward Dam and the Sacramento River confluence used to determine total escapement. DIDSON camera used during turbid periods to determine passage. Kayak surveys conducted to collect bio-data from fresh fish. All ad-clipped fish (fresh and non-fresh), including "unknown" ad-clipped status, were sampled and heads collected for CWT recovery. Grilse cutoff: 670 mm females, 700 mm males.	CDFW

Table 1b. Estimation and sampling methods used for the 2014 CV Chinook natural escapement. (page 2 of 2)

Sampling Location	Estimation and Sampling Methods	Agency
Natural Spawners cont.		
Deer Creek Fall	Video counts at Stanford Vina Ranch Irrigation Company (SVRIC) Dam plus expanded redd count between SVRIC Dam and the Sacramento River confluence used to determine total escapement. Two kayak surveys conducted to collect bio-data from fresh fish. Approximately 3% of total escapement sampled; opportunistic collection of CWTs. Grilse cutoff: 670 mm females, 710 mm males.	CDFW
Butte Creek Spring and Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate for spring and fall. All fish examined for fin-clips, tags, marks. Systematic random bio-sample of all fish. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 600 mm spring, 650 mm fall.	CDFW
Feather River Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fish examined for fin-clips, tags, marks. Systematic random bio-sample of fresh fish. All ad-clipped fresh fish sampled and heads collected for CWT recovery. Escapement estimate includes spring-run. Grilse cutoff: 650 mm.	DWR
Yuba River Fall	Above Daguerre Point Dam: Vaki Riverwatcher direct count of escapement and ad-clipped fish. Supplemental carcass survey to collect bio-data and heads from ad-clipped fish (fresh fish only). Below Daguerre Point Dam: Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fish examined for fin-clips, tags, marks, and condition. All ad-clipped fresh fish sampled and heads collected for CWT recovery. Escapement estimate includes spring-run. Grilse cutoff: 650 mm.	CDFW, YARMT
American River Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fish examined for fin-clips, tags, marks, and condition. Systematic random bio-sample of all fish. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 680 mm females, 720 mm males.	CDFW
Nimbus Weir Fall	Direct count. Installed Aug 13 to force returning salmon into Nimbus Hatchery; salmon that migrated above prior to installation trapped between Nimbus Dam (located 1/4 mile upstream) and weir. All dead fish that washed back down river ("washbacks") onto weir examined for fin-clips, tags, marks. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 700 mm.	CDFW
Mokelumne River Fall	Video count at Woodbridge Irrigation District Dam (WIDD) used to determine total escapement and ad-clipped fish above WIDD. Natural spawner escapement estimate and ad-clip rate calculated by subtracting total count and number of ad-clipped fish returning to MOK. Supplemental carcass survey to collect bio-data from fresh fish and heads from all ad-clipped fish. Grilse cutoff: 700 mm.	EBMUD
Stanislaus River Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fresh fish examined for fin-clips, tags, marks. All fresh ad-clipped fish sampled and heads collected for CWT recovery. Opportunistic sampling of ad-clipped fish on Stanislaus Weir (i.e., "washbacks"). Grilse cutoff: 660 mm females, 740 mm males.	CDFW
Tuolumne River Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fish examined for fin-clips, tags, marks, and condition. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 660 mm females, 740 mm males.	CDFW
Merced River Fall	Superpopulation modification of the Cormack-Jolly-Seber mark-recapture estimate. All fresh fish examined for fin-clips, tags, marks. All fresh ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 660 mm females, 740 mm males.	CDFW

^{a/} Biological sampling ("bio-samples" or "bio-data") of live fish or carcasses may include observed tags or marks, sex, fork length, scales, carcass condition, spawning condition, and heads collected from ad-clipped fish for CWT recovery.

Table 1c. Survey design and open dates for the 2014 CV Chinook river sport harvest.

Sampling Location	Survey Design and Open Dates	Agency
Sport Harvest		
	Survey Design	
Central Valley Angler Survey (CVAS)	Stratified-random sampling design (one weekday and one weekend sample per week per section during the open season in each management zone) that included both roving counts and access interview components and sub-sampling of kept salmon. Almost all ad-clipped salmon sampled and heads collected for CWT recovery. Estimates of fishing effort, catch, and harvest of Chinook salmon made monthly for each survey section and then summed for the season total.	CDFW
Open Dates		
Upper Sacramento River Fall and Late-Fall	Open Jul 16 - Dec 16 From the Lower Red Bluff Boat Ramp to Highway 113 bridge and Aug 1 - Dec 16 from the Deschutes Road Bridge to the Red Bluff Diversion Dam. Nov 1 is used to delineate the cutoff between the fall-run fishery and the late-fall-run fishery. Grilse cutoff: 650 mm fall, 600 mm late-fall.	
Feather River Fall	Open Jul 16 - Oct 15 from the unimproved boat ramp above the Thermolito Afterbay Outfall to 200 yards above the Live Oak boat ramp and Jul 16 - Dec 16 from 200 yards above the Live Oak boat ramp to the Sacramento River confluence. Grilse cutoff: 650 mm.	
American River Fall	Open Jul 16 - Dec 31 from Nimbus Dam to the Hazel Avenue Bridge, Jul 16 - Aug 15 from the Hazel Avenue Bridge to the USGS cable crossing, Jul 16 - Oct 31 from the USGS cable crossing to the SMUD power line crossing, Jul 16 - Dec 31 from the SMUD power line crossing to the Jibboom Street Bridge, and Jul 16 - Dec 16 from the Jibboom Street Bridge to the Sacramento River confluence. Grilse cutoff: 650 mm.	
Lower Sacramento River Fall	Open Jul 16 - Dec 16 from the Highway 113 bridge to the Carquinez Bridge. Grilse cutoff: 650 mm.	
Mokelumne River Fall	Open Jul 16 - Oct 15 from Camanche Dam to the Highway 99 Bridge, Jul 16 - Dec 31 from the Highway 99 Bridge to Woodbridge Dam, including Lodi Lake, and Jul 16 - Dec 16 from the Lower Sacramento Road bridge to the San Joaquin River confluence. Grilse cutoff: 700 mm.	
Bag and Size Limit		
All Areas	2 Chinook salmon per day; no minimum size limit.	

Table 2. California ocean salmon sport and commercial fishery seasons by major port area, 2014.

Major Port Area	Sport Fishery			Commercial Fishery			
	Season	Size Limit ^{a/}	Days Open	Season	Size Limit ^{a/}	Days Open	Quota
Eureka/Crescent City (Klamath Mgmt Zone)	May 10 - Sep 7	24" TL	121	Sep 12 - 30	27" TL	15	4,000 ^{b/}
Fort Bragg	Apr 5 - Nov 9	20" TL	219	Jun 19 - 30	27" TL	12	
				Jul 15 - Aug 29	27" TL	46	
				Sep 1 - 30	27" TL	<u>30</u>	
						88	
San Francisco	Apr 5 - Jun 30	24" TL	87	May 1 - Jun 30	27" TL	61	
	Jul 1 - Nov 9	20" TL	<u>132</u>	Jul 15 - Aug 29	27" TL	46	
			219	Sep 1 - 30	26" TL	30	
				Oct 1 - 15 ^{c/}	26" TL	<u>11</u>	
						148	
Monterey ^{d/}	Apr 5 - Oct 5	24" TL	184	May 1 - Jun 30	27" TL	61	
				Jul 15 - Aug 13	27" TL	<u>30</u>	
						91	
California Total			743				342

a/ Size limit in inches total length (TL).

b/ Klamath Management Zone quota fishery; daily bag and possession limit of 20 salmon per day.

c/ Open Monday through Friday between Pt. Reyes and Pt. San Pedro.

d/ Recreational and commercial regulations apply from the Monterey area to the U.S./Mexico border.

Table 3. Central Valley coded-wire tag (CWT) Chinook releases recovered in 2014 by age, run, stock, and release type.(page 1 of 2)

Age 2 CWT releases									
Release type*	Brood year	Hatchery / wild	Stock origin	Run type	CWT codes	# CWT tagged	Total fish released	% CWT	Release strategy
FRHS	2012	FRH	Fea R	Spr	2	1,106,679	1,125,897	98%	In-basin
FRHSn	2012	FRH	Fea R	Spr	1	1,015,285	1,033,174	98%	Net pens
CFHFh	2012	CFH	Sac R	Fall	14	2,956,873	11,877,921	25%	Hatchery
FRHFb	2012	FRH	Fea R	Fall	3	293,784	299,404	98%	Barge study
FRHFe	2012	FRH	Fea R	Fall	12	138,888	138,888	100%	Experimental
FRHFn	2012	FRH	Fea R	Fall	4	1,453,105	5,848,045	25%	Bay pens
FRHFnc	2012	FRH	Fea R	Fall	2	649,160	656,564	99%	Coastal pens
FRHFtib	2012	FRH	Fea R	Fall	1	9,918	10,028	99%	Bay pens
NIMF	2012	NIM	Ame R	Fall	3	1,026,596	3,277,594	31%	In-basin
NIMFn	2012	NIM	Ame R	Fall	1	182,413	734,906	25%	Bay pens
MOKF	2012	MOK	Mok R	Fall	1	99,548	100,306	99%	In-basin
MOKFn	2012	MOK	Mok R	Fall	13	1,275,158	5,123,986	25%	Bay pens
MERFt	2012	MER	Mer R	Fall	4	325,953	1,384,973	24%	In-basin
SacW	2012	LSH	Sac R	Wint	16	169,967	181,857	92%	In-basin
CFHLh	2013	CFH	Sac R	Late	14	960,075	984,977	97%	Hatchery
Total age 2 releases:					91	11,663,402	32,778,520	36%	0% wild CWT releases

Age 3 CWT releases									
Release type*	Brood year	Hatchery / wild	Stock origin	Run type	CWT codes	# CWT tagged	Total fish released	% CWT	Release strategy
FRHS	2011	FRH	Fea R	Spr	2	1,088,286	1,110,709	98%	In-basin
FRHSn	2011	FRH	Fea R	Spr	1	1,125,189	1,134,280	99%	Bay pens
CFHFh	2011	CFH	Sac R	Fall	28	3,117,042	12,508,161	25%	Hatchery
FRHFb	2011	FRH	Fea R	Fall	3	297,089	297,969	100%	Barge study
FRHFe	2011	FRH	Fea R	Fall	2	11,449	11,449	100%	Experimental
FRHFn	2011	FRH	Fea R	Fall	6	2,293,211	9,265,375	25%	Bay pens
FRHFnc	2011	FRH	Fea R	Fall	3	426,190	427,337	100%	Coastal pens
FRHFtib	2011	FRH	Fea R	Fall	1	9,933	9,967	100%	Bay pens
FeeFW	2011	wild	Fee R	Fall	23	156,526	159,811	98%	In-basin
NIMF	2011	NIM	Ame R	Fall	3	1,078,191	3,492,113	31%	In-basin
NIMFn	2011	NIM	Ame R	Fall	2	328,073	1,312,930	25%	Bay pens
MOKF	2011	MOK	Mok R	Fall	1	92,020	109,043	84%	In-basin
MOKFn	2011	MOK	Mok R	Fall	21	1,487,132	5,973,754	25%	Bay pens
MOKFt	2011	MOK	Mok R	Fall	2	110,737	448,659	25%	Trucked
MERF	2011	MER	Mer R	Fall	9	262,108	262,108	100%	In-basin
SacW	2011	LSH	Sac R	Wint	18	185,313	194,264	92%	In-basin
CFHLh	2012	CFH	Sac R	Late	14	1,031,419	1,094,288	94%	Hatchery
Total age 3 releases:					139	13,099,908	37,812,217	35%	1% wild CWT releases

Table 3. Central Valley coded-wire tag (CWT) Chinook releases recovered in 2014 by age, run, stock, and release type. (Page 2 of 2)

Age 4 CWT releases										
Release	Brood	Hatchery	Stock	Run	CWT codes	# CWT tagged	Total fish released	% CWT	Release strategy	Release locations / notes
type*	year	origin	type	origin	type	codes	tagged			
FRHS	2010	FRH	Fea R	Spr	Spr	2	1,170,340	1,181,710	99%	In-basin
FRHSn	2010	FRH	Fea R	Spr	Spr	2	1,136,690	1,157,167	98%	Bay pens
CFHFh	2010	CFH	Sac R	Fall	Fall	25	2,835,420	11,369,732	25%	Hatchery
CFHFn	2010	CFH	Sac R	Fall	Fall	3	334,756	1,339,659	25%	Bay pens
FRHFn	2010	FRH	Fea R	Fall	Fall	9	2,554,115	10,308,722	25%	Bay pens
FRHFnc	2010	FRH	Fea R	Fall	Fall	2	185,985	187,022	99%	Coastal pens
FRHFtib	2010	FRH	Fea R	Fall	Fall	2	56,030	56,398	99%	Tibur. pens
FeeFW	2010	wild	Fea R	Fall	Fall	38	188,791	194,798	97%	In-basin
NIMF	2010	NIM	Ame R	Fall	Fall	3	1,014,340	3,259,868	31%	In-basin
NIMFn	2010	NIM	Ame R	Fall	Fall	3	368,363	1,595,731	23%	Bay pens
MOKF	2010	MOK	Mok R	Fall	Fall	1	100,215	100,467	100%	In-basin
MOKFn	2010	MOK	Mok R	Fall	Fall	1	1,126,781	4,548,348	25%	Bay pens
MOKFt	2010	MOK	Mok R	Fall	Fall	13	473,268	1,898,828	25%	Trucked
MERF	2010	MER	Mer R	Fall	Fall	0	122,973	128,375	96%	In-basin
MERFt	2010	MER	Mer R	Fall	Fall	4	6,669	6,762	99%	Trucked
SacW	2010	LSH	Sac R	Wint	Wint	14	113,905	123,859	92%	In-basin
CFHLh	2011	CFH	Sac R	Late	Late	14	1,037,859	1,053,282	99%	Hatchery
Total age 4 releases:				136	12,826,500	38,510,728	33%	1%	wild CWT releases	

Age 5 CWT releases

Release	Brood	Hatchery	Stock	Run	CWT codes	# CWT tagged	Total fish released	% CWT	Release strategy	Release locations / notes
type*	year	origin	type	origin	type	codes	tagged			
FRHSn	2009	Spr	Fea R	Spr	Spr	6	1,058,635	1,085,409	98%	Bay pens
CFHFh	2009	Fall	Sac R	Fall	Fall	28	2,541,142	10,210,449	25%	Hatchery
FRHFn	2009	Fall	Fea R	Fall	Fall	11	2,367,209	9,536,050	25%	Bay pens
NIMFn	2009	Fall	Ame R	Fall	Fall	2	347,527	1,391,632	25%	Bay pens
MOKF	2009	Fall	Mok R	Fall	Fall	6	99,048	99,157	100%	In-basin
MOKFn	2009	Fall	Mok R	Fall	Fall	3	2,015,730	2,023,958	100%	Bay pens
CFHLh	2010	CNFH	Sac R	Late	Late	13	992,047	1,018,422	97%	Hatchery

***CWT release types:**

Sacramento River Basin Fall Chinook CWT release types

- CFHFh Coleman National Fish Hatchery fall hatchery releases
- CFHFn Coleman National Fish Hatchery fall net pen releases
- FRHFb Feather River Hatchery fall net pen releases
- FRHFe Feather River Hatchery fall barge study releases
- FRHFh Feather River Hatchery fall experimental releases
- FRHFn Feather River Hatchery fall bay net pen releases
- FRHFnc Feather River Hatchery fall coastal net pen releases
- FRHFtib Feather River Hatchery fall Tiburon net pen releases
- FeeFW Feather River fall wild
- NIMF Nimbus Fish Hatchery fall in-basin releases
- NIMFn Nimbus Fish Hatchery fall net pens
- SacW Livingston Stone Hatchery winter in-basin releases

San Joaquin River Basin Fall Chinook CWT release types

- MOKF Mokelumne Hatchery fall in-basin releases
- MOKFn Mokelumne Hatchery fall net pen releases
- MOKFt Mokelumne Hatchery fall trucked releases (no net pens)
- MERF Merced River Hatchery fall in-basin releases
- MERFt Merced River Hatchery fall trucked releases (no net pens)

Central Valley Spring Chinook CWT release types

- FRHS Feather River Hatchery spring in-basin releases
- FRHSn Feather River Hatchery spring net pen releases

Central Valley Late-Fall Chinook CWT release types

- CFHLh Coleman National Fish Hatchery late fall hatchery releases

Table 4. Central Valley hatchery and natural escapement estimates, sport harvest, and sample data, 2014.

Central Valley Survey	Run	Total	Chinook Sampled ^{a/}	Observed Ad-Clips	Heads Processed	Valid CWTs	Sample rate (fe)	Ad-clips processed (fa)	Valid CWTs (fa)	CWT F samp
Hatchery Escapement										
Feather River Hatchery	Spring	2,776	2,776	2,637	2,637	2,594	100%	100%	100%	1.00
Feather River Hatchery Trap (pre-season)	Spring	23	23	16	16	16	100%	100%	100%	1.00
Coleman National Fish Hatchery	Fall	18,840	18,840	4,339	4,323	4,218	100%	100%	100%	1.01 ^{b/}
Feather River Hatchery	Fall	23,420	23,420	9,160	9,160	8,984	100%	100%	100%	1.00
Nimbus Fish Hatchery	Fall	8,343	8,343	2,068	2,068	1,975	100%	100%	100%	1.02
Mokelumne River Hatchery	Fall	8,820	8,820	2,126	2,126	2,085	100%	100%	100%	1.00
Merced River Hatchery	Fall	811	811	213	213	210	100%	100%	99%	1.01
Coleman National Fish Hatchery	Late-fall ^{c/}	6,814	6,814	6,700	6,694	6,569	100%	100%	100%	1.01 ^{b/}
Coleman National Fish Hatchery Trap	Late-fall ^{c/}	137	137	130	27	26	100%	21%	100%	4.81
Total Hatchery Escapement	Fall-run only	69,984	69,984	27,389	27,264	26,677				
Natural Area Escapement										
Upper Sacramento River (above RBDD)	Winter	2,627	1,293	195	191	167	49%	98%	100%	2.45 ^{d/}
Butte Creek	Spring	5,083	2,481	0	0	0	49%	-	-	-
Upper Sacramento River (above RBDD)	Fall	29,885	2,077	248	248	225	7%	100%	100%	22.09 ^{d/}
Clear Creek	Fall	15,794	988	172	172	165	6%	100%	99%	15.68 ^{d/}
Cow Creek	Fall	3,535	video	Opportunistic sampling of CWTs		1%	-	-	-	-
Battle Creek	Fall	26,575	video	No biodata collected	106 ^{e/}	-	-	-	-	-
Cottonwood Creek	Fall	1,940	108	11	11	11	6%	100%	100%	17.96 ^{f/}
Paynes Creek	Fall	72	66	9	8	8	92%	89%	100%	1.23
Mill Creek	Fall	2,488	147	26	26	23	6%	100%	100%	13.37 ^{f/}
Deer Creek	Fall	849	video	Opportunistic sampling of CWTs		3%	-	-	-	-
Butte Creek	Fall	1,412	717	44	44	40	51%	100%	100%	1.97
Feather River	Fall	60,721	4,984	1,724	1,724	1,634	8%	100%	98%	12.38
Yuba River above Daguerre Point Dam (DPD)	Fall	9,135	8,886	1,393	58	53	97%	4%	100%	24.69 ^{g/}
Yuba River below DPD	Fall	2,569	382	59	59	53	15%	100%	100%	6.73 ^{d/}
American River	Fall	24,503	16,617	2,333	2,196	1,993	68%	94%	99%	2.24 ^{d/}
Nimbus Fish Hatchery Weir	Fall	1,972	1,972	178	178	159	100%	100%	98%	1.02
Mokelumne River	Fall	3,297	3,297	764	65	54	100%	9%	100%	11.75 ^{g/}
Stanislaus River	Fall	3,064	551	102	102	97	18%	100%	98%	5.49 ^{h/}
Tuolumne River	Fall	206	107	7	7	7	52%	100%	100%	5.35 ^{d/}
Merced River	Fall	860	92	17	17	16	11%	100%	100%	9.35 ^{d/}
Upper Sacramento River (above RBDD)	Late-fall ^{c/}	2,033	199	3	3	2	10%	100%	100%	10.22
Total Natural Area Escapement	Fall-run only	198,620	44,964	7,285	5,109	4,813				
CV Sport Harvest										
Sacramento River (above Feather River)	Fall	13,322	1,045	204	202	201	8%	99%	100%	12.94
Sacramento River (below Feather River)	Fall	6,506	264	52	52	52	4%	100%	100%	24.64
Feather River	Fall	8,404	243	65	62	62	3%	95%	100%	36.26
American River	Fall	12,520	482	118	118	116	4%	100%	100%	25.98
Mokelumne River	Fall	1,380	92	23	23	23	7%	100%	100%	15.00
Sacramento River (above Feather River)	Late-fall ^{c/}	281	24	9	7	7	9%	78%	100%	15.05
Total Sport Harvest	Total Sampled	42,413	2,150	471	464	461				
		117,098		35,145	32,837	31,951				

^{a/} Number of Chinook sampled and visually checked for a clipped adipose fin or electronically scanned to check for the presence of a CWT.^{b/} Average sample expansion factor; Coleman National Fish Hatchery sample expansion factors calculated based on run-timing and sampling protocol; fall and late-fall counts parsed based on CWT codes.^{c/} Late-fall hatchery returns, natural escapement, and sport harvest occurred during late fall of 2014 through early 2015 (return year 2015).^{d/} Carous survey sample expansion factor based on fresh fish only and expanded to all valid CWTs (Mohr and Satterthwaite, 2013; Appendix 1).^{e/} Battle Creek fall natural escapement estimated using Battle Creek video count minus fall return to Coleman National Fish Hatchery (CFH). Surrogate CWTs based on CFH hatchery proportion and CWT recoveries.^{f/} Escapement estimate based on video counts; CWTs collected in separate survey (e.g., kayak survey).^{g/} Natural escapement CWTs collected on spawning grounds and expanded based on total ad-clip count observed via video weir (e.g., Mokelumne River, Yuba River above DPD).^{h/} Stanislaus natural escapement and sample expansion factor based on fresh fish only and expanded to all valid CWTs (e.g., 23 CWTs recovered from washbacks on Stanislaus Weir).

Table 5. Total harvest and sample data for 2014 Ocean Salmon Sport and Commercial Fisheries by major port area.

Fishery - Port Area	Ocean Harvest	Chinook Sample ^{a/}	Observed Ad-Clips	Heads Processed	CWTs	Valid Sample rate (fe)	Ad-clips processed (fa)	CWTs (fd)	CWT F samp
California Sport									
Eureka/Crescent	15,827	4,351	956	955	871	28%	100%	99%	3.66
Fort Bragg	12,540	2,572	648	642	614	21%	99%	99%	4.97
San Francisco	32,453	11,252	2,975	2,963	2,893	35%	100%	100%	2.91
Monterey	<u>14,020</u>	<u>3,445</u>	<u>1,143</u>	<u>1,135</u>	<u>1,101</u>	25%	99%	100%	4.11
	74,840	21,620	5,722	5,695	5,479				
California Commercial									
Eureka/Crescent	620	477	119	117	109	77%	98%	99%	1.33
Fort Bragg	76,931	28,816	6,144	6,143	5,811	38%	100%	99%	2.70
San Francisco	82,424	35,283	6,788	6,776	6,428	43%	100%	99%	2.36
Monterey	<u>8,308</u>	<u>3,162</u>	<u>829</u>	<u>828</u>	<u>799</u>	38%	100%	100%	2.64
	168,283	67,738	13,880	13,864	13,147				
California Total	243,123	89,358	19,602	19,559	18,626				
Oregon Sport	16,174	5,333	1,019	1,016	925	33%	100%	100%	3.05
Oregon Commercial	<u>191,914</u>	<u>73,885</u>	<u>12,003</u>	<u>11,999</u>	<u>11,597</u>	39%	100%	99%	2.62
Oregon Total	<u>208,088</u>	<u>79,218</u>	<u>13,022</u>	<u>13,015</u>	<u>12,522</u>				

a/ Number of salmon visually checked for a clipped adipose fin or electronically scanned to check for the presence of a CWT.

Table 6. Raw and expanded Chinook CWT recoveries in the Central Valley by run type and brood year during 2014.

<u>Fall-run</u>		2013	2012	2011	2010	2009	Total CV CWTs	Total CV %
Age		1	2	3	4	5		
Raw CWT Recoveries		1 (<1%)	4,142 (22%)	8,429 (45%)	6,065 (33%)	4 (<1%)	18,641	58%
Expanded CWTtotal		1 <td>29,892 (15%)</td> <td>91,215 (45%)</td> <td>80,528 (40%)</td> <td>21 (<1%)</td> <td>201,657</td> <td>90%</td>	29,892 (15%)	91,215 (45%)	80,528 (40%)	21 (<1%)	201,657	90%
<u>Spring-run</u>		2012	2011	2010	2009	Total CV CWTs	Total CV %	
Age		2 ^{a/}	3	4 ^{a/}	5			
Raw CWT Recoveries		904 (14%)	3,152 (48%)	2,470 (38%)	1 (<1%)	6,527	20%	
Expanded CWTtotal		1,666 (11%)	7,672 (49%)	6,212 (40%)	1 (<1%)	15,551	7%	
<u>Late-Fall-run</u>		2013	2012	2011	2010	Total CV CWTs	Total CV %	
Age		2	3	4	5			
Raw CWT Recoveries		129 (2%)	4,500 (68%)	1,970 (30%)	17 (<1%)	6,616	21%	
Expanded CWTtotal		131 (2%)	4,843 (68%)	2,112 (30%)	21 (<1%)	7,107	3%	
<u>Winter-run</u>		2012	2011	2010	2009	Total CV CWTs	Total CV %	
Age		2	3	4	5			
Raw CWT Recoveries		12 (7%)	148 (89%)	7 (4%)		167	0.5%	
Expanded CWTtotal		31 (7%)	381 (88%)	18 (4%)		430	0.2%	
<u>All Runs</u>		2012	2011	2010	2009	Total CV CWTs	Total CV %	
Age		1	2 ^{a/}	3	4 ^{a/}	5		
Raw CWT Recoveries		1 (<1%)	5,187 (16%)	16,229 (51%)	10,512 (33%)	22 (<1%)	31,951	100%
CV Expanded CWTtotal		1 <td>31,721 (14%)</td> <td>104,111 (46%)</td> <td>88,870 (40%)</td> <td>43 (<1%)</td> <td>224,746</td> <td>100%</td>	31,721 (14%)	104,111 (46%)	88,870 (40%)	43 (<1%)	224,746	100%

a/ Includes one spring-run Chinook released from Trinity River Hatchery in the Klamath River Basin.

Table 7. Raw and expanded Chinook CWT recoveries in 2014 California ocean fisheries by run type and brood year.

<u>Fall-run</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		1,771 (11%)	11,088 (69%)	3,312 (20%)	10 (<1%)	16,181	87%
Expanded CWT total		11,733 (8%)	95,812 (68%)	32,440 (23%)	62 (<1%)	140,047	92%
<u>Spring-run</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		64 (6%)	975 (86%)	98 (9%)	1 (<1%)	1,138	6%
Expanded CWT total		225 (7%)	2,877 (85%)	277 (8%)	3 (<1%)	3,383	2%
<u>Late-Fall-run</u>		2013	2012	2011	2010	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries			452 (55%)	370 (45%)	6 (<1%)	828	4%
Expanded CWT total			1,321 (57%)	979 (42%)	16	2,317	2%
<u>Winter-run</u>		2013	2012	2011	2010	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries			31 (100%)			31	0.2%
Expanded CWT total			115 (100%)			115	0.1%
<u>Non-CV stocks</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		4 (<1%)	106 (24%)	327 (73%)	11 (2%)	448	2%
Expanded CWT total		77 (1%)	1,842 (33%)	3,582 (64%)	76 (1%)	5,577	4%
<u>All Runs</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		1,839 (10%)	12,652 (68%)	4,107 (22%)	28 (<1%)	18,626	100%
Expanded CWT total		12,035 (8%)	101,967 (67%)	37,279 (25%)	157 (<1%)	151,437	100%
CV Expanded CWT total proportion CV stocks		11,958 (99%)	100,125 (98%)	33,697 (90%)	81 (52%)	145,861	96%

Table 8. Raw and expanded Chinook CWT recoveries in 2014 Oregon ocean fisheries by run type and brood year.

<u>Fall-run</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		36 (<1%)	5,617 (72%)	2,177 (28%)	9 (<1%)	7,839	63%
Expanded CWT total		267 (<1%)	49,734 (71%)	20,056 (29%)	41 (<1%)	70,097	67%
<u>Spring-run</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		20 (2%)	1,219 (96%)	32 (3%)		1,271	10%
Expanded CWT total		74 (2%)	3,229 (96%)	68 (2%)		3,370	3%
<u>Late-Fall-run</u>		2013	2012	2011	2010	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries			23 (16%)	115 (82%)	2 (1%)	140	1%
Expanded CWT total			60 (17%)	287 (81%)	7	354	0%
<u>Non-CV stocks</u>		2012	2011	2010	2009	Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		6 (<1%)	765 (23%)	2,037 (62%)	464 (14%)	3,272	26%
Expanded CWT total		163 (<1%)	13,894 (44%)	15,291 (49%)	1,953 (6%)	31,301	30%
<u>All Runs</u>						Total Ocean CWTs	Total Ocean%
Age		2	3	4	5		
Raw CWT Recoveries		62 (<1%)	7,624 (61%)	4,361 (35%)	475 (4%)	12,522	100%
Expanded CWT total		503 (<1%)	66,917 (64%)	35,701 (34%)	2,001 (2%)	105,122	100%
CV Expanded CWT total (proportion CV stocks)		340 (68%)	53,023 (79%)	20,410 (57%)	48 (2%)	73,821	70%

Table 9. Percentage of inland CWT total recoveries by location, run, and release type^{a/} in hatchery returns, natural escapement and sport harvest during 2014.

Location	Run	SacW	CFHLh	CFHFh	CFHFn	FRH			MER			MOK			MERF			Hatchery			Total %		
						FRHS	FRHFn	FRHFb	FRHFnc	FRHFtb	NMF	NMFn	MOKF	MOKFn	MOKFt	MERF	MERFn	MERFt	Hatchery	Natural	Total %		
Hatchery Spawners																							
Feather River Hatchery	Spring					81% 43%	12% 22%	-	7% 4%										100%	0%	2,776		
Feather River Hatchery	preseason					1% 0%	-	0% 10%	3% 4%	3% 0%	0% 3%	-	-	-	0% 33%	24% 1%	0% 3%	21% 67%	3% 7%	0% 4%	95% 86%	11% 13%	18,840 8,343
Coleman National Fish Hatchery	Fall					85% - 0%	1% 1% 0%	0% 0% 0%	0% 3% 1%	0% 2% 2%	0% 0% 1%	-	-	-	-	-	-	-	-	-	5% 14%	5% 14%	23,420 8,820
Feather River Hatchery	Fall																						
Nimbus Fish Hatchery	Fall																						
Mokelumne River Hatchery	Fall																						
Merced River Hatchery	Fall																						
Coleman National Fish Hatchery	Late-fall ^{b/}																						
Coleman National Fish Hatchery	Total					98% 85%	0% - 27%	1% 4% 0%	31% 2% 0%	1% 0% 0%	0% 5% 5%	0% 4% 4%	0% 0% 0%	0% 14% 14%	0% 2% 2%	0% - -	1% 1% 1%	91% 85% 9%	2% 15% 9%	1% 1% 1%	0% 84% 100%	0% 54% 54%	2,627 6,814 60,234
Natural Spawners																							
Upper Sacramento River	Winter	16%																					
Butte Creek	Spring																						
Upper Sacramento River	Fall		15% 21%	4% 1%	0% 1%	1% 1%	1% 0%	30% 30%	2% 1%	0% 0%	0% 3%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	5,083
Clear Creek	Fall		85% 37%	1% 37%	-	0% 1% 0%	0% 0% 0%	30% 19%	1% 2%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	0% 0%	29,885 15,794 26,575
Battle Creek	Fall ^{c/}																						
Cottonwood Creek	Fall																						
Paynes Creek	Fall																						
Mill Creek	Fall																						
Butte Creek	Fall																						
Feather River	Fall																						
T Yuba River above DPD	Fall																						
13 Yuba River below DPD	Fall																						
American River	Fall																						
Nimbus Fish Hatchery Weir	Fall																						
Mokelumne River	Fall																						
Stanislaus River	Fall																						
Tuolumne River	Fall																						
Merced River	Fall																						
Upper Sacramento River	Late-fall ^{b/}																						
Natural Area Fall-run Total^{d/}																							
In-basin CWT _{Total}	All	0%	3%	19%	1%	5%	1%	1%	27%	1%	-	5%	3%	0%	3%	0%	3%	0%	0%	0%	69%	31%	13,322
Stray CWT _{Total}	All	-	13%	5%	0%	1%	1%	48%	3%	0%	0%	1%	0%	0%	4%	3%	0%	6%	1%	3%	100%	31%	6,506
Total CV Spawners	0%	3%	18%	1%	4%	1%	1%	29%	1%	21%	0%	42%	5%	0%	4%	3%	3%	5%	5%	5%	59%	51%	13,322
CV Sport Harvest																							
Upper Sacramento River	Fall																						
Lower Sacramento River	Fall																						
Feather River	Fall																						
American River	Fall																						
Mokelumne River	Fall																						
Upper Sacramento River	Late-fall ^{b/}																						
Total Sport Harvest	1%	16%	2%	1%	1%	1%	1%	24%	1%	0%	11%	4%	-	11%	1%	1%	1%	1%	1%	1%	74%	26%	13,322

a/ Any values less than 0.05% of CWT_{Total} are displayed as "—"; values equal or greater than 0.05% but less than 0.5% of CWT_{Total} are displayed as 0%.

b/ Late-fall hatchery returns, natural escapement, and sport harvest occurred in late fall 2014 (return year 2015).

c/ No CWT recovery survey or ad-clip count available for Battle Creek natural escapement; CWT release groups and hatchery proportions assumed to be equivalent to fall return at CFH (FWS staff, per. comm.).

d/ Natural Area Fall-run total does not include unsampled escapement into Cow Creek (n=3,555) and Deer Creek (n=849).

Table 10. Fall- and late-fall-run Chinook salmon escapement at Coleman National Fish Hatchery in 2014 based on run-timing and CWT stock composition

Calculation of CFH sample expansion factors based on run-timing and sample rate												
2014 CFH fall-run escapement (Oct 2, 2014 - Dec 4, 2014)												
Run timing (CWT sample rate)	Escapement N	Chinook Observed sampled (n)	Heads processed ad-clips	CWTS recovered	Valid CWTS	Sample rate (fe)	Ad-clips processed (fa)	Valid CWTs (fd)	Total CWT Production	Hatchery proportion		
Oct 2 - Dec 4 (100%)	18,981	18,981	4,500	4,484	4,400	4,381	100%	99.6%	1.01	16,800	16,929	89.2%

2015 CFH late-fall-run escapement (Dec 5, 2014 - Mar 17, 2015)												
Run timing (CWT sample rate)	Escapement N	Chinook Observed sampled	Heads processed	CWTS recovered	Valid CWTS	Sample rate (fe)	Ad-clips processed (fa)	Valid CWTs (fd)	Total CWT Production	Hatchery proportion		
Dec 5 - Mar 17 (100%)	6,673	6,673	6,539	6,533	6,437	6,406	100%	99.9%	1.00	6,563	6,595	98.8%
Total CFH count	25,654	25,654	11,039	11,017	10,837	10,787			23,363	23,524		

Final CFH escapement based on CWT segregation and sample expansion factors F_{sample} calculated above												
2014 CFH fall-run escapement												
Run timing	Escapement N	Chinook Observed sampled	Heads processed	CWTS recovered	Fall CWTS	Sample rate (fe)	Ad-clips processed (fa)	Valid CWTs (fd)	Average F_{sample}	Total CWT Production		
Oct 2 - Dec 17	18,840	18,840	4,339	4,323	4,235	4,218	100%	99.6%	1.01	16,890	16,817	89.3%

2015 CFH late-fall-run escapement												
Run timing	Escapement N	Chinook Observed sampled	Heads processed	CWTS recovered	Late fall CWTS	Sample rate (fe)	Ad-clips processed (fa)	Valid CWTs (fd)	Average F_{sample}	Total CWT Production		
Nov 6 - Mar 17	6,814	6,814	6,700	6,694	6,602	6,569	100%	99.9%	1.01	6,673	6,707	98.4%
Total CFH count	25,654	25,654	11,039	11,017	10,837	10,787			23,363	23,524		

Table 11. Total inland CWT^{a/} total recoveries by location, run, and release type^{b/} in hatchery returns, natural escapement and sport harvest during 2014.

Location	Run	SacW	FRH						MER						Total CWT ^{c/}		Total Run					
			CFH	CFHlh	CFHFh	CFHFn	FRHS	FRHSn	FRHFb	FRHFn	FRHFnc	FRHFtib	NIMF	NIMFn	MOK	MOKF	MOKFn	MERF	MERFt	Hatchery	Natural	
Hatchery Spawners																						
Feather River Hatchery	Spring		2,251	334	1	182							4	8				2,768	8	2,776		
Feather River Hatchery	preseason Spring		15,961	153	1	5	12	579	58	4			4	10	1	40	4	16	7	23		
Coleman National Fish Hatchery	Fall		4	76	2,360	930	660	17,288	723	30			2,794	1,996	5	1,769	259	22,174	1,246	18,840		
Feather River Hatchery	Fall			45		17	217	14				4	92	240	5,907	658	2	357	7,227	1,116	8,343	
Nimbus Fish Hatchery	Fall		6	8	16		10	245	48			45	14	12	447	65	14	178	7,595	1,225	8,820	
Mokelumne River Hatchery	Fall		1	4															781	30	811	
Merced River Hatchery	Fall																		6,707	107	6,814	
Coleman National Fish Hatchery	Late-fall ^{b/}		6,707																			
Coleman National Fish Hatchery	Late-fall ^{b/}		116																			
Coleman Hatchery Fish Trap	Total Hatchery Fall / Run		7	15,973	294	2,361	932	699	18,374	857	34	2,802	2,114	246	8,171	986	17	723	54,595	5,639	60,234	
Natural Spawners																						
Upper Sacramento River	Winter	430																	430	2,197	2,627	
Butte Creek	Spring																		5,083	5,083		
Upper Sacramento River	Fall		4,608	1,060	112	269	245	9,064	576	89	63	63						99	16,123	13,762	29,885	
Clear Creek	Fall		3,334	188	175	127	4,799	189		6	11							50	23,724	2,851	26,575	
Battle Creek	Fall ^{c/}		22,515	216	1	3	17	817	82	6									792	1,148	1,940	
Cottonwood Creek	Fall		720						72										39	33	72	
Paynes Creek	Fall		39																	1,113	1,375	2,488
Mill Creek	Fall		483	107															294	1,118	1,412	
Butte Creek	Fall		16																			
- Feather River	Fall		149	644	6,245	1,934	895	38,925	1,266	62	99	50	99	99	8	9	9	52	50,420	10,301	60,721	
- Yuba River above DPD	Fall		494	25			50	3,287	200		99	99	198	100					4,452	4,683	9,135	
- Yuba River below DPD	Fall		135				20	868	68	7			61						1,159	1,410	2,569	
American River	Fall		27	206	2	9	324	36				8,048	4,350	5	2,297	397	89		15,790	8,713	24,503	
Nimbus Fish Hatchery Weir	Fall		12	3	8	8	70	5				149	45	24	1,945	189	85		554	1,418	1,972	
Mokelumne River	Fall																		2,511	786	3,297	
Stanislaus River	Fall		22																1,981	1,083	3,064	
Tuolumne River	Fall																		134	72	206	
Merced River	Fall																		496	364	860	
Upper Sacramento River	Late-fall ^{b/}		10																51	1,982	2,033	
Natural Area Fall-run Total^{d/}																				55,973	184,493	
In-basin CWT _{Total}	All	430	6,833	43,084	1,429	10,891	3,203	1,626	60,551	2,257	99	10,991	6,391	264	7,852	847	42	222	157,013	71,017	228,030	
Stray CWT _{Total}	All	7	4,764	1,965	117	459	447	17,391	1,128	99	170	357	24	6,822	1,072	15	1,199	151	36,190	36,190		
Total CV Spawners	430	6,840	47,848	3,394	11,008	3,662	2,073	77,942	3,385	198	11,161	6,748	288	14,674	1,919	58	1,421	151	193,203	71,017	264,220	
CV Sport Harvest																				19%	14%	
Upper Sacramento River	Fall		6,697	362	118	92	2,085	117				223	493	595	100				9,471	3,851	13,322	
Lower Sacramento River	Fall		156	99	296	75	1,985	99						291				4,120	2,386	6,506		
Feather River	Fall			145	295	184	218	4,663	255					4,220	1,192	210		6,088	2,316	8,404		
American River	Fall			208	53	79	131	1,358	52				60	15	1,025	122	70		10,386	2,134	12,520	
Mokelumne River	Fall																		1,352	28	1,380	
Upper Sacramento River	Late-fall ^{b/}		110																110	171	281	
Total Sport Harvest		286	6,796	1,011	348	381	516	10,151	523	37	4,503	1,685	15	4,632	432	233		31,527	10,886	42,413		

a/ Release types defined in Table 3.

b/ Late-fall hatchery returns, natural escapement, and sport harvest occurred in late fall 2014 (return year 2015).

c/ Battle Creek natural escapement CWT_{total} based on hatchery proportions at CFH (FWS staff, per. comm).

d/ Natural Area Fall-run total does not include unsampled escapee into Cow Creek (n=3,535) and Deer Creek (n=849).

Table 12. CWT recovery rate (recoveries per 100,000 CWTs released) by release type, brood year and recovery location in 2014. (page 1 of 2)

Age 2 CWT recoveries										Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals			
Release type	Brood year	Run type	# CWT tagged	Bat Cr	Up Sac	Nat crks ^{a/}	Fee	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	% CV Stray	Ocean CWT samp	In-basin	Stray	CV total	% Ocean		
FRHS	2012	Spr	1,106,679	66	16	755	25	6					553	553	71	50	50	74	9	83	6		
FRHSn	2012	Spr	1,015,285	524	13	645	38	11	4				524	13	538	10%	222	18	1	19	22		
CFHFh	2012	Fall	2,956,873	15	177	78	4						684	285	969	2%	372	233	97	330	127		
FRHFB	2012	Fall	293,784	138,888	244	1,989	117	52	47	29	27	2,106	815	2,921	28%	1,271	145	56	201	87			
FRHFe	2012	Fall	1,453,105	150	265	614	258	12	47	23	44	872	397	1,269	31%	3,317	134	61	195	511			
FRHFnc	2012	Fall	649,160	80	66	124	4						4	2	6	38%	15	40	24	64	150		
FRHFtib	2012	Fall	9,918	2									13	320	13	333	4%	114	31	1	32	11	
NIMF	2012	Fall	1,026,596										50	4	50	54	7%	14	28	2	30	8	
NIMFn	2012	Fall	182,413										2	30	30	32	7%	30	2				
MOKF	2012	Fall	99,548										935	99	148	1,498	38%	484	73	44	117	38	
MOKFn	2012	Fall	1,275,158	5	4	16	7	284					50	55	266	316	84%	93	15	82	97	28	
MERFt	2012	Fall	325,953	19	2	9		65	116	50	55		29		130			105	17	17	62		
SacW ^{b/}	2012	Wint	169,967		29																		
CFHLh	2013	Late	960,075	130																			
Total	11,663,402		926	604	482	4,578	444	803	1,183	201	274	7,045	2,450	9,495	26%	6,175	905	380	1,285	1,053			
Age 3 CWT recoveries										Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals			
Release type	Brood year	Run type	# CWT tagged	Bat Cr	Up Sac	Nat crks ^{a/}	Fee	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	% CV Stray	Ocean CWT samp	In-basin	Stray	CV total	% Ocean		
FRHS	2011	Spr	1,088,286	44	5,231	3							5,231	47	5,279	1%	3,935	481	4	485	362		
FRHSn	2011	Spr	1,125,189	5	133	141	1,650	2					1,650	281	1,931	15%	2,074	147	25	172	184		
CFHFh	2011	Fall	3,117,042	4,870	177	276	4						5,047	281	5,328	5%	6,288	162	9	171	202		
FRHFB	2011	Fall	297,089	14	66	49	884	31	23	6			915	159	1,074	15%	2,428	308	54	362	817		
FRHFe	2011	Fall	11,449			13							13		13		8	117		117	67		
FRHFnc	2011	Fall	2,293,211	114	1,060	747	5,885	568	62	30			22	6,453	2,035	8,489	24%	17,489	281	89	370	763	
FRHFtib	2011	Fall	426,190	56	442	94	1,363	7	43	1			5	1,370	642	2,011	32%	10,175	321	151	472	2,387	
NIMF	2011	Fall	9,933		17	7							24		24		49	243		243	492		
NIMFn	2011	Fall	1,078,191										1,348		1,348		2,755	125		125	255		
CFHLh	2011	Fall	328,073	10	12	25	829	14	3	11	829	75	904	8%	1,899	253	23		276	579			
MOKF	2011	Fall	92,020			1	143	11					143	12	155	8%	128	155	13	168	139		
MOKFn	2011	Fall	1,487,132		4	17	25	503	866	76	181	866	805	1,671	48%	4,075	58	54	112	274			
MOKFt	2011	Fall	110,737		2			79	141	33	27	141	142	282	50%	707	127	128	255	638			
MERF	2011	Fall	262,108					1	19	19	1		20		5%	57	7	0.4	7	22			
SacW	2011	Wint	185,313		363								363		4,517	0.1%	1,311	196	196				
CFHLh	2012	Late	1,031,419	4,511									4,511	6	4,517	437	1	438		127			
Total	12,943,382		9,570	2,295	1,313	15,074	662	2,898	1,207	131	257	28,923	4,485	33,408	13%	53,375	3,418	550	3,968	7,308			

Table 12. CWT recovery rate (recoveries per 100,000 CWTs released) by release type, brood year and recovery location in 2014. (page 2 of 2)

Age 4 CWT recoveries										Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals				Recovery rate per 100K released			
Release	Brood	Run	Run	type	# CWT	tagged	Bat Cr	Up Sac	Nat crks ^a	Fee	Yub	Ame	Mok	Mer	In-basin	Stray	CV total	% CV	Ocean	CWT samp	In-basin	Stray	CV total	Ocean			
FRHS	2010	Spr	1,170,340	2	66	4,945	750	84	834	1%	274	422	6	428	23												
FRHSn	2010	Spr	1,136,690	66	16	4,202	851	38	2	2	5,174	894	6,068	15%	3,221	182	32	214	114								
CFHFh	2010	Fall	2,835,420	92	265	78	180	157	66	4	1	5	357	491	848	58%	1,329	107	147	254	397						
CFHFn	2010	Fall	334,756	83	928	392	6,136	346	38	32	1	6,481	1,472	7,954	19%	4,844	254	58	312	190							
FRHFn	2010	Fall	2,554,115	2	66	16	6	6	6	6	6	84	90	93%	1,199	3	45	48	644								
FRHFtib	2010	Fall	56,030	7	88	71	16	12	1,804	1	1,804	29	1,833	2%	1,969	178	3	181	194								
NIMF	2010	Fall	1,014,340	368,363	2	2	668	5	668	9	677	1%	947	181	3	184	257										
MOKF	2010	Fall	100,215	18	1	31	261	150	2	11	150	325	475	10%	4,3	64	7	71	43								
MOKFn	2010	Fall	1,126,781	1	25	85	70	2	11	70	11	124	194	64%	692	13	29	42	61								
MOKFt	2010	Fall	473,268	1	1	23	11	23	11	13	13	36	36%	34	18	10	28	56									
MERF	2010	Fall	122,973	17	17	1	1	2,066	1	17	17	2,067	0.05%	1,243	15	15	10	28									
SacW	2010	Wint	113,905	1,037,859	2,056	10	1	2,933	329	30	38	22,645	3,698	26,343	14%	16,340	199	0.1	199	120							
CFHLh	2011	Late	12,631,040	6,447	2,479	1,385	12,143	559	1	1	21	21	21	0.1	544	2387	2,511										
Age 5 CV recoveries										Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals				Recovery rate per 100K released			
Release	Brood	Run	Run	type	# CWT	tagged	Bat Cr	Up Sac	Nat crks ^a	Fee	Yub	Ame	Mok	Mer	In-basin	Stray	CV total	% CV	Ocean	CWT samp	In-basin	Stray	CV total	Ocean			
FRHSn	2009	Spr	1,058,635	2,541,142	1								1		1		3	0.1	0.1	0.2							
CFHFh	2009	Fall	2,367,209	347,527	4												3										
NIMFn	2009	Fall	99,048	2,015,730	2	1	1	2	1	1	2	3	21	21	23	23	5	6	1	2							
MOKFn	2009	Fall	992,047	21													23	0.1	0.1	0.1							
CFHLh	2010	Late																									

a/ Natural creeks can include Clear Creek, Cow Creek, Cottonwood Creek, Paynes Creek, Mill Creek, Deer Creek and Butte Creek, depending on survey year.

b/ Ocean recoveries of SacW are considered one year older than those of the same brood year recovered in CV; Brood year 2012 = age-3 ocean.

Sacramento River fall Chinook release types (SFC)

CFHFh	Coleman National Fish Hatchery fall hatchery releases
CFHFn	Coleman National Fish Hatchery fall bay net pen releases
FRHFb	Feather River Hatchery fall barge study releases
FRHFe	Feather River Hatchery fall experimental (includes rice field releases @ Knaggs Ranch)
FRHFn	Feather River Hatchery fall bay net pen releases (Santa Cruz and Pillar Point)
FRHFtib	Feather River Hatchery fall coastal net pen releases (released as yearlings)
NIMF	Nimbus Hatchery fall in-basin releases
NIMFn	Nimbus Hatchery fall bay net pens releases

Other CV Chinook release types (OCV)

FRHS	Feather River Hatchery spring in-basin releases
FRHSn	Feather River Hatchery spring bay net pen releases
MOKF	Mokelumne River Hatchery fall in-basin releases
MOKFn	Mokelumne River Hatchery fall bay net pen releases
MOKFt	Mokelumne River Hatchery fall trucked releases
MERF	Merced River Hatchery fall in-basin releases
MERFT	Merced River Hatchery fall trucked releases
SacW	Livingston Stone Hatchery winter in-basin releases
CFHLh	Coleman National Fish Hatchery late fall hatchery releases

Table 13. Percentage of CWT_{total} recoveries by port area, month and release type^a in 2014 California ocean salmon sport fishery.

		<u>CFH</u>		<u>CFHLh</u>		<u>CFHFh</u>		<u>FRHS</u>		<u>FRHShn</u>		<u>FRHFb</u>		<u>FRHFnc</u>		<u>FRHFt</u>		<u>NFH</u>		<u>NMF</u>		<u>MOK</u>		<u>MOKf</u>		<u>MER</u>		<u>MERF</u>		<u>MERft</u>		<u>nonCV</u>		<u>Total CV</u>		<u>Total %</u>		<u>Total Hatchery</u>		<u>Total Natural</u>		<u>Total Harvest</u>			
		<u>SacW</u>		<u>CFHl</u>		<u>CFHFh</u>		<u>CFHFn</u>		<u>FRHS</u>		<u>FRHShn</u>		<u>FRHFb</u>		<u>FRHFnc</u>		<u>FRHFt</u>		<u>NMF</u>		<u>NMFf</u>		<u>MOK</u>		<u>MOKf</u>		<u>MER</u>		<u>MERF</u>		<u>MERft</u>		<u>nonCV</u>		<u>Total CV</u>		<u>Total %</u>		<u>Hatchery</u>		<u>Natural</u>		<u>Total Harvest</u>	
California Sport Harvest																																													
Eureka/Crescent City																																													
May	0%	12%	3%	1%	0%	0%	23%	2%	0%	3%	2%	4%	4%	5%	1%	0%	0%	0%	0%	9%	50%	59%	41%	3,596	44%	5,279	44%	3,596	41%	5,279	44%														
Jun	1%	9%	1%	1%	1%	1%	22%	3%	4%	3%	4%	4%	5%	5%	0%	0%	0%	0%	6%	65%	71%	29%	4,443	22%	2,206	22%	4,443	29%	2,206	22%															
Jul	0%	15%	1%	1%	1%	1%	30%	3%	0%	4%	4%	2%	3%	10%	0%	0%	1%	1%	77%	78%	75%	75%	303	25%	303	25%	303	25%	303	25%															
Aug	0%	9%	1%	0%	1%	1%	44%	5%	2%	2%	1%	21%	4%	24%	18%	6%	6%	1%	-	0%	6%	59%	64%	36%	15,827	(21%)	7,14	53%	7,14	53%	7,14	53%													
Total	0%	11%	2%	1%	1%	1%	28%	3%	0%	4%	3%	25%	4%	2%	2%	3%	3%	3%	3%	1%	46%	47%	53%	714	20%	630	20%	714	53%	630	20%														
Fort Bragg																																													
Apr	7%	2%	2%	1%	1%	1%	21%	4%	4%	4%	4%	21%	4%	5%	3%	3%	3%	3%	3%	3%	0%	2%	2%	2%	48%	50%	50%	50%	1,358	50%	9,035	27%	1,358	50%	9,035	27%									
May	22%	5%	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	72%	73%	73%	73%	9,035	27%	9,035	27%	9,035	27%										
Jun	1%	5%	1%	1%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	96%	96%	96%	96%	696	4%	696	4%	696	4%	696	4%													
Jul	1%	13%	2%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%	0%	72%	73%	73%	73%	9,035	27%	9,035	27%	9,035	27%										
Aug	2%	8%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%												
Total	1%	12%	2%	1%	0%	1%	32%	6%	-	4%	3%	29%	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
San Francisco																																													
Apr	9%	3%	2%	1%	0%	0%	29%	5%	0%	3%	4%	0%	0%	2%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%											
May	10%	2%	2%	1%	0%	0%	25%	5%	0%	2%	4%	0%	0%	2%	3%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%											
Jun	15%	2%	1%	1%	1%	1%	3%	0%	0%	3%	28%	6%	3%	0%	1%	1%	1%	1%	3%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%												
Jul	16%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Aug	12%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Sep	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Oct	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Nov	23%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Total	0%	10%	1%	0%	0%	1%	28%	9%	0%	3%	3%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%											
Monterey																																													
Apr	1%	12%	1%	6%	3%	2%	3%	2%	3%	56%	5%	4%	4%	4%	4%	4%	4%	4%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%										
May	2%	6%	1%	21%	1%	0%	1%	0%	1%	31%	13%	0%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%											
Jun	1%	13%	1%	4%	4%	4%	4%	4%	4%	40%	21%	7%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%													
Jul	2%	3%	3%	3%	3%	3%	3%	3%	3%	68%	100%	0%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%												
Aug	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%											
Sep	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%											
Oct	0%	12%	1%	5%	2%	1%	1%	1%	1%	37%	9%	0%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%											
California Total Sport Harvest	0%	11%	1%	1%	1%	1%	1%	1%	1%	30%	7%	0%	3%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%												
Oregon Total Sport Harvest	0%	6%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%										

a/ Any values less than 0.05% of CWT_{total} are displayed as "-"; values equal or greater than 0.05% but less than 0.5% of CWT_{total} are displayed as 0%.

74,840

16,174

Table 14. Total CWT_{total} recoveries by port area, month and release type in 2014 California ocean salmon sport fishery.

Table 15. Percentage of CWT total recoveries by port area, month and release type^a/ in 2014 California ocean salmon commercial fishery.

		California Commercial Harvest										FRH				MER				Total CV	Total % Hatchery	Total % Natural	Total Harvest
		SacW	CFH	CFHLh	CFHFh	CFHFn	FRHS	FRHFn	FRHFb	FRHFnc	FRHFtib	NIMF	NIMFn	MOKF	MOKFn	MERF	MERFn	nonCV					
Eureka/Crescent City	1%	11%										11%	7%	16%	4%			1%	74%	75%	25%		620 (<1%)
Fort Bragg												3%	2%	-	3%	1%	-	6%	39%	45%	55%		23,126
Jun	1%	8%	1%	1%	0%	0%	18%	2%	-	5%	4%	0%	5%	1%	-	2%	66%	68%	32%		45,563		
Jul	1%	13%	2%	1%	0%	1%	29%	4%	0%	4%	4%	4%	4%	1%	-	1%	78%	79%	21%		7,788		
Aug	0%	2%	13%	3%	0%	0%	1%	42%	4%	0%	-	6%	10%	4%	2%	4%	54%	54%	46%		454		
Sep	4%	2%			1%		22%	2%		6%	10%					3%	3.2%	59%	62%	38%		76,931 (46%)	
Total	-	1%	11%	2%	1%	0%	1%	27%	4%	0%	4%	3%	0%	4%	1%	-							
San Francisco																							
May	1%	8%	2%	2%	1%	0%	17%	3%	0%	2%	2%	2%	2%	2%	0%	0%	-	4%	44%	56%		30,605	
Jun	1%	8%	1%	1%	0%	1%	19%	3%	0%	2%	3%	-	3%	1%	-	4%	42%	47%	53%		14,917		
Jul	1%	16%	2%	1%	0%	1%	29%	4%	0%	3%	4%	0%	5%	0%	1%	67%	68%	68%		6,994			
Aug	-	0%	17%	3%	-	0%	1%	38%	4%	0%	3%	1%	0%	0%	0%	-	-	71%	71%	29%		15,879	
Sep	-	0%	6%	1%	-	-	1%	31%	3%	0%	9%	4%	0%	12%	2%	0%	69%	69%	31%		11,044		
Oct	-	1%	1%	-	0%	0%	6%	1%	14%	17%	0%	14%	17%	0%	22%	5%	0%	68%	68%	32%		2,985	
Total	-	1%	10%	2%	1%	0%	1%	24%	3%	0%	4%	3%	0%	5%	1%	-	2%	54%	56%	44%		82,424 (49%)	
Monterey																							
May	1%	14%	1%	2%	1%	1%	31%	6%	0%	2%	1%	0%	5%	0%	0%	0%	0%	65%	66%	34%		4,341	
Jun	1%	14%	3%	0%	0%	0%	33%	7%	0%	1%	2%	3%	1%	0%	1%	66%	67%	33%		1,538			
Jul	1%	4%	13%	1%	0%	0%	28%	9%	5%	3%	7%	1%	74%	74%	26%		2,011						
Aug	1%	2%	2%	1%	0%	0%	5%	8%	3%	3%	5%	0%	24%	24%	24%	24%	24%	76%	418				
Total	0%	2%	13%	1%	1%	0%	1%	29%	7%	0%	3%	2%	-	5%	0%	-	0%	66%	66%	34%		8,308 (9%)	
California Total Commercial Harvest																		3%	57%	59%	41%		
-	1%	11%	2%	1%	0%	1%	26%	4%	0%	4%	3%	0%	5%	1%	-	-						168,283	
Oregon Total Commercial Harvest																							
	0%	6%	1%	1%	1%	0%	14%	2%	-	3%	2%	-	4%	1%	-	16%	35%	50%	50%		19,1,914		

a/ Any values less than 0.05% of CWT_{total} are displayed as “-”, values equal or greater than 0.05% but less than 0.5% of CWT_{total} are displayed as 0%.

Table 16. Total CWT_{total} recoveries by port area, month and release type in 2014 California ocean salmon commercial fishery.

Table 17. CWT recovery rate (recoveries per 100,000 CWTs released) for Experimental & Net Pen release types in 2014.

Age 2 CWT recoveries												Age 3 CWT recoveries												Age 4 CWT recoveries																			
Release type	Brood year	Run type	# CWT tagged	Central Valley total recoveries (CWT samp ^a) by basin												Central Valley total recoveries (CWT samp ^a) by basin												Central Valley total recoveries (CWT samp ^a) by basin															
				Bat Cr	Up Sac	Nat crks ^a	Fea	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	CW samp	CW total	% CV	Ocean	CW samp	In-basin	Stray	CV total	% CV	Ocean	CW samp	In-basin	Stray	CV total	% CV	Ocean	CW samp	In-basin	Stray	CV total	% CV	Ocean						
FRHFBb	2012	Fall	97,760	10	66	63	271	7	5	1			277	145	422	34%	245	284	148	432	251																						
FRHFBg	2012	Fall	99,192	5	110	16	360	31	6	3			392	140	532	26%	127	395	141	536	128																						
FRHFBr	2012	Fall	96,832										14		14																												
FRHFPb	2012	Fall	412,360	75	44	124	524	258	10	45	23		38	782	360	1,143	32%	2,211	190	87	277	536																					
FRHFPs	2012	Fall	236,800	5	22	90	2	2	5	90	37		126	29%	1,106																												
FRHFC	2012	Fall	46,492										4		4																												
FRHFKr	2012	Fall	92,396																																								
FRHFn	2012	Fall	1,453,105	150	265	244	1,989	117	52	47	29		27	2,106	815	2,921	28%	1,271	145	56	201	87																					
FRHFlb	2012	Fall	9,918	2				4					50	4		54		7%	14		28	2	30	8																			
NIMFn	2012	Fall	182,413																																								
MOKFn	2012	Fall	1,275,158	5																																							
T-22																																											

^a Natural creeks can include Clear Creek, Cow Creek, Cottonwood Creek, Paynes Creek, Mill Creek, Deer Creek and Butte Creek, depending on survey year.

Central Valley Chinook Experimental and Net Pen release types

CFHFn	Coleman National Fish Hatchery fall bay net pen releases	FRHFkc	Feather River Hatchery fall rice field study: Elkhorn boat ramp Sac River (control group)
FRHFBb	Feather River Hatchery fall barge study: trucked & released in SF Bay (@ Ft Baker)	FRHFkr	Feather River Hatchery fall rice field study: Yolo Bypass Knaggs Ranch rice field
FRHFBg	Feather River Hatchery fall barge study: barged to SF Bay and released	FRHFn	Feather River Hatchery fall bay net pen releases
FRHFBr	Feather River Hatchery fall barge study: in-river releases	FRHFib	Feather River Hatchery fall Tiburon net pen releases
FRHFPb	Feather River Hatchery fall coastal net pen releases - Pillar Point	NIMFn	Nimbus Hatchery fall bay net pens releases
FRHFPs	Feather River Hatchery fall coastal net pen releases - Santa Cruz	MOKFn	Mokelumne River Hatchery fall bay net pen releases

#	Release Type	Release Location
1	SacW	Lake Redding Park
2	CFHFh, CFHLh	CFH
3	FRHS	Feather River (Thermalito High Flow Area, Gridley)
4	FRHS	Feather River (Boyd's Pump Launch Ramp)
5	FRHFbr, FRHFkc	Sacramento River (Elkhorn Boat Launch)
6	NIMF	American River
7	NIMF	Discovery Park
8	FRHFe, FRHFkr	Yolo Bypass
9	MOKF	Mokelumne River
10	MokFw	Mok R Vino Farms
11	MokFw	Woodbridge
12	MERF	Merced River
13	MERF	Hatfield State Area
14	MERFt	Mossdale
15	FRHFe	San Joaquin River (above mouth)
16	MOKFn, MOKFt	Sherman Island
17	FRHSn, NIMFn	Mare Island Net Pens
18	FRHFn, NIMFn	Wickland Oil Net Pens
17	CFHFn, FRHSn	San Pablo Bay Net Pens
18	FRHFn	(both Wickland & Mare Island)
19	FRHFtib	Tiburon Net Pens
20	FRHFbb, FRHFbg	Fort Baker (Golden Gate mouth)
21	FRHFnp	Pillar Point Net Pens
22	FRHFns	Santa Cruz Net Pens

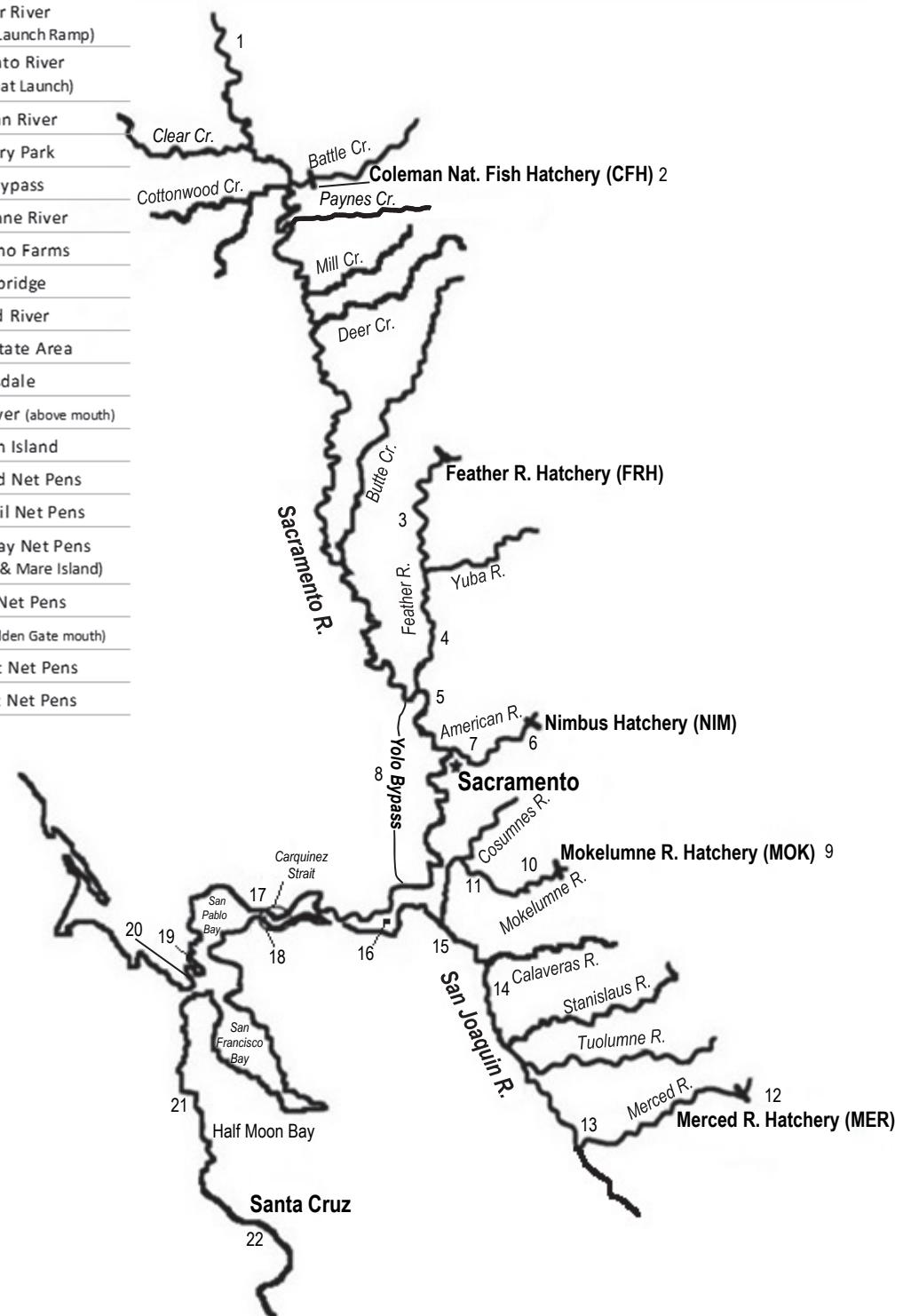


Figure 1. Map of release locations for CV hatchery release types, brood years 2009-2012.

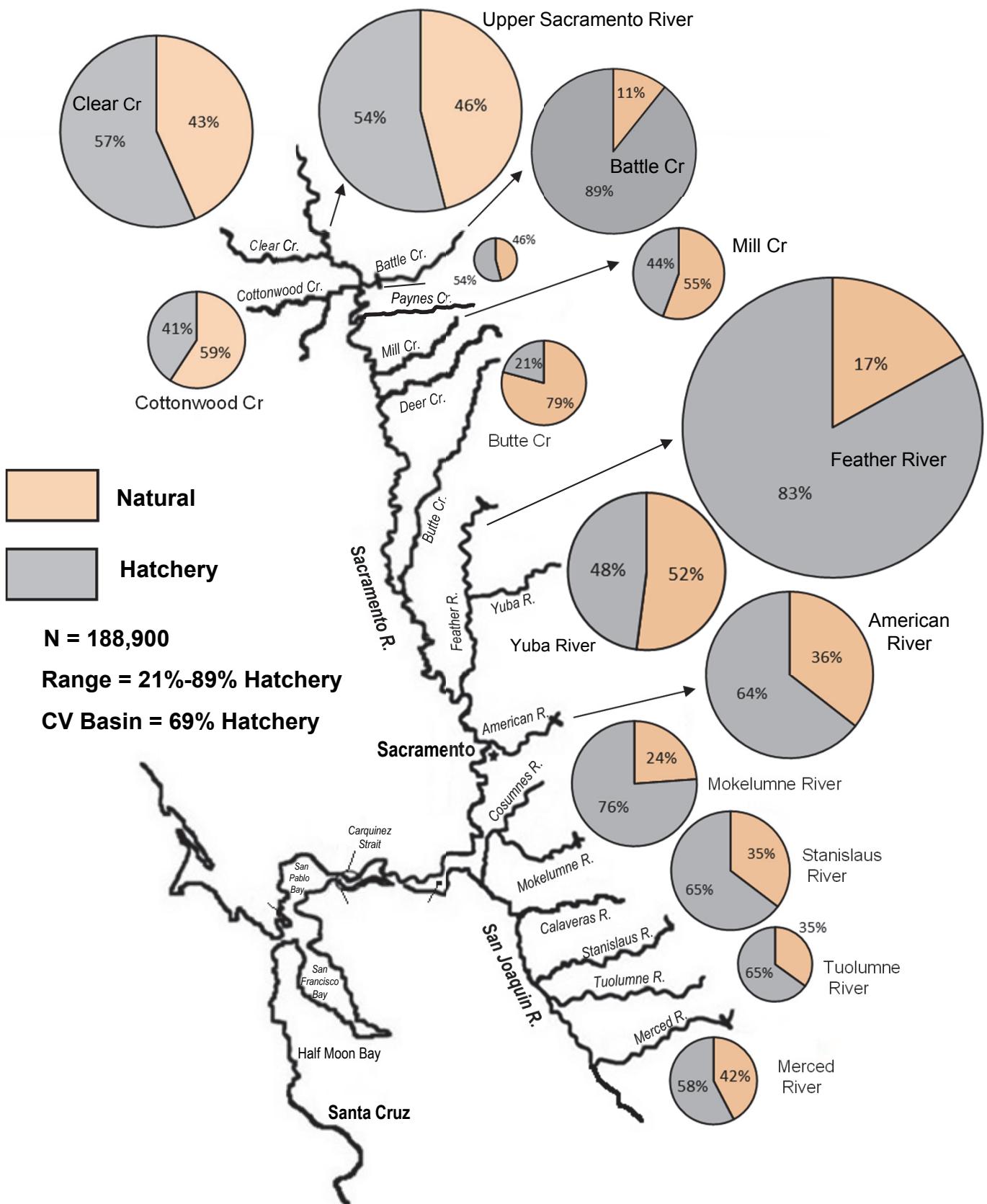


Figure 2. Fall-run CV Natural Area Escapement, Hatchery and Natural Proportions, 2014.

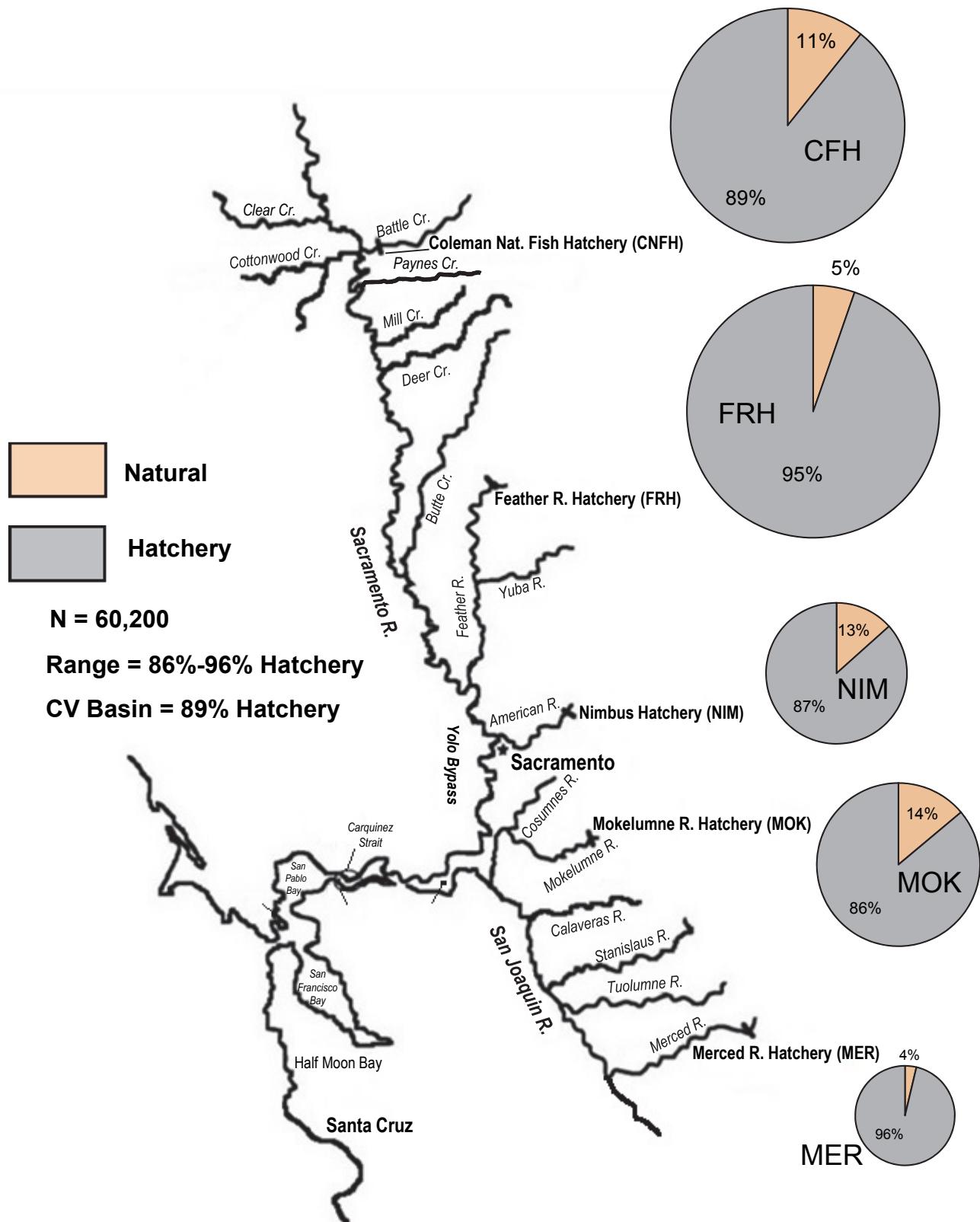


Figure 3. Fall-run CV Hatchery Escapement, Hatchery and Natural Proportions, 2014.

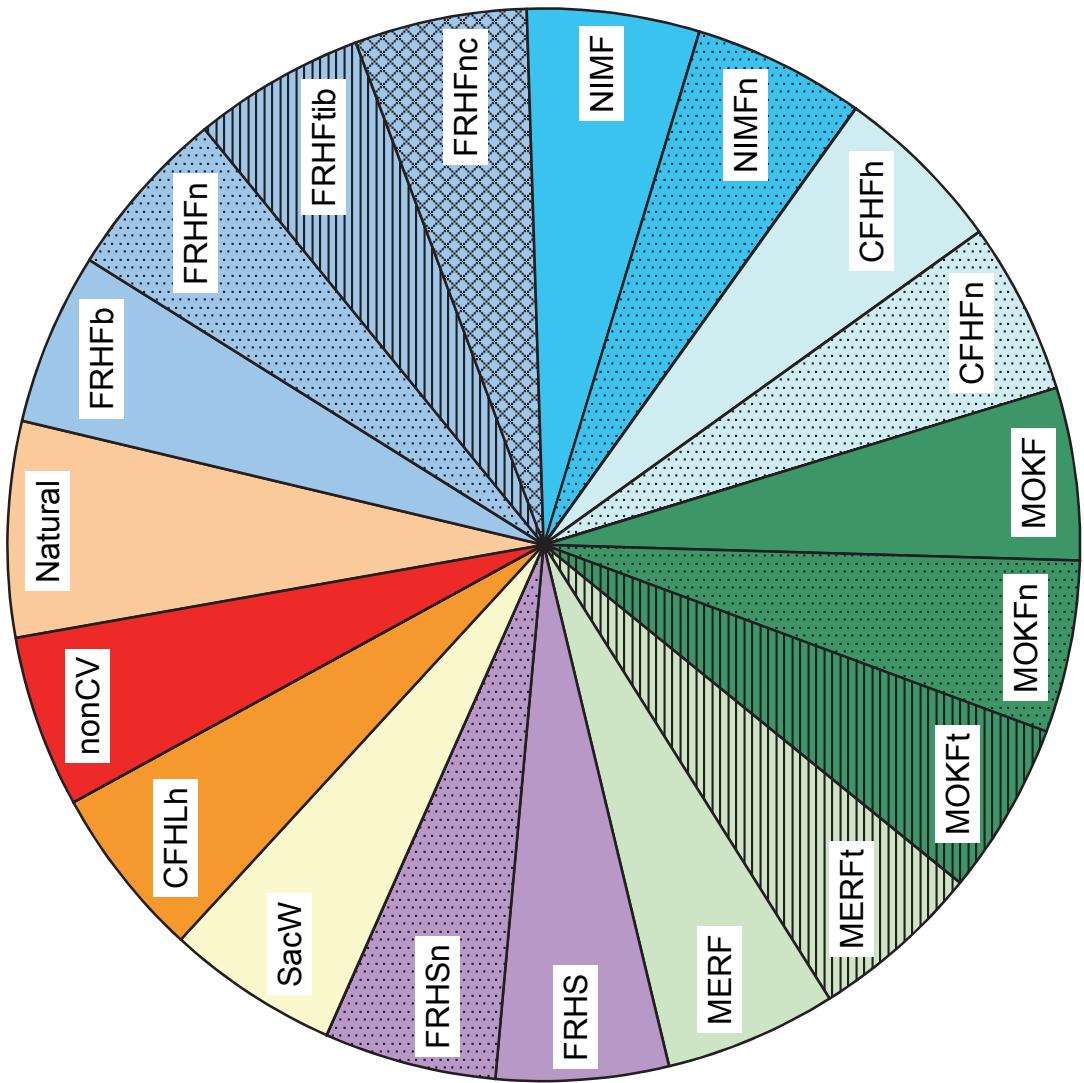
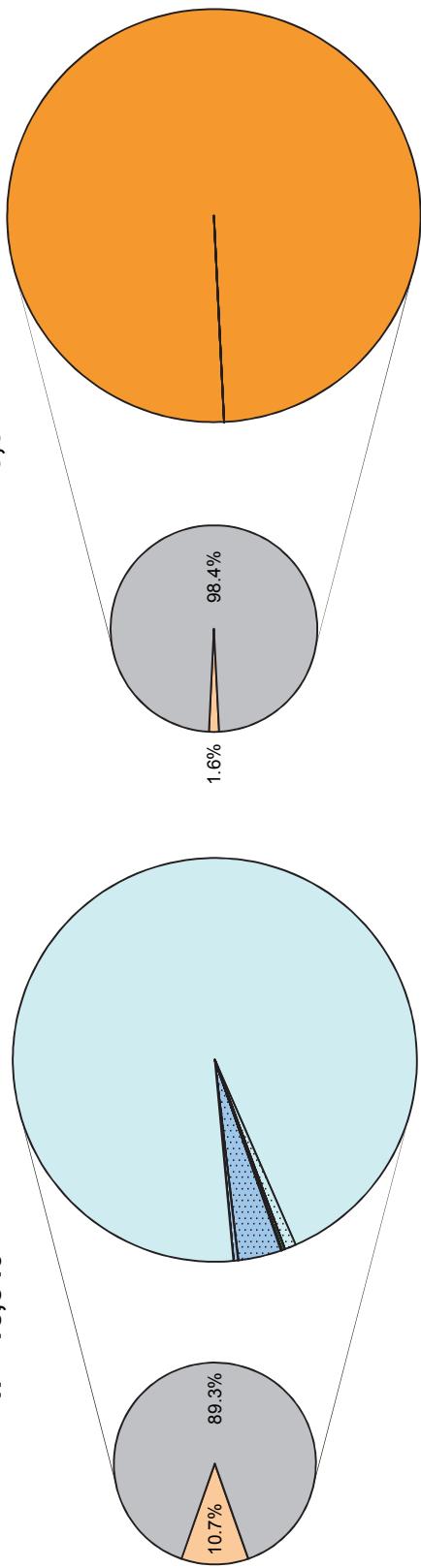


Figure 4. Color chart for Central Valley hatchery release types, brood years 2009-2012.

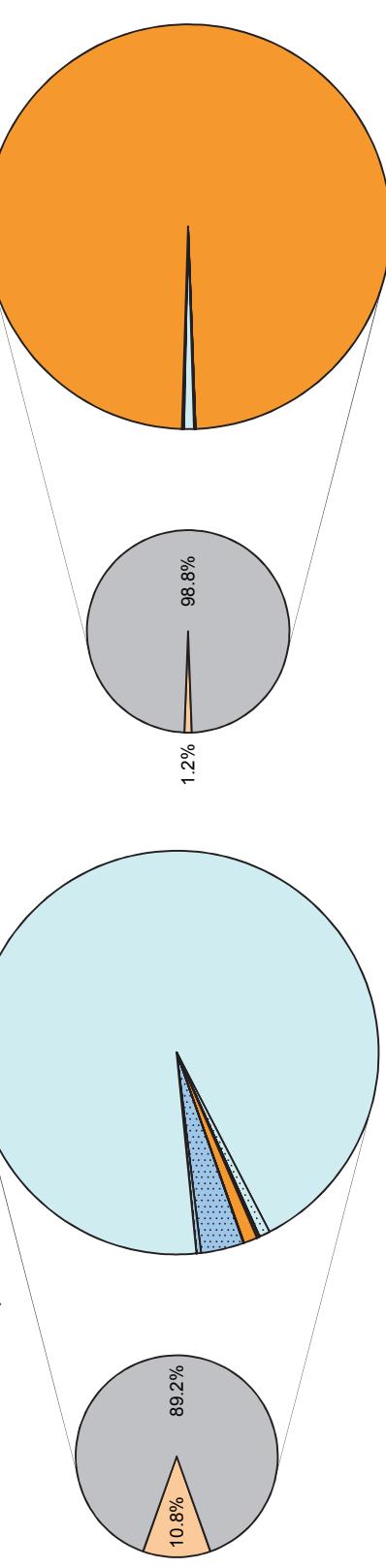
Coleman National Fish Hatchery fall 2014
n = 18,840

Coleman National Fish Hatchery late-fall 2015
n = 6,814



Coleman National Fish Hatchery fall period
(Oct 2, 2014 - Dec 4, 2014)
n = 18,981

Coleman National Fish Hatchery late-fall period
(Dec 5, 2014 - Mar 17, 2015)
n = 6,673

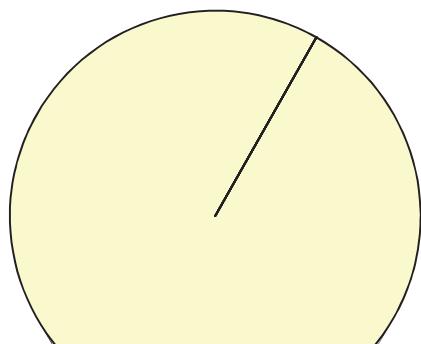
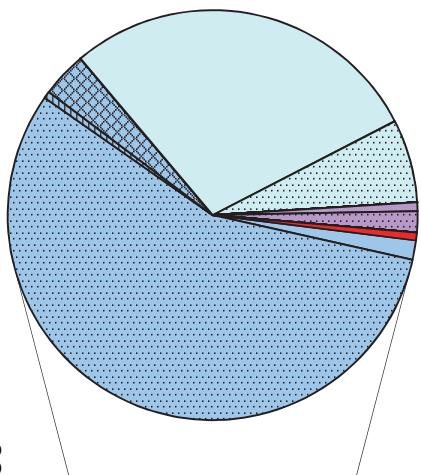


Legend:

- Natural
- FRHFb
- FRHFnc
- FRHFtib
- NIMF
- CFHFh
- MOKFn
- MOKFt
- MERFt
- FRHSn
- SacW
- CFHLh
- nonCV
- MOKF

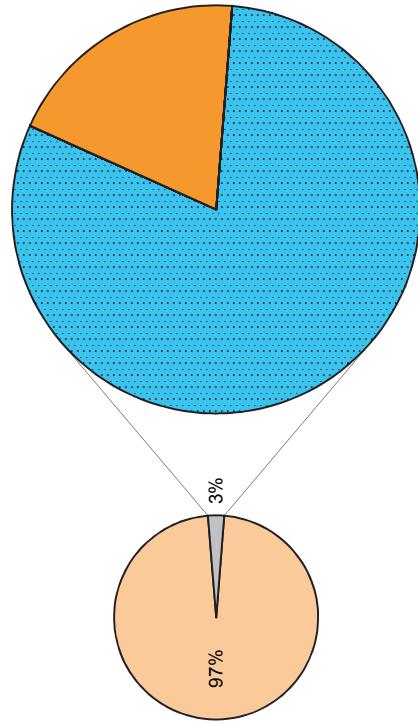
Figure 5. Proportion of hatchery- and natural-origin fish at Coleman National Fish Hatchery, 2014.

Upper Sacramento River fall carcass
n = 29,885

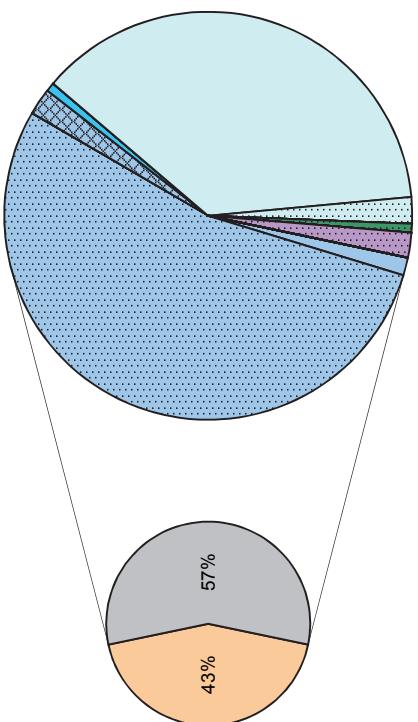


n = 2,627

Upper Sacramento River late-fall carcass
n = 2,033



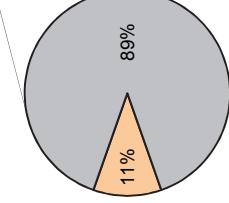
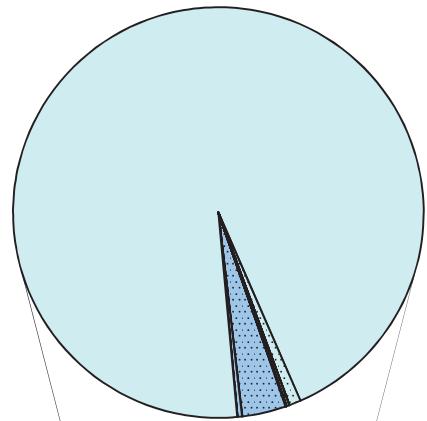
Clear Creek fall carcass
n = 15,794



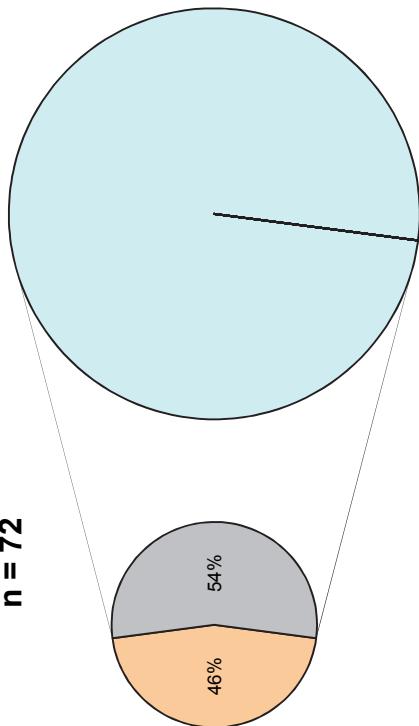
- Natural
- FRHFb
- MOKFn
- MOKFt
- FRHFtib
- FRHFc
- MERFt
- MERF
- FRHSn
- SacW
- CFHFn
- CFHLh
- nonCV
- MOKF
- CFHFh
- NIMFn
- FRHSn
- CFHFh
- MOKFn

Figure 6. Proportion of hatchery- and natural-origin fish in Upper Sacramento River & tributaries, 2014. (page 1 of 2)

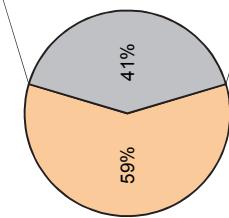
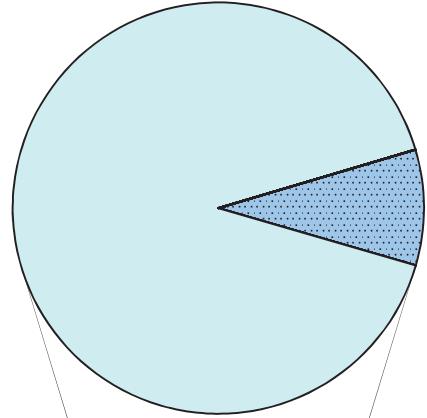
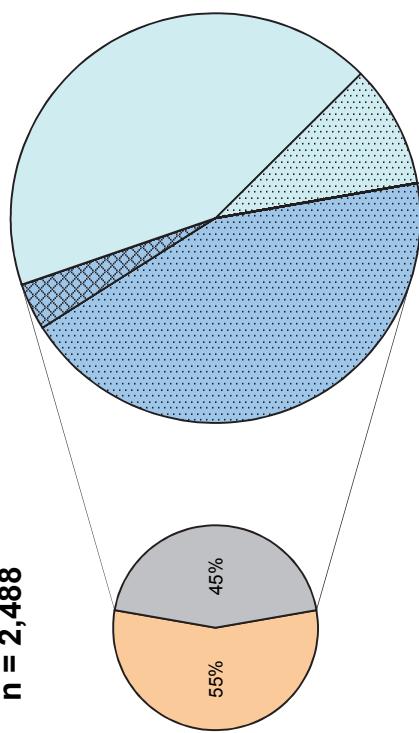
Battle Creek fall spawners
n = 26,575



Paynes Creek fall carcass
n = 72



Mill Creek fall carcass
n = 2,488

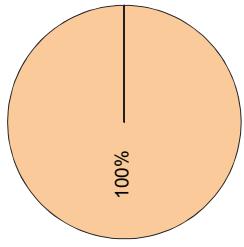


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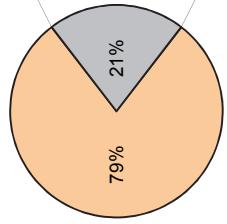
- Natural
- FRHFb
- MOKF
- MERF
- nonCV
- FRHFnc
- FRHFc
- FRHS
- FRHFtib
- FRHFt
- MERFt
- NIMF
- NIMFn
- NIMFh
- SacW
- CFHFh
- CFHFh
- CFHLh
- MOKFh

Figure 6. Proportion of hatchery- and natural-origin fish in Upper Sacramento River & tributaries, 2014 (page 2 of 2).

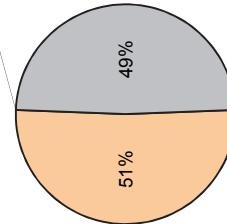
Butte Creek Spring carcass
n = 5,083



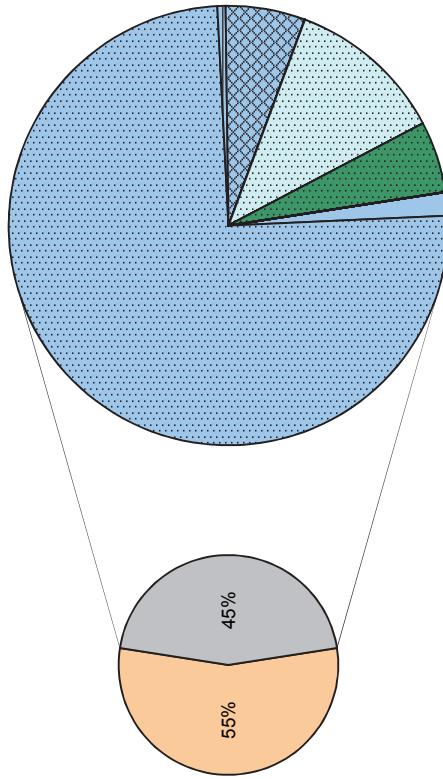
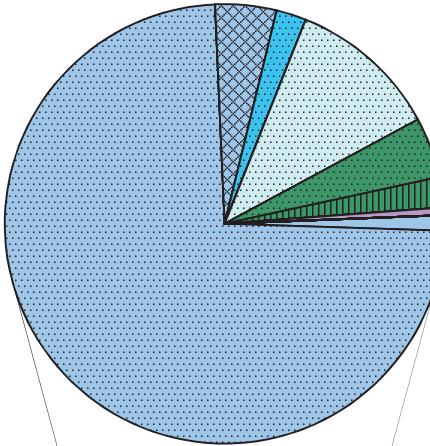
Butte Creek fall carcass
n = 1,412



Yuba River carcass (above DPD)
n = 9,135



Yuba River carcass (below DPD)
n = 2,569

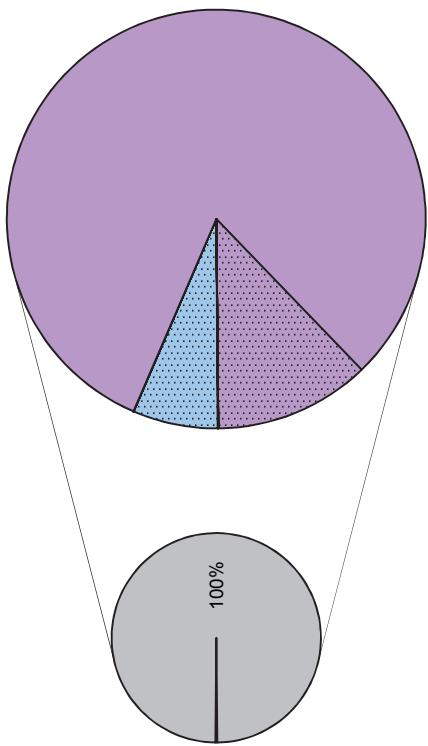
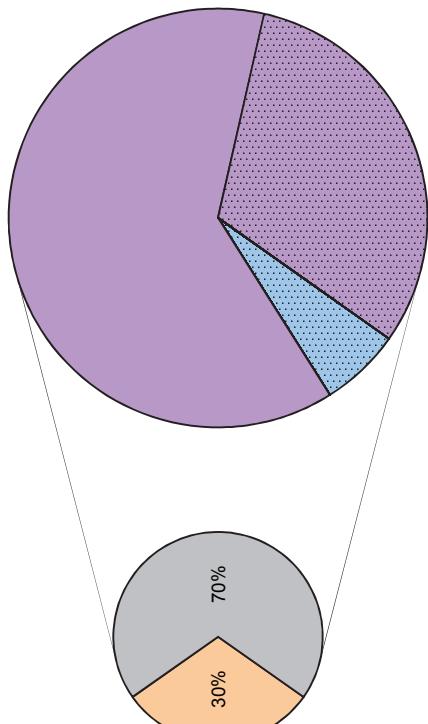


Legend:
 ■ Natural
 ■ MOKFn
 ■ FRHFb
 ■ MOKFt
 ■ FRHFn
 ■ MERF
 ■ FRHFnc
 ■ MERF
 ■ FRHS
 ■ FRHFh
 ■ SacW
 ■ CFHFh
 ■ CFHFnc
 ■ NIMF
 ■ NIMFn
 ■ FRHFtib
 ■ FRHFn
 ■ MERF
 ■ FRHFnc
 ■ FRHS
 ■ CFHFh
 ■ CFHFnc
 ■ nonCV

Figure 7. Proportion of hatchery- and natural-origin fish in Butte Creek & Yuba River, 2014.

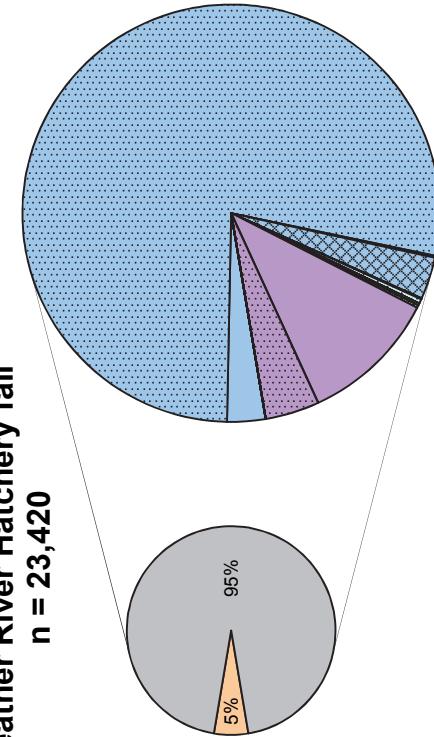
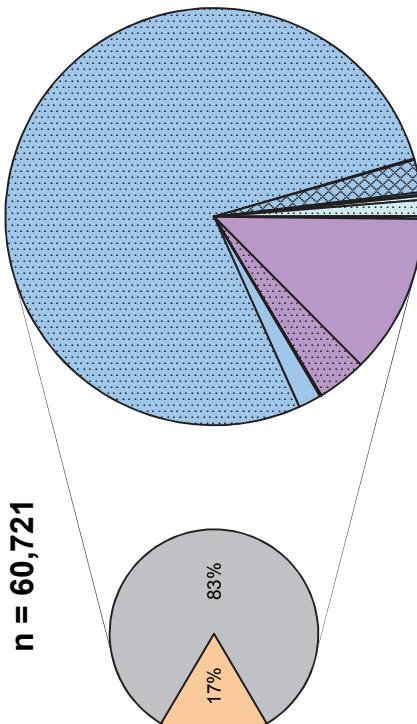
Feather River Hatchery spring (preseason)
n = 23

Feather River Hatchery spring
n = 2,776



Feather River fall carcass
n = 60,721

Feather River Hatchery fall
n = 23,420



Legend:

- Natural
- MOKFn
- FRHFb
- MERFt
- MOKFt
- FRHFn
- FRHFtib
- FRHSn
- MERF
- MOKFn
- FRHFnc
- FRHFh
- NIMFn
- FRHFtib
- MERF
- MOKFn
- FRHFh
- NIMFn
- FRHFnc
- FRHFh
- MOKFn
- nonCV
- MOKF

Figure 8. Proportion of hatchery- and natural-origin fish in the Feather River Basin, 2014.

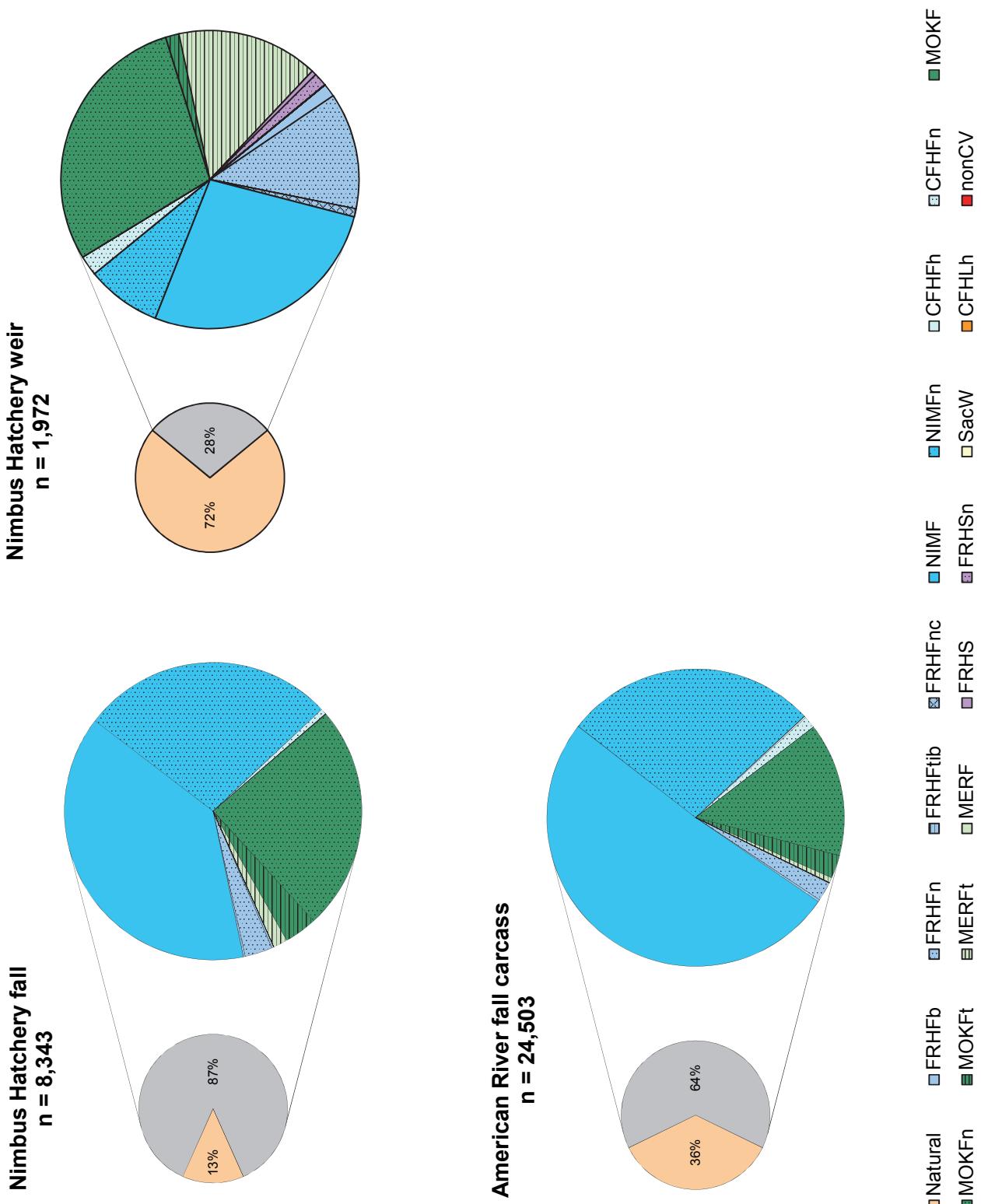


Figure 9. Proportion of hatchery- and natural-origin fish in the American River Basin, 2014.

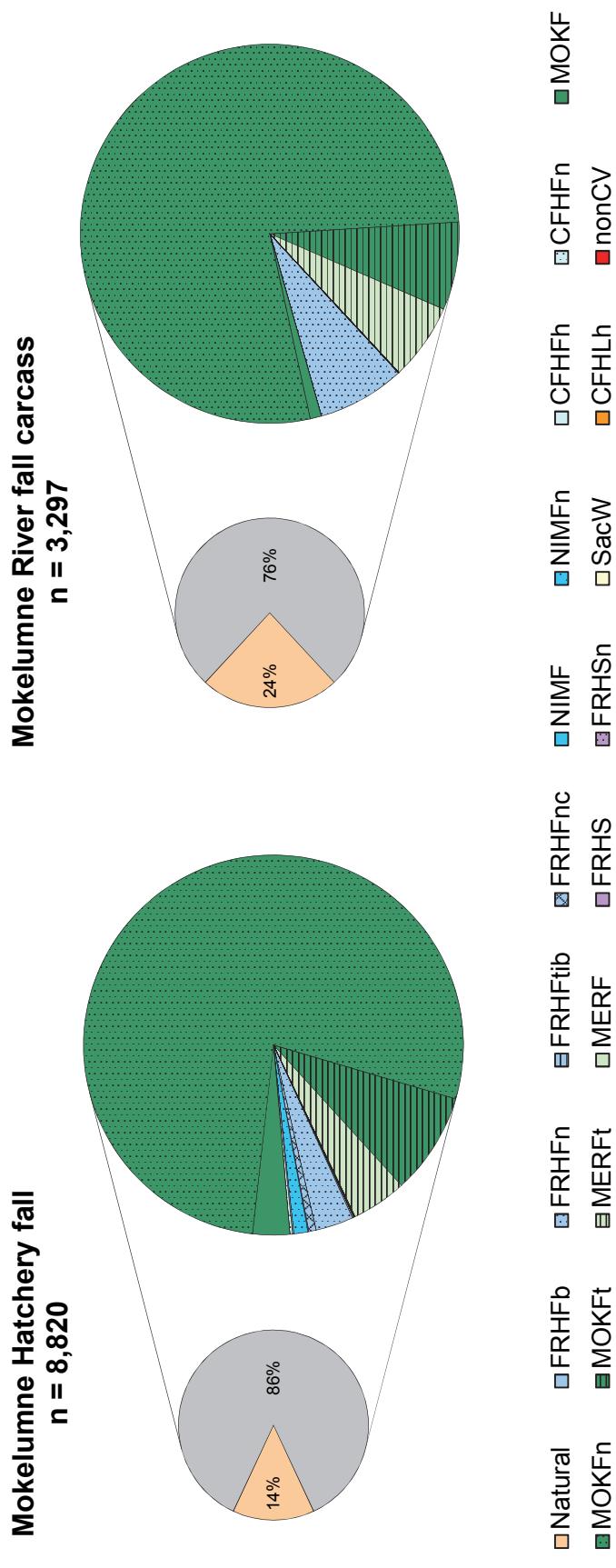


Figure 10. Proportion of hatchery- and natural-origin fish in the Mokelumne River Basin, 2014.

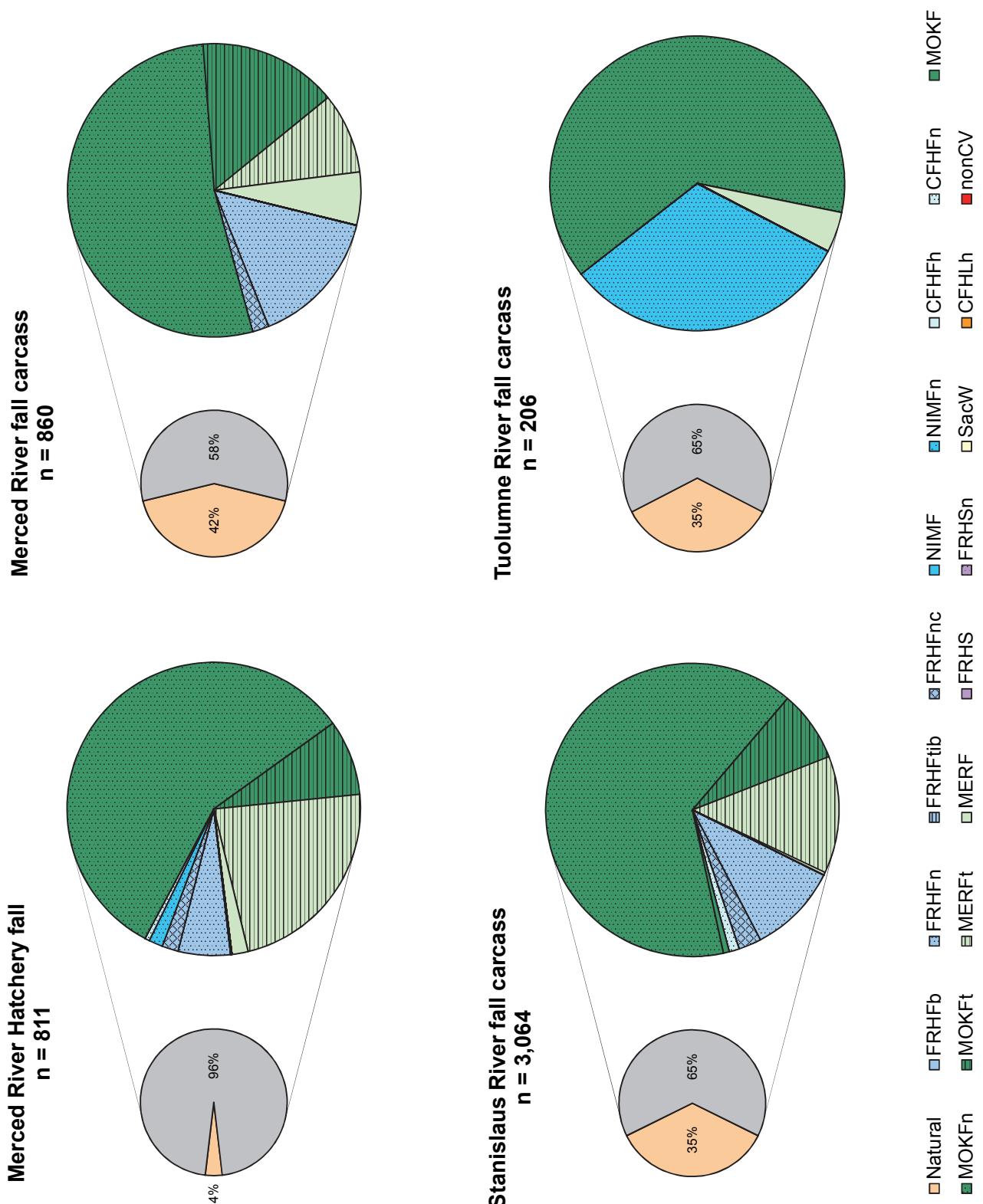
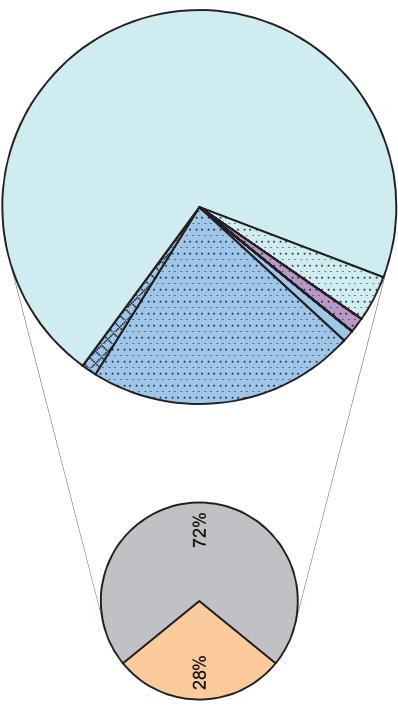
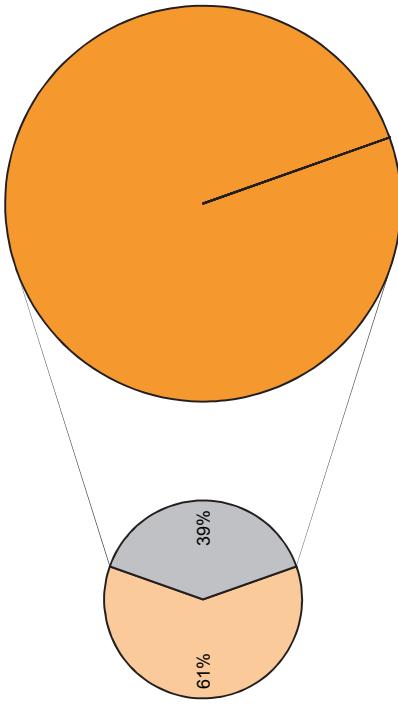


Figure 11. Proportion of hatchery- and natural-origin fish in Merced River & San Joaquin Basin tributaries, 2014.

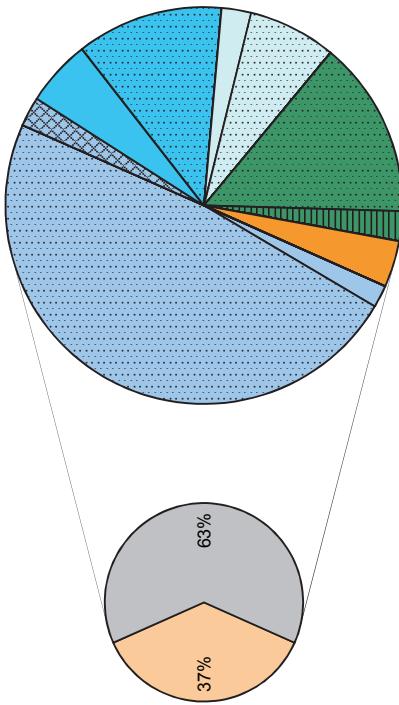
Upper Sacramento River late-fall creel
n = 281



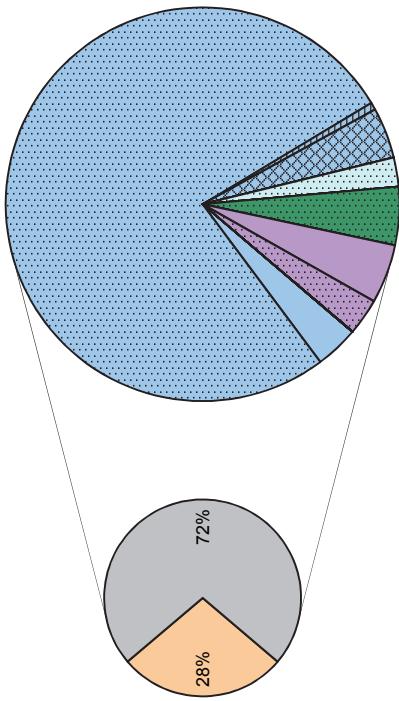
Upper Sacramento River fall creel
n = 13,322



Lower Sacramento River fall creel
n = 6,506



Feather River fall creel
n = 8,404



□ Natural
 ■ MOKFn
 □ FRHFb
 ■ MOKFt
 □ FRHFn
 ■ MERFt
 □ FRHFn
 ■ FRHSn
 □ FRHFnc
 ■ MERF
 □ FRHFc
 ■ FRHS
 □ CFHLh
 ■ nonCV
 □ CFHFh
 ■ SacW
 □ CFHFh
 ■ MOKF
 ■ NIMF
 ■ FRHFnc
 ■ FRHFtib
 ■ FRHFtbc
 ■ FRHFtbc
 ■ NIMF
 ■ FRHFh
 ■ CFHFh
 ■ MOKF
 ■ nonCV

Figure 12. Proportion of hatchery- and natural-origin fish in sport harvest on Sacramento & Feather rivers, 2014.

American River fall creel
n = 12,520

Mokelumne River fall creel
n = 1,380

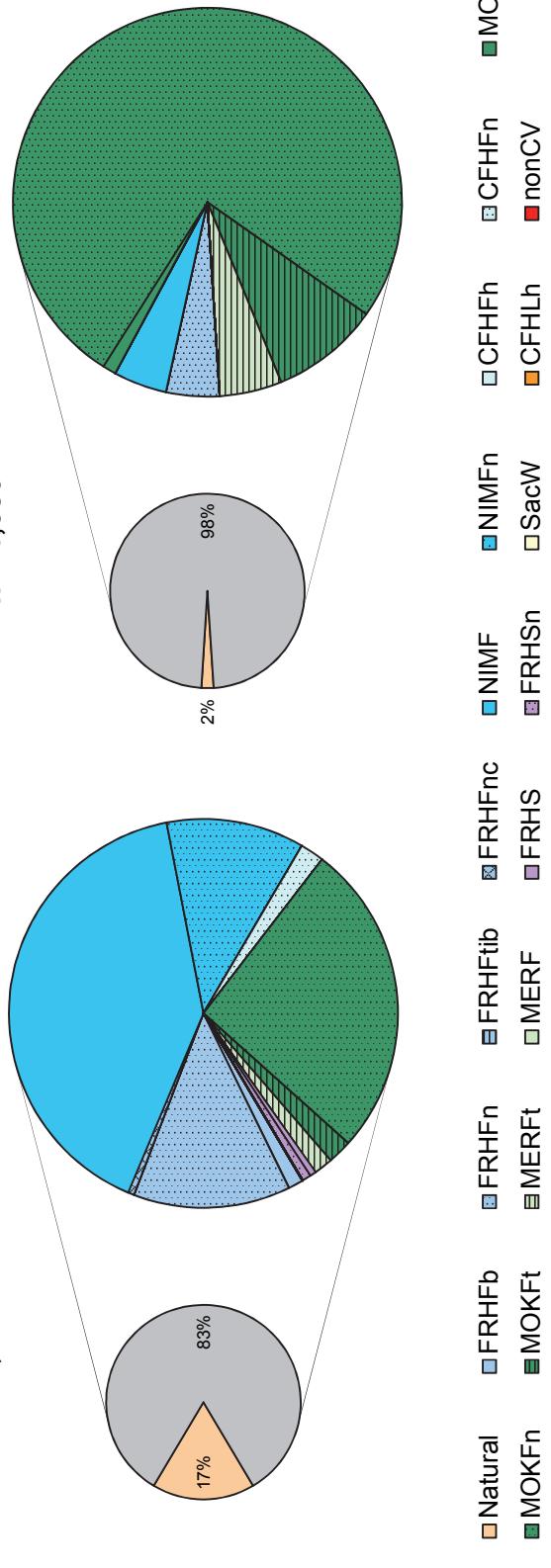


Figure 13. Proportion of hatchery- and natural-origin fish in sport harvest on American & Mokelumne rivers, 2014.

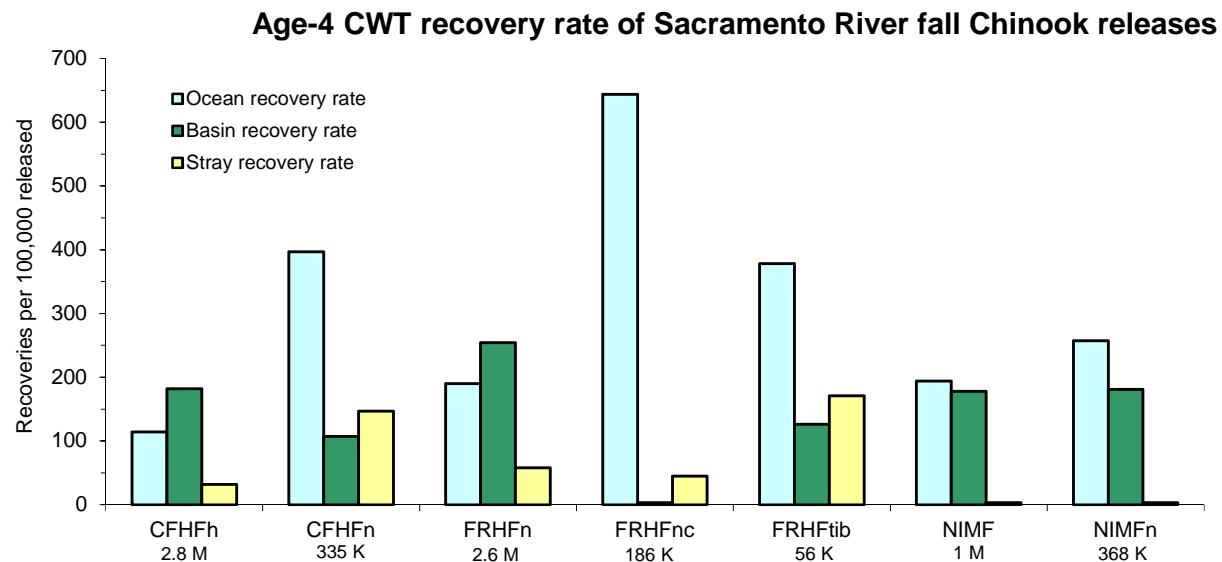
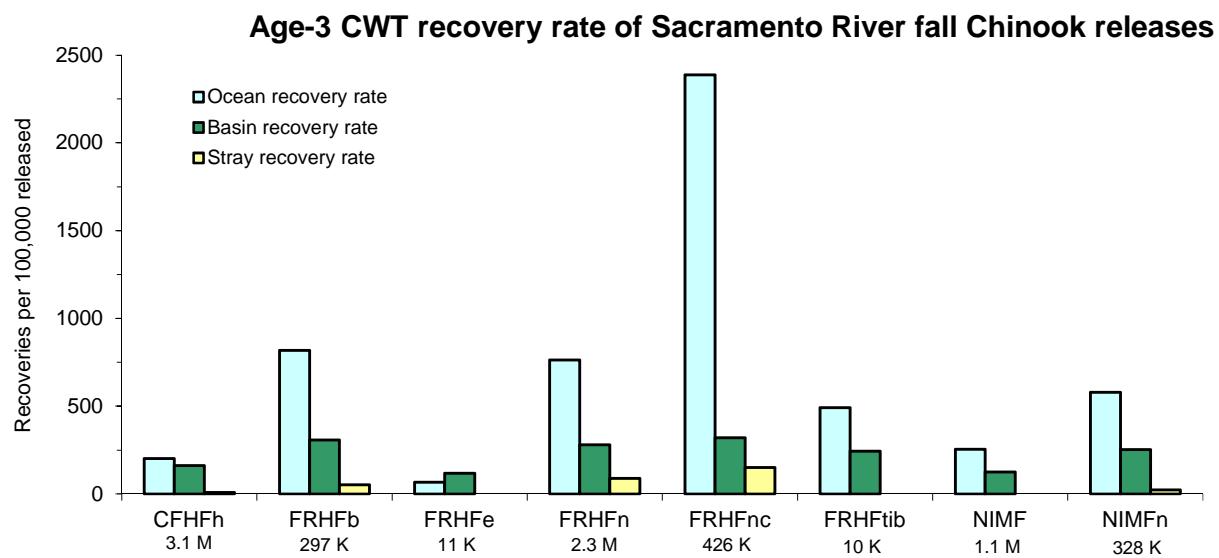
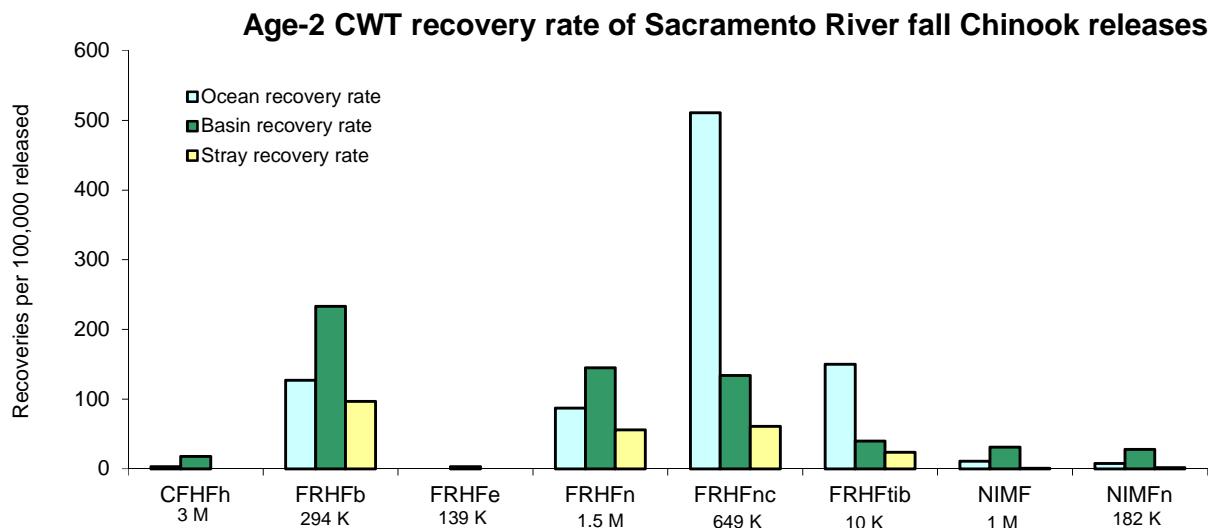


Figure 14. CWT recovery rates of Sacramento River fall Chinook releases by age in 2014.

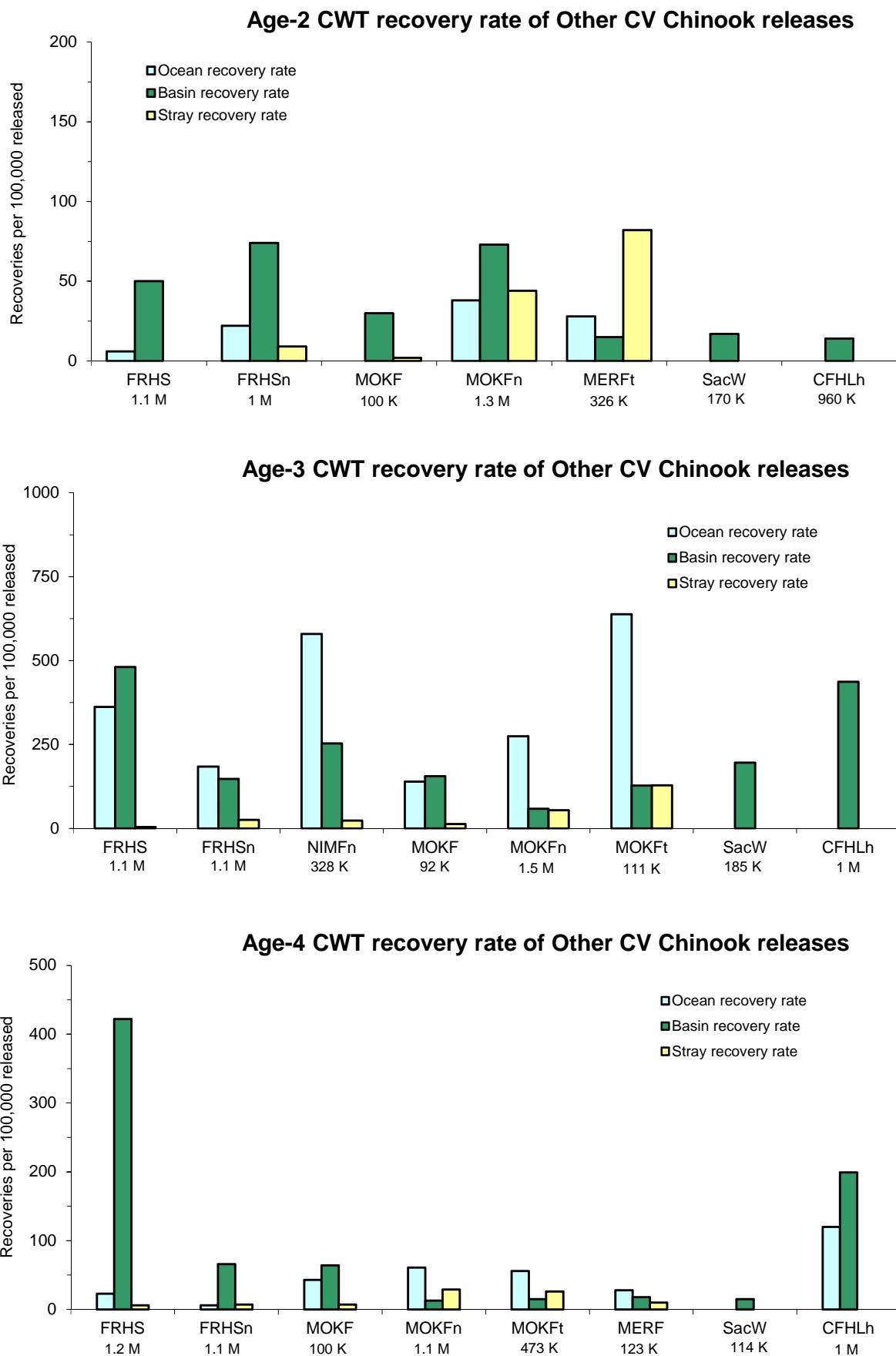
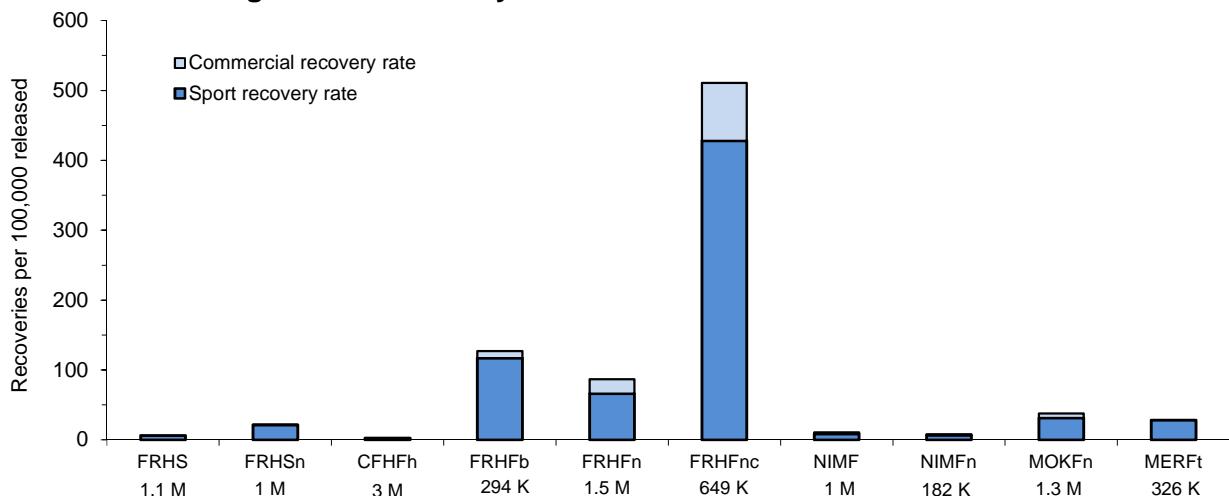
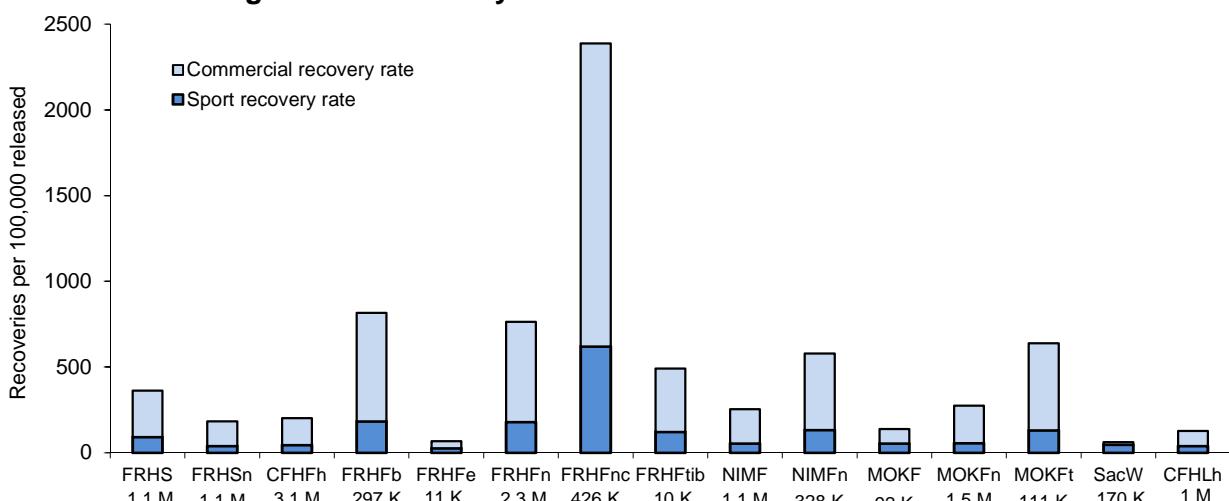


Figure 15. CWT recovery rates of Other CV Chinook releases by age in 2014.

Age-2 CWT recovery rate of CV releases in Ocean Fisheries



Age-3 CWT recovery rate of CV releases in Ocean Fisheries



Age-4 CWT recovery rate of CV releases in Ocean Fisheries

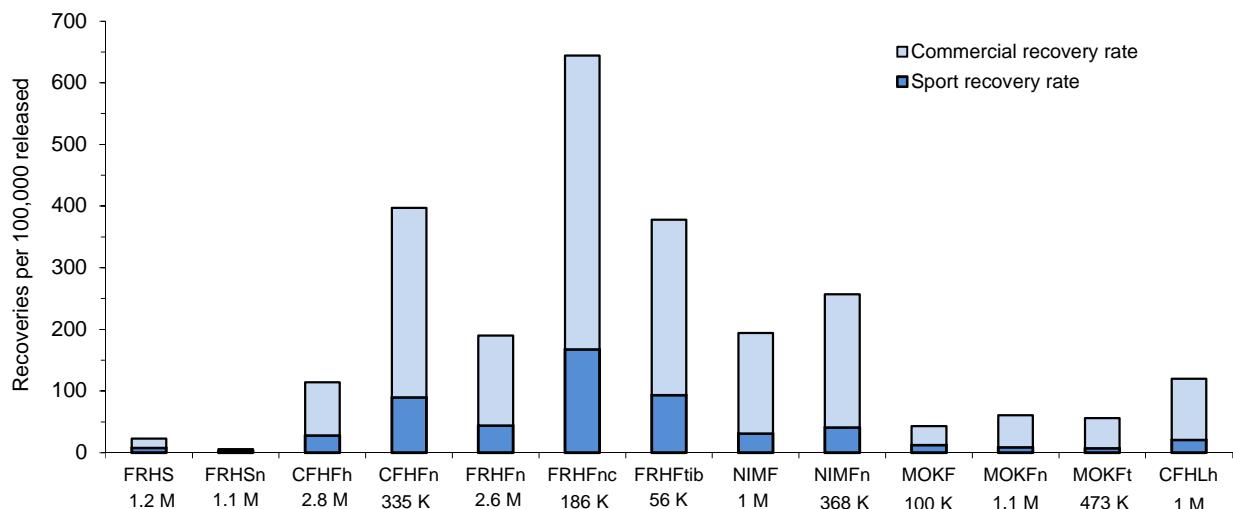


Figure 16. CWT recovery rates by release type in 2014 Ocean Salmon Fisheries.

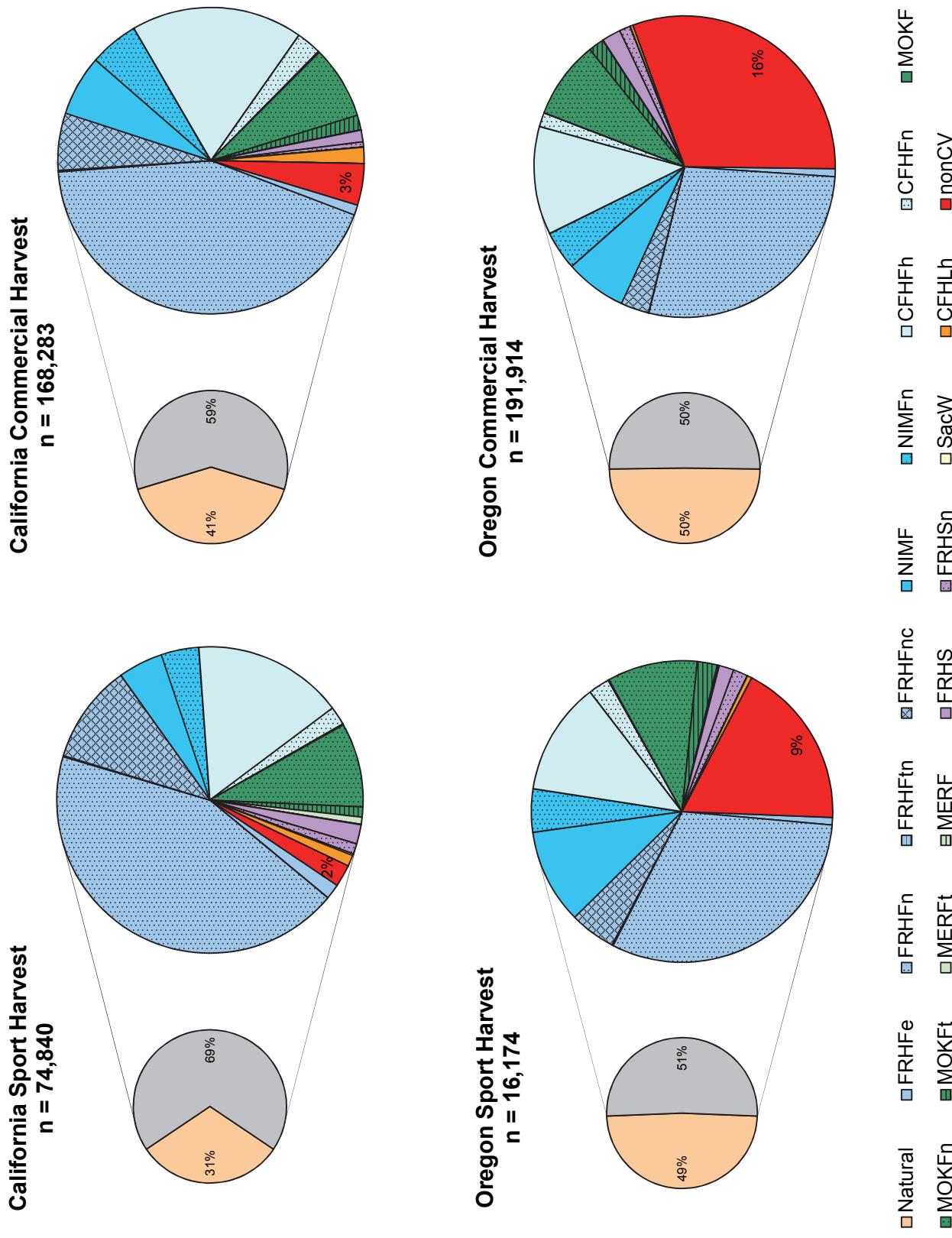


Figure 17. Proportion of hatchery- and natural-origin salmon in 2014 California and Oregon ocean fisheries.

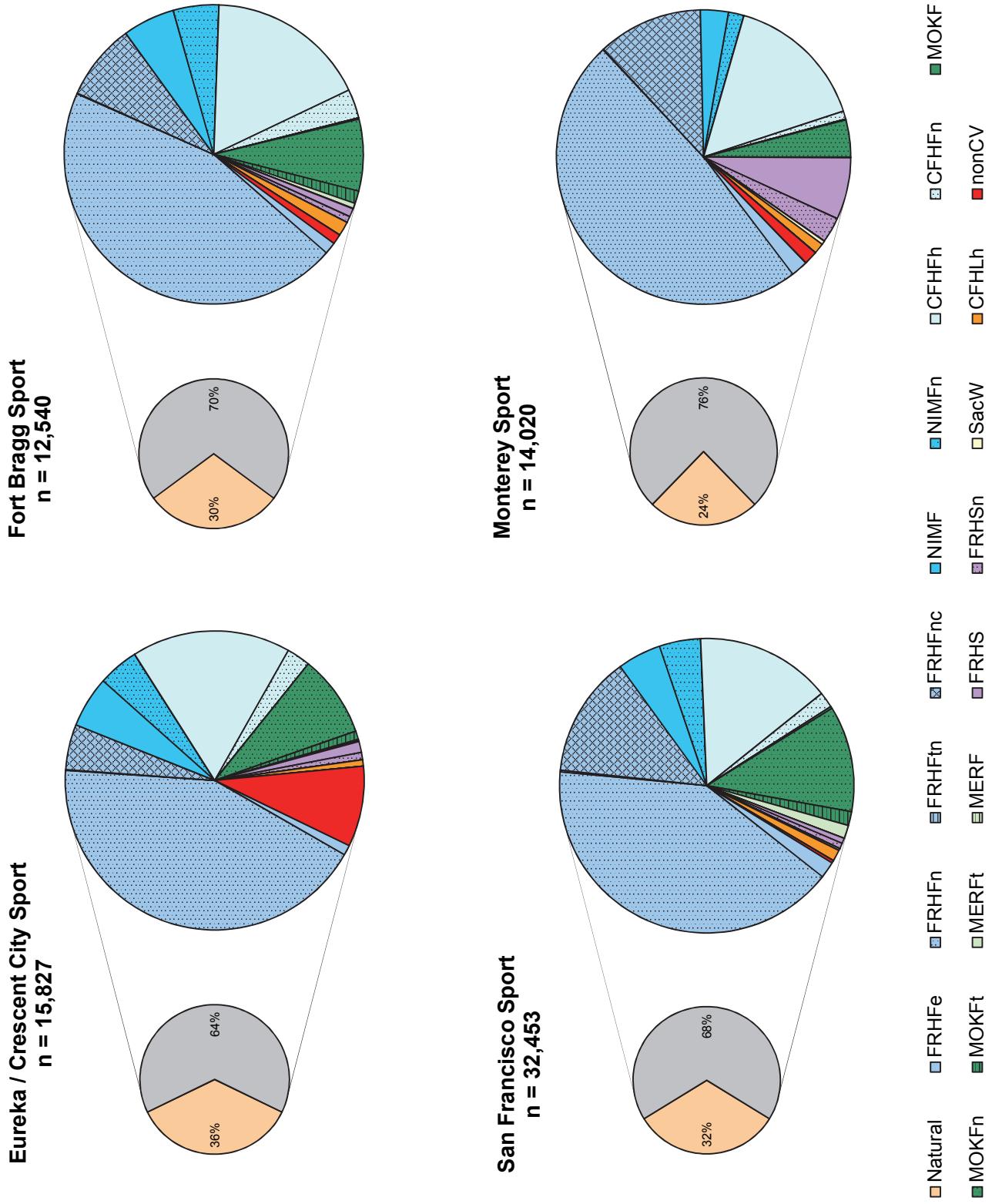


Figure 18. Proportion of hatchery- and natural-origin salmon in the 2014 California ocean sport fishery.

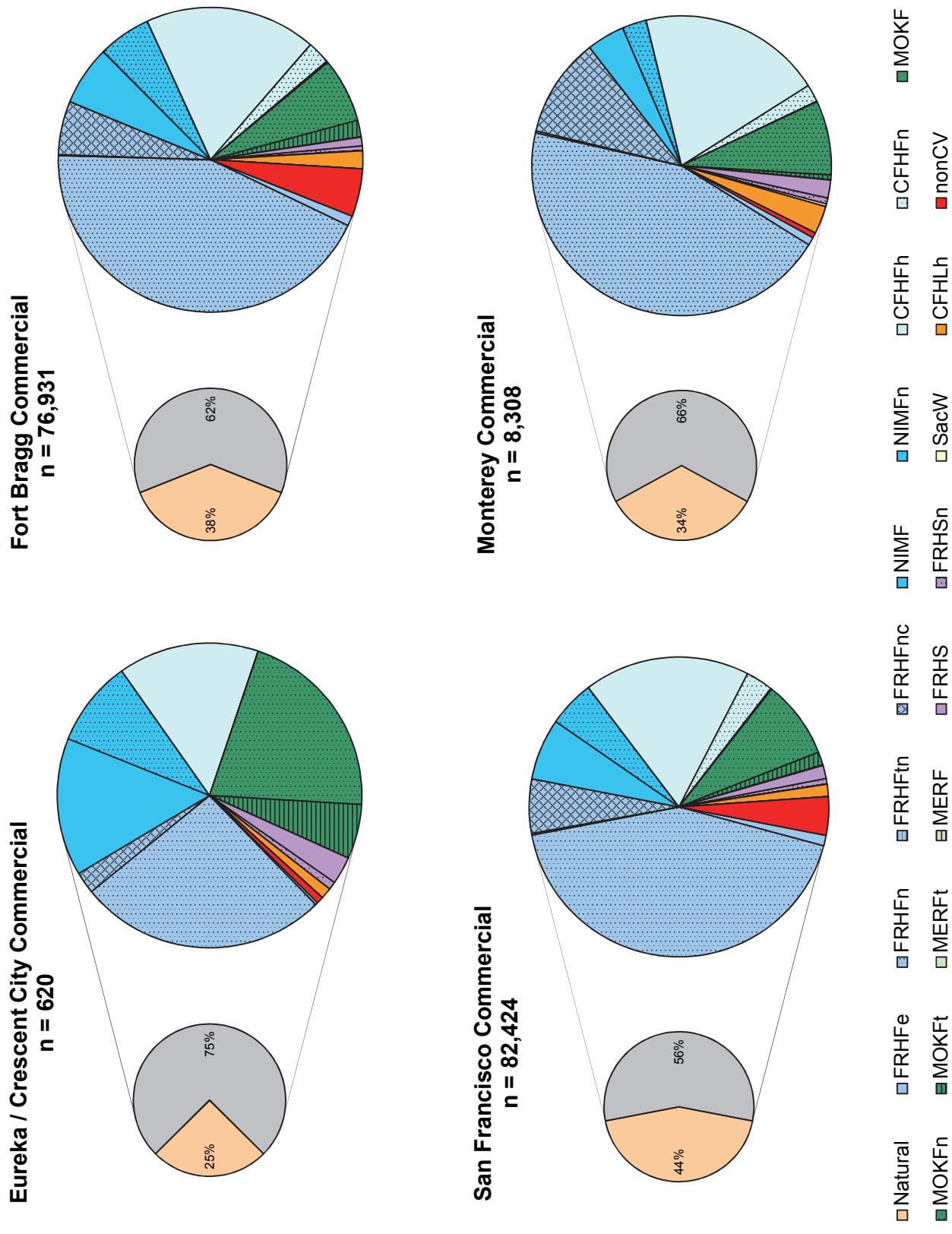


Figure 19. Proportion of hatchery- and natural-origin salmon in the 2014 California ocean commercial fishery.

Appendix 1. Sample expansion factors for Central Valley salmon carcass surveys collecting fish condition in 2014. (page 1 of 2)

Upper Sacramento River fall-run Chinook salmon carcass survey

Condition	N	Escapement	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh	23%		469	1.6%	81	78	78	0.17	0.96	63.72	3.24	16,123	54.0%
nonfresh	77%		1,608	5.4%	167	147	147	0.10	0.88				
total	29,885	2,077	6.9%	248	248	225	225	0.17	0.96	22.09	3.24	16,123	54.0%

Clear Creek fall-run Chinook salmon carcass survey

Condition	N	Escapement	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh	99%		977	6.2%	166	166	160	0.17	0.96	16.27	3.46	8,938	56.6%
nonfresh	1%		11	0.1%	6	6	6	0.55	1.00				
total	15,794	988	6.3%	172	172	166	165	0.17	0.96	15.68	3.46	8,938	56.6%

Mill Creek fall-run Chinook salmon carcass survey

Condition	N	Escapement	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh	61%		89	3.6%	13	13	11	0.15	0.85	27.96	3.62	1,113	44.7%
nonfresh	39%		58	2.3%	13	13	12	0.22	0.92				
total	2,488	147	5.9%	26	26	23	23	0.15	0.85	13.37	3.62	1,113	44.7%

Feather River fall-run Chinook salmon carcass survey (fresh only)

Condition	N	Escapement	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh	100%		4,984	8.2%	1,724	1,724	1,660	0.35	0.96	12.38	2.49	50,420	83.0%
nonfresh													
total	60,721	4,984	8.2%	1,724	1,724	1,660	1,634	0.35	0.96	12.38	2.49	50,420	83.0%

Lower American River fall-run Chinook salmon carcass survey

Condition	N	Escapement	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh	9%		1,566	6.4%	308	306	283	0.20	0.92	15.92	3.54	15,790	64.4%
nonfresh	91%		15,051	61.4%	2,025	1,890	1,722	0.13	0.91				
total	24,503	16,617	67.8%	2,333	2,196	2,005	1,993	0.20	0.92	2.24	3.54	15,790	64.4%

Appendix 1. Sample expansion factors for Central Valley salmon carcass surveys collecting fish condition in 2014. (page 2 of 2)

Stanislaus River fall-run Chinook salmon carcass survey													
Condition	Escapement N	Chinook sampled (n)	Sample rate	Observed ad-clips	Ad-clips processed	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh 79%		437	14.3%	77	77	76	74	0.18	0.99	7.20	3.72	1,981	64.7%
weir CWTs 21%		114	3.7%	25	25	23	23						
total	3,064	551	18.0%	102	102	99	97			5.49	3.72	1,981	64.7%

Tuolumne River fall-run Chinook salmon carcass survey

Condition	Escapement N	Chinook sampled (n)	Sample rate	Observed ad-clips	Ad-clips processed	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh 31%		33	16.0%	6	6	6	6	0.18	1.00	6.24	3.59	134	65.0%
nonfresh 69%		74	35.9%	1	1	1	1	0.01	1.00				
total	206	107	51.9%	7	7	7	7			5.35	3.59	134	65.0%

Upper Sacramento River winter-run Chinook salmon carcass survey

Condition	Escapement N	Chinook sampled (n)	Sample rate	Observed ad-clips	Ad-clips processed	CWTs recovered	Valid CWTs	ρ_{adc}	$\rho_{cwt adc}$	F_{samp}	Avg F_{prod}	$\sum_{i=1}^m CWT_{total,i}$	% hatchery
fresh 44%		570	21.7%	98	95	86	86	0.17	0.91	4.75	1.05	430	16.4%
nonfresh 56%		723	27.5%	97	96	81	81	0.13	0.84				
total	2,627	1,293	49.2%	195	191	167	167			2.45	1.05	430	16.4%

p-adc = proportion of sampled fish that were ad-clipped; $\rho_{cwt|adc}$ = proportion of ad-clipped fish containing CWTs

Appendix 2. Alternative 2014 CWT recovery and stray rates (recoveries per 100,000 CWTs released) of CFH and FRH releases^{a/}

Age 2 CWT recoveries				Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals				Ocean			
Release type	Brood year	Run type	# CWT tagged	Bat Cr	Up Sac	Nat crks ^{a/}	Feea	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	% CV Stray	CWT samp	In-basin	Stray	CV total	Ocean
CFHFh	2012 Fall	2,956,873	524	13								524	13	538	2%	98	18	0	18	3	
CFHLh	2013 Late	960,075	130									130		130		14				14	
FRHFb	2012 Fall	293,784	15	177	78	645	38	11	4			645	323	969	33%	372	220	110	330	127	
FRHFe	2012 Fall	138,888				4								4							
FRHFn	2012 Fall	1,453,105	150	265	244	1,989	117	52	47	29	27	1,989	932	2,921	32%	1,271	137	64	201	87	
FRHFnc	2012 Fall	649,160	80	66	124	614	258	12	47	23	44	614	655	1,269	52%	3,317	95	101	195	511	
FRHFtib	2012 Fall	9,918	2			4								4	2	6	38%	15	40	24	65
FRHS	2012 Spr	1,106,679				528	25							528	25	553	4%	71	48	2	50
FRHSn	2012 Spr	1,015,285	66	16	755	6								755	88	844	10%	222	74	9	83
																					22

Age 3 CWT recoveries

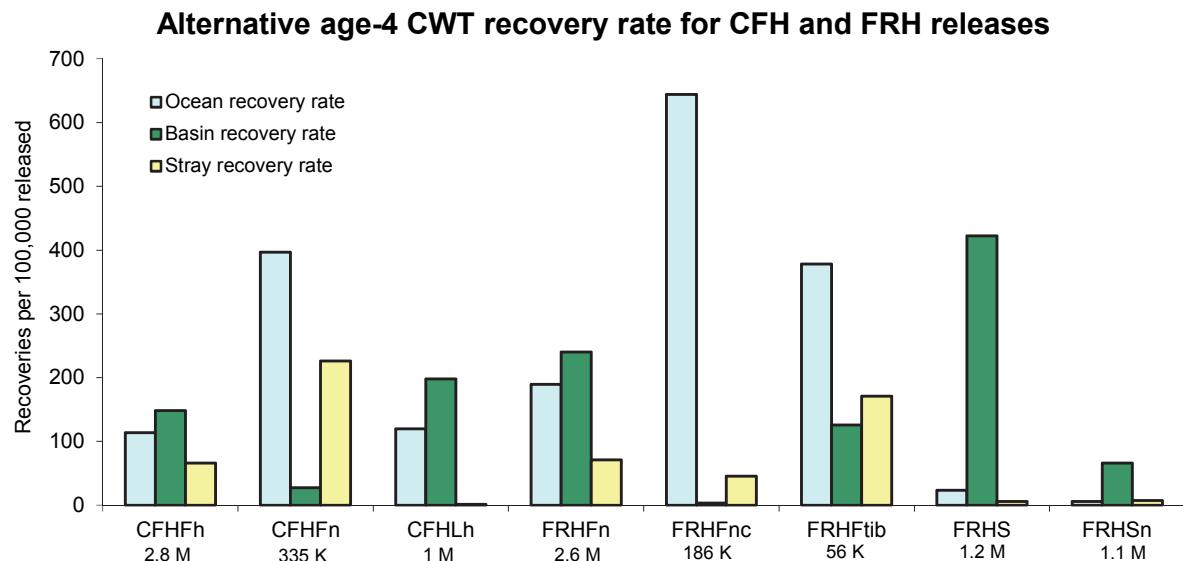
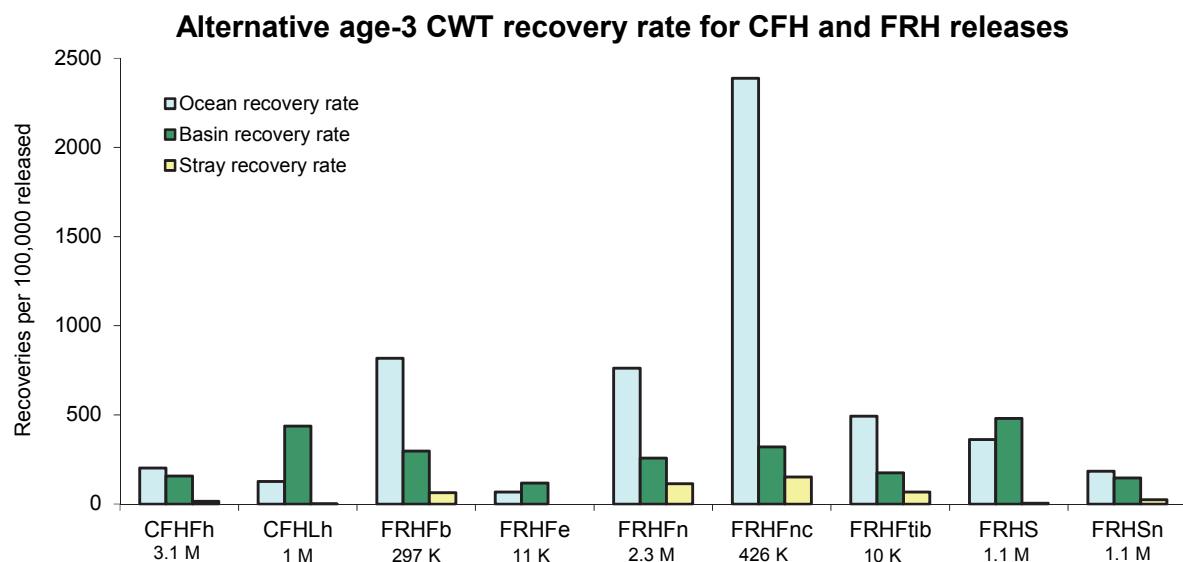
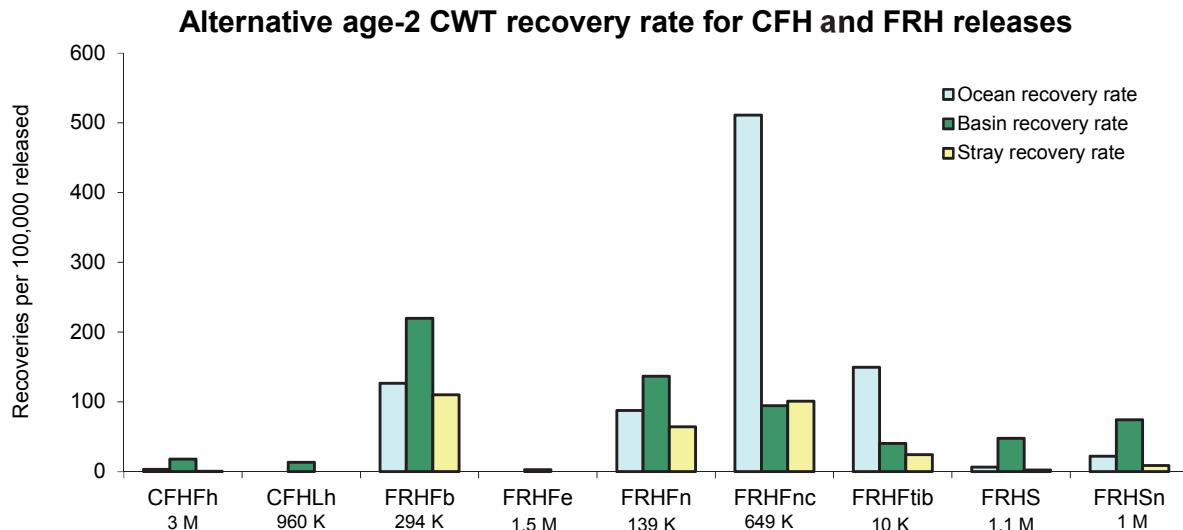
Age 3 CWT recoveries				Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals				Ocean				
Release type	Brood year	Run type	# CWT tagged	Bat Cr	Up Sac	Nat crks ^{a/}	Feea	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	% CV Stray	CWT samp	In-basin	Stray	CV total	Ocean	
CFHFh	2011 Fall	3,117,042	4,870	177	276	4							4,870	457	5,328	9%	6,288	156	15	171	202	
CFHLh	2012 Late	1,031,419	4,511										4,511	6	4,517	0%	1,311	437	1	438	127	
FRHFb	2011 Fall	297,089	14	66	49	884	31	23	6				884	190	1,074	18%	2,428	297	64	361	817	
FRHFe	2011 Fall	11,449				13								13				8	117		67	
FRHFn	2011 Fall	2,293,211	114	1,060	747	5,885	568	62	30				5,885	2,603	8,489	31%	17,489	257	114	370	763	
FRHFnc	2011 Fall	426,190	56	442	94	1,363	7	43	1				5	1,363	648	2,011	32%	10,175	320	152	472	2,387
FRHFtib	2011 Fall	9,933				17	7						17	7	24	28%	49	175	68	243	492	
FRHS	2011 Spr	1,088,286	44			5,231	3						5,231	47	5,279	1%	3,935	481	4	485	362	
FRHSn	2011 Spr	1,125,189	5	133	141	1,650	2						1,650	281	1,931	15%	2,074	147	25	172	184	

Age 4 CWT recoveries

Age 4 CWT recoveries				Central Valley total recoveries (CWT _{samp}) by basin										CV CWT _{samp} totals				Ocean			
Release type	Brood year	Run type	# CWT tagged	Bat Cr	Up Sac	Nat crks ^{a/}	Feea	Yub	Ame	Mok	Mer	SJ	In-basin	Stray	CV total	% CV Stray	CWT samp	In-basin	Stray	CV total	Ocean
CFHFh	2010 Fall	2,835,420	4,202	972	851	38		2	2				4,202	1,866	6,068	31%	3,221	148	66	214	114
CFHFn	2010 Fall	334,756	92	265	78	180	157						92	756	848	89%	1,329	28	226	253	397
CFHLh	2011 Late	1,037,859	2,056	10									2,056	11	2,067	1%	1,243	198	1	199	120
FRHFb	2010 Fall	2,554,115	83	928	392	6,136	346	38	32	1			6,136	1,818	7,954	23%	4,844	240	71	311	190
FRHFn	2010 Fall	185,985	2	66	16	6							6	84	90	93%	1,199	3	45	49	644
FRHFnc	2010 Fall	56,030	7	88		71							71	96	166	58%	212	126	171	297	378
FRHFtib	2010 Fall	1,170,340	2	66	4,945								4,945	69	5,013	1%	274	422	6	428	23
FRHS	2010 Spr	1,136,690	66	16	750	2							750	84	834	10%	68	66	7	73	6
FRHSn	2010 Spr																				

a/ CFH and FRH releases recovered in upper Sacramento River and Yuba River, respectively, considered stray recoveries.

b/ Natural creeks can include Clear Creek, Cow Creek, Cottonwood Creek, Paynes Creek, Mill Creek, and Butte Creek, depending on survey year.



Appendix 3. Alternative CWT recovery rates for CFH and FRH releases by age in 2014.

Appendix 4. Sample expansion for CWTs recovered in Yuba River escapement above Daguerre Point Dam (DPD) based on video data, 2014.

		known status	
DPD Vaki video	Total	% adclip	
no clip	7,493		7,493
adclip	1,393	15.7%	1,393
unknown clip	249		
total	9,135		8,886

Yuba River natural escapement above DPD: Total video count (known status) with supplemental carcass survey CWT data

Escapement N	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs		$\sum_{i=1}^m CWT_{total,i}$	% hatchery				
				Ad-clips processed	Recovered	ρ_{adc}	$\rho_{cwt/adc}$	F_{samp}	Avg F_{prod}		
9,135	8,886	97%	1,393	58	53	0.157	0.914	24.69	3.40	4,452	48.7%
video count	known status		video count								

Appendix 5. Sample expansion for CWTs recovered in Mokelumne River escapement above Woodbridge Dam (WD) based on video data, 2014.

		Known ad status		% adclip
	Total	Ad-clips	CWTs	
Woodbridge Dam video	12,117		2,890	23.9%
MRFI return	8,820		2,126	24.1%
Natural Escapement Mokelume River	3,297	764	764	23.2%
video count	known status	video count	carcass survey	

Mokelumne River natural escapement above WD: Total video count minus MRFI with supplemental carcass survey CWT data

Escapement N	Chinook sampled (n)	Sample rate	Observed ad-clips	CWTs		$\sum_{i=1}^m CWT_{total,i}$	% hatchery				
				Ad-clips processed	Recovered	ρ_{adc}	$\rho_{cwt/adc}$	F_{samp}	Avg F_{prod}		
3,297	3,297	100%	764	65	54	0.232	0.831	11.75	3.96	2,511	76.2%
video count	known status	video count	carcass survey								