

# **Recovery of Coded-Wire Tags from Chinook Salmon in California's Central Valley Escapement, Inland Harvest, and Ocean Harvest in 2015**

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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 ( $\leq 1$  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 sixth annual report on the recovery of CFM CWTs in the CV and ocean fisheries. In 2015, approximately 41,500 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 their natal waterways 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, 2019) 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 and River Sport Harvest Monitoring**

During 2015, 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 2016 return year, however the escapement monitoring period began in late 2015.

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 2015 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 93,500 salmon sampled, 28,600 ad-clipped salmon observed, and approximately 27,400 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 additional heads were 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 2015, California sport and commercial ocean salmon fisheries (Table 2) continued to be less constrained than during the late 2000s primarily due to an increase in the abundance of both Sacramento River and Klamath River fall-run Chinook salmon. CDFW field staff sampled 48,600 salmon and collected 11,400 heads that were processed by the Santa Rosa CWT lab. An additional 4,600 heads collected in Oregon ocean sport and commercial fisheries during 2015 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 2015 inland and ocean CWT recoveries are publicly available on the RMPC website at [www.rmpec.org](http://www.rmpec.org).

## CWT Data Analysis

A “master” release database of CWT codes recovered in 2015 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) 2010 through 2013 was downloaded from the RMPC. Approximately 142 million CV salmon were released for these brood years, of which 49 million were marked and tagged utilizing 449 unique CWT codes. Although a few thousand natural-origin salmon are trapped, marked, and tagged each year, primarily in the Feather and Mokelumne rivers, salmon produced by hatcheries make up more than 99% of all CWT releases. In 2015, there were 294 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,  $F_{\text{prod}}$ , 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.  $F_{\text{prod}}$  was calculated for each CWT code and is defined as,

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

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.  $F_{\text{prod}}$  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 sixteen 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 <b>F</b> all-run <b>h</b> atchery releases (in-basin)                           |
| CFHF <sub>n</sub>   | Coleman National Fish Hatchery <b>F</b> all-run bay <b>n</b> et pen releases (San Pablo Bay)                   |
| FRHFb               | Feather River Hatchery <b>F</b> all-run <b>b</b> arge study releases                                           |
| FRHF <sub>k</sub>   | Feather River Hatchery <b>F</b> all-run <b>K</b> naggs Ranch experimental releases                             |
| FRHF <sub>n</sub>   | Feather River Hatchery <b>F</b> all-run bay <b>n</b> et pen releases (San Pablo Bay)                           |
| FRHF <sub>nc</sub>  | Feather River Hatchery <b>F</b> all-run <b>c</b> oastal <b>n</b> et pen releases (Santa Cruz and Pillar Point) |
| FRHF <sub>tib</sub> | Feather River Hatchery <b>F</b> all-run <b>T</b> iburon net pen releases (held several months)                 |
| NIMF                | Nimbus Fish Hatchery <b>F</b> all-run in-basin releases                                                        |
| NIMF <sub>n</sub>   | Nimbus Fish Hatchery <b>F</b> all-run bay <b>n</b> et pen releases (San Pablo Bay)                             |

### San Joaquin River Basin Fall-run Chinook salmon release types

|       |                                                                        |
|-------|------------------------------------------------------------------------|
| MOKF  | Mokelumne River Hatchery <b>F</b> all-run in-basin releases            |
| MOKFb | Mokelumne River Hatchery <b>F</b> all-run <b>b</b> arge study releases |

|        |                                                                                             |
|--------|---------------------------------------------------------------------------------------------|
| MOKFn  | Mokelumne River Hatchery <b>F</b> all-run bay <b>n</b> et pen releases (Sherman Island)     |
| MOKFnc | Mokelumne River Hatchery <b>F</b> all-run coastal <b>n</b> et pen releases (Santa Cruz)     |
| MOKFt  | Mokelumne River Hatchery <b>F</b> all-run <b>t</b> rucked releases (no net pen acclimation) |
| MERF   | Merced River Hatchery <b>F</b> all-run in-basin releases                                    |
| MERFt  | Merced River Hatchery <b>F</b> all-run <b>t</b> rucked releases (no net pen acclimation)    |

#### Central Valley Spring-run Chinook salmon release types

|       |                                                                                        |
|-------|----------------------------------------------------------------------------------------|
| FRHS  | Feather River Hatchery <b>S</b> pring-run in-basin releases                            |
| FRHSn | Feather River Hatchery <b>S</b> pring-run bay <b>n</b> et pen releases (San Pablo Bay) |

#### Sacramento River winter-run Chinook salmon release types

|      |                                                                                          |
|------|------------------------------------------------------------------------------------------|
| SacW | Sacramento River <b>W</b> inter-run supplementation natural production in-basin releases |
|------|------------------------------------------------------------------------------------------|

#### Central Valley Late-fall Chinook salmon release types

|       |                                                                                           |
|-------|-------------------------------------------------------------------------------------------|
| CFHLh | Coleman National Fish Hatchery <b>L</b> ate-fall-run <b>h</b> atchery releases (in-basin) |
|-------|-------------------------------------------------------------------------------------------|

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., 15% of BY 2011 FRHFn were released directly into the bay). Thus, we urge caution when analyzing or comparing CWT recovery data from certain release types.

To estimate the total escapement or harvest associated with each CWT recovery, each tag recovery was expanded by its respective  $F_{\text{prod}}$  and sample expansion factor,  $F_{\text{samp}}$ , 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 2015 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 usually very different with the number of non-fresh salmon sampled generally much greater than fresh salmon in surveys that collected both conditions.

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:

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

where  $N$  = estimated total escapement,  $p_{adc|fresh}$  = proportion of fresh salmon sampled that were ad-clipped,  $p_{cwt|fresh,adc}$  = proportion of ad-clipped fresh salmon that contained a CWT, and  $n_{valid\ cwt}$  = 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:

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

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:

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

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

Data from all CWT release groups belonging to the same brood year and release type (e.g., coastal net pen) were combined and an overall release type-specific CV recovery rate,  $R_{type}$ , was calculated as:

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

where  $k$  ( $= 1, 2, 3, \dots, n$ ) 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, 2019), 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 2015 CV inland recoveries and California ocean harvest**

All except four of the 26,546 valid CWTs recovered in the CV during 2015 were from CV Chinook salmon releases. Most CWTs were brood year 2011 through 2013 releases (Table 6). About 89% of all  $CWT_{total}$  recoveries were fall-run, followed by spring-run (8%), and late-fall-run (2%) salmon releases. Less than one percent of all  $CWT_{total}$  recovered were winter-run, all of which were collected in the upper Sacramento River winter-run carcass survey and the Keswick Dam Fish Trap, where natural winter-run fish are collected for broodstock purposes at Livingston Stone National Hatchery. The four non-CV salmon were fall-run Chinook salmon released from hatcheries in the Klamath-Trinity River Basin and Smith River. The majority of fall-run  $CWT_{total}$  recovered in the CV were age-3 (59%), age-4 (21%), and age-2 (19%) fish (Table 6).

Most of the 10,501 valid CWT recoveries in the 2015 California ocean harvest were CV salmon releases belonging to brood years 2011 through 2013 (Table 7). Approximately 91% of all  $CWT_{total}$  in the ocean harvest were CV fall-run, followed by CV spring-run (3%), CV late-fall-run (1%), and CV winter-run (0.01%) salmon. The remaining 6% of California ocean CWT recoveries originated primarily from the Klamath-Trinity Basin and Smith River in northern California, and Oregon coastal streams. The majority of the hatchery-origin fish in the California harvest were age-3 (70%) and age-4 (18%) fish.

Approximately half of the 4,443 valid CWT recoveries in the 2015 Oregon ocean harvest were CV salmon releases (Table 8). Approximately 48% of all  $CWT_{total}$  in the ocean harvest were CV fall-run salmon and 1% were CV spring-run. Non-CV stocks made up 51% 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 (58%) and age-4 (37%) fish.

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

Approximately 100,000 fall-run Chinook salmon returned to spawn in natural areas during 2015 (Table 4) and the proportion of hatchery-origin salmon in those areas sampled varied throughout the CV. The lowest hatchery proportion occurred in Cottonwood Creek (15%) while the highest proportion (100%) occurred in Deer 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 Mokelumne River (94%). The total fall-run hatchery proportion for all natural areas surveyed in the CV was 71%.

The hatchery proportion of the 55,900 fall-run salmon returning to the five CV hatcheries ranged from 74% to 96% (Table 9, Fig. 3). The fall-run hatchery proportion for all CV hatcheries combined was 85%. The spring-run return to FRH was almost entirely hatchery-origin fish (98%) while the late-fall-return to CFH was 100% 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: 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 (Fig. 4). 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. Experimental barge study and 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 2015 (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 early-March 2015. Based solely on the run-timing above, 15,806 salmon returned to CFH during the



“fall” run sampling period, and 2,266 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 December. As a result, the final escapement was adjusted to 15,724 fall-run and 2,348 late-fall-run salmon. To promote genetic integrity, 65 natural (i.e., unmarked) late-fall salmon were collected at the Keswick Dam Fish Trap in the mainstem Sacramento River and transported to CFH as supplemental broodstock. An additional 104 late-fall salmon were trapped or counted via video at CFH after spawning operations ended in early-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 Mill creeks (Figs. 5, 6). The proportion of hatchery-origin fish (prevalent release type shown in parentheses) at each of the following locations was:

- Fall-run returns CFH: 74% (CFHFh)
- Late-fall-run returns CFH: 100% (CFHLh)
- Fall-run spawners Upper Sacramento River: 68% (FRHF<sub>n</sub>)
- Fall-run spawners Clear Creek: 74% (FRHF<sub>n</sub>)
- Fall-run spawners Battle Creek: 74% (CFHFh)
- Fall-run spawners Cottonwood Creek: 15% (CFHF<sub>n</sub>)
- Fall-run spawners Deer Creek: 100% (FRHF<sub>n</sub>)
- Fall-run spawners Mill Creek: 44% (FRHF<sub>n</sub>)
- Winter-run spawners Upper Sacramento River: 18% (SacW)
- Spring-run spawners Butte Creek: zero hatchery fish observed
- Late-fall-run spawners Upper Sacramento River: 8% (CFHLh)

### **Feather River Basin**

Spring- and fall-run returns to FRH and spawners in both the Feather River and Yuba River above Daguerre Point Dam (DPD) were predominantly hatchery-origin while escapement to the Yuba River below 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:

- Spring-run returns FRH: 98% (FRHS)
- Fall-run returns FRH: 90% (FRHF<sub>n</sub>)
- Fall/spring-run spawners Feather River: 83% (FRHF<sub>n</sub>)
- Fall/spring-run spawners Yuba River above DPD: 60% (CFHF<sub>n</sub>)
- Fall/spring-run spawners Yuba River below DPD: 45% (FRHF<sub>n</sub>)

### **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: 83% (NIMF<sub>n</sub>, NIMF, MOKF<sub>n</sub>)
- Fall-run spawners American River: 65% (NIMF, NIMF<sub>n</sub>)
- Fall-run returns NIM weir: 43% (NIMF<sub>n</sub>)

### **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: 96% (MOKFn)
- Fall-run spawners Mokelumne River: 94% (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 (prevalent release type shown in parentheses) at each of the following locations was:

- Fall-run returns MER: 88% (MOKFn)
- Fall-run spawners Merced River: 81% (MOKFn)
- Fall-run spawners Stanislaus River: 78% (MOKFn)
- Fall-run spawners Tuolumne River: 65% (MOKFn)

## **2. Contribution of CV Release Types to Total Salmon Escapement**

Approximately 75% of the 167,700 total salmon escapement to CV hatcheries and natural areas during 2015-2016 were hatchery-origin fish (Table 11). The proportion of these fish that strayed from their basin-of-origin ranged from zero to 88 percent, depending on release type:

| $R_{type}$ | Run  | CWT <sub>total</sub> | #Strays | (%)    |
|------------|------|----------------------|---------|--------|
| CFHFh      | Fall | 14,846               | 773     | (5%)   |
| CFHFh      | Fall | 4,938                | 3,891   | (79%)  |
| FRHFk      | Fall | 18                   | 0       | (0%)   |
| FRHFb      | Fall | 2,435                | 966     | (40%)  |
| FRHFh      | Fall | 48,090               | 23,337  | (49%)  |
| FRHFnc     | Fall | 2,757                | 1,301   | (47%)  |
| NIMF       | Fall | 6,177                | 631     | (10%)  |
| NIMFn      | Fall | 7,639                | 1,872   | (25%)  |
| MOKF       | Fall | 173                  | 16      | (9%)   |
| MOKFn      | Fall | 20,202               | 11,343  | (56%)  |
| MOKFe      | Fall | 1,304                | 808     | (62%)  |
| MERF       | Fall | 4                    | 0       | (0%)   |
| MERFt      | Fall | 2,143                | 1,894   | (88%)  |
| FRHS       | Spr  | 5,706                | 4       | (0%)   |
| FRHSn      | Spr  | 5,391                | 506     | (9%)   |
| SacW       | Wint | 558                  | 0       | (0%)   |
| CFHLh      | Late | 2,646                | 4       | (0.2%) |
| Total      |      | 125,054              | 47,373  | (38%)  |

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

In 2015, approximately 78% of the 24,400 salmon harvested in the CV river sport fishery were hatchery-origin fish (Table 9; Figs. 12, 13). The proportion of hatchery-origin fish (prevalent release type shown in parentheses) in each of the following fisheries was:

- Upper Sacramento River fall-run harvest: 73% (CFHFh, FRHFh)
- Lower Sacramento River fall-run harvest: 77% (FRHFh, NIMFn)
- Feather River fall-run harvest: 100% (FRHFh)
- American River fall-run harvest: 75% (NIMFn, MOKFn)
- Mokelumne River fall-run harvest: 98% (MOKFn)
- Upper Sacramento River late-fall-run harvest: 51% (CFHLh)

It should be noted that the sample expansion factor,  $F_{\text{samp}}$ , for the Feather River fall-run harvest had to be reduced from 23.24 to 21.81 to prevent the calculated hatchery component from exceeding the total harvest (106%). Of all hatchery release types, FRHFh contributed the most (24%) to the total CV sport harvest, followed by CFHFh (13%), NIMFn (13%), and MOKFn (12%). All of the CFHFh recoveries occurred in the Upper Sacramento River fall fishery whereas FRHFh were recovered in all inland fisheries (Table 11).

#### Contribution of CV Release Types to CV Sport Harvest

| R <sub>type</sub> | Run  | CWT <sub>total</sub> | (% harvest) |
|-------------------|------|----------------------|-------------|
| CFHFh             | Fall | 3,256                | (13%)       |
| CFHFh             | Fall | 850                  | (3%)        |
| FRHFk             | Fall | 0                    | (0%)        |
| FRHFb             | Fall | 407                  | (2%)        |
| FRHFh             | Fall | 5,896                | (24%)       |
| FRHFnc            | Fall | 258                  | (1%)        |
| NIMF              | Fall | 796                  | (3%)        |
| NIMFn             | Fall | 3,132                | (13%)       |
| MOKF              | Fall | 0                    | (0%)        |
| MOKFn             | Fall | 2,971                | (12%)       |
| MOKFe             | Fall | 95                   | (0%)        |
| MERF              | Fall | 0                    | (0%)        |
| MERFt             | Fall | 382                  | (2%)        |
| FRHS              | Spr  | 152                  | (1%)        |
| FRHSn             | Spr  | 434                  | (2%)        |
| SacW              | Wint | 0                    | (0%)        |
| CFHLh             | Late | 276                  | (1%)        |
| Total             |      | 18,903               | (78%)       |

#### 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 2011 through 2013 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  $CWT_{\text{samp}}$  recoveries and the escapement recovery rate,  $R_{\text{type}}$ , (in-basin and stray) for all release types collected in the CV escapement and ocean fisheries during 2015. The CWTs collected in the river sport fishery are not included since it is not possible to ascertain where these fish would have eventually spawned. Recovery rates are standardized utilizing total  $CWT_{\text{samp}}$  recoveries per 100,000 tagged salmon released. Release types with less than 15,000 fish released with CWTs are not reported below since just a few recoveries may result in relatively large recovery and stray rate estimates.

Figures 14 and 15 provide a graphical representation of  $R_{\text{type}}$  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

| $R_{\text{type}}$ | Brdyr | Run  | # recoveries per<br>100K released | % stray |
|-------------------|-------|------|-----------------------------------|---------|
| CFHFh             | 2013  | Fall | 18                                | 0%      |
| CFHFh             | 2013  | Fall | 67                                | 79%     |
| FRHFk             | 2013  | Fall | 5                                 | 0%      |
| FRHFb             | 2013  | Fall | 35                                | 18%     |
| FRHFh             | 2013  | Fall | 83                                | 29%     |
| FRHFnc            | 2013  | Fall | 254                               | 32%     |
| NIMFh             | 2013  | Fall | 122                               | 32%     |
| MOKFb             | 2013  | Fall | 110                               | 53%     |
| MOKFh             | 2013  | Fall | 79                                | 61%     |
| MOKFnc            | 2013  | Fall | 31                                | 79%     |
| MERFt             | 2013  | Fall | 11                                | 92%     |
| FRHS              | 2013  | Spr  | 2                                 | 7%      |
| FRHSn             | 2013  | Spr  | 4                                 | 10%     |
| SacW              | 2013  | Wint | 8                                 | 0%      |
| CFHLh             | 2014  | Late | 76                                | 0%      |

**Age-3 CV Escapement recovery rate; percent stray**

| R <sub>type</sub>  | Brdyr | Run  | # recoveries per<br>100K released | % stray |
|--------------------|-------|------|-----------------------------------|---------|
| CFHFh              | 2012  | Fall | 56                                | 6%      |
| FRHFk              | 2012  | Fall | 12                                | 0%      |
| FRHFb              | 2012  | Fall | 666                               | 42%     |
| FRHF <sub>n</sub>  | 2012  | Fall | 577                               | 49%     |
| FRHF <sub>nc</sub> | 2012  | Fall | 200                               | 54%     |
| NIMF               | 2012  | Fall | 142                               | 8%      |
| NIMF <sub>n</sub>  | 2012  | Fall | 217                               | 16%     |
| MOKF               | 2012  | Fall | 93                                | 10%     |
| MOKF <sub>n</sub>  | 2012  | Fall | 290                               | 54%     |
| MERF <sub>t</sub>  | 2012  | Fall | 139                               | 88%     |
| FRHS               | 2012  | Spr  | 316                               | 0%      |
| FRHS <sub>n</sub>  | 2012  | Spr  | 439                               | 9%      |
| SacW               | 2012  | Wint | 371                               | 0%      |
| CFHLh              | 2013  | Late | 49                                | 1%      |

**Age-4 CV Escapement recovery rate; percent stray**

| R <sub>type</sub>  | Brdyr | Run  | # recoveries per<br>100K released | % stray |
|--------------------|-------|------|-----------------------------------|---------|
| CFHFh              | 2011  | Fall | 57                                | 6%      |
| FRHFb              | 2011  | Fall | 99                                | 30%     |
| FRHF <sub>n</sub>  | 2011  | Fall | 101                               | 57%     |
| FRHF <sub>nc</sub> | 2011  | Fall | 119                               | 57%     |
| NIMF               | 2011  | Fall | 40                                | 19%     |
| NIMF <sub>n</sub>  | 2011  | Fall | 126                               | 13%     |
| MOKF               | 2011  | Fall | 74                                | 8%      |
| MOKF <sub>n</sub>  | 2011  | Fall | 27                                | 63%     |
| MOKF <sub>t</sub>  | 2011  | Fall | 216                               | 65%     |
| MERF               | 2011  | Fall | 1                                 | 0%      |
| FRHS               | 2011  | Spr  | 188                               | 0%      |
| FRHS <sub>n</sub>  | 2011  | Spr  | 71                                | 12%     |
| SacW               | 2011  | Wint | 2                                 | 0%      |
| CFHLh              | 2012  | Late | 119                               | 0%      |

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

The relative recovery rate of CV hatchery releases in 2015 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 those for the commercial fishery (Table 2). 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 <sub>type</sub> | Brdyr | Run  | # recoveries per<br>100K released | % sport |
|-------------------|-------|------|-----------------------------------|---------|
| CFHFh             | 2013  | Fall | 5                                 | 100%    |
| CFHFh             | 2013  | Fall | 41                                | 91%     |
| FRHFk             | 2013  | Fall | 9                                 | 100%    |
| FRHFb             | 2013  | Fall | 11                                | 88%     |
| FRHFh             | 2013  | Fall | 29                                | 97%     |
| FRHFnc            | 2013  | Fall | 256                               | 98%     |
| NIMFn             | 2013  | Fall | 45                                | 97%     |
| MOKFb             | 2013  | Fall | 70                                | 93%     |
| MOKFn             | 2013  | Fall | 26                                | 97%     |
| MOKFnc            | 2013  | Fall | 206                               | 94%     |
| MERFt             | 2013  | Fall | 1                                 | 100%    |
| FRHS              | 2013  | Spr  | 6                                 | 100%    |
| FRHSn             | 2013  | Spr  | 11                                | 100%    |
| CFHLh             | 2014  | Late | 1                                 | 100%    |

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

| R <sub>type</sub> | Brdyr | Run  | # recoveries per<br>100K released | % sport |
|-------------------|-------|------|-----------------------------------|---------|
| CFHFh             | 2012  | Fall | 48                                | 19%     |
| FRHFk             | 2012  | Fall | 17                                | 10%     |
| FRHFb             | 2012  | Fall | 924                               | 23%     |
| FRHFh             | 2012  | Fall | 616                               | 18%     |
| FRHFnc            | 2012  | Fall | 1,143                             | 20%     |
| NIMF              | 2012  | Fall | 98                                | 16%     |
| NIMFn             | 2012  | Fall | 234                               | 26%     |
| MOKF              | 2012  | Fall | 9                                 | 71%     |
| MOKFn             | 2012  | Fall | 234                               | 18%     |
| MERFt             | 2012  | Fall | 137                               | 16%     |
| FRHS              | 2012  | Spr  | 77                                | 34%     |
| FRHSn             | 2012  | Spr  | 189                               | 29%     |
| SacW              | 2013  | Wint | 1                                 | 100%    |
| CFHLh             | 2013  | Late | 6                                 | 64%     |

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

| R <sub>type</sub> | Brdyr | Run  | # recoveries per<br>100K released | % sport |
|-------------------|-------|------|-----------------------------------|---------|
| CFHFh             | 2011  | Fall | 38                                | 12%     |
| FRHFb             | 2011  | Fall | 119                               | 12%     |
| FRHFfn            | 2011  | Fall | 94                                | 11%     |
| FRHFnc            | 2011  | Fall | 337                               | 16%     |
| NIMF              | 2011  | Fall | 23                                | 7%      |
| NIMFn             | 2011  | Fall | 181                               | 10%     |
| MOKF              | 2011  | Fall | 12                                | 14%     |
| MOKFn             | 2011  | Fall | 30                                | 12%     |
| MOKFt             | 2011  | Fall | 111                               | 13%     |
| MERF              | 2011  | Fall | 2                                 | 100%    |
| FRHS              | 2011  | Spr  | 23                                | 22%     |
| FRHSn             | 2011  | Spr  | 12                                | 21%     |
| SacW              | 2012  | Wint | 2                                 | 0%      |
| CFHLh             | 2012  | Late | 43                                | 6%      |

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

More than half of the 148,000 and 100,100 Chinook salmon harvested in California and Oregon fisheries, respectively, were hatchery-origin fish (Fig. 17). Most of the hatchery-origin salmon in California ocean fisheries originated from the CV. Approximately half of the hatchery-origin salmon in Oregon ocean fisheries were CV stocks.

##### California ocean sport fishery

California anglers harvested almost 37,500 Chinook salmon in the ocean sport fishery during 2015. The total contribution of hatchery-origin salmon to the California ocean sport fishery was 69%, ranging from 59% to 81% of the total harvest, depending on major port area (Fig. 18). Most of the harvest occurred in San Francisco (67%) and Fort Bragg (15%), followed by Eureka-Crescent City (10%) and Monterey (8%) port areas (Table 13).

Of all hatchery release types, FRHFfn contributed the most (24%) to the total California ocean sport harvest, followed by MOKFn (9%), CFHFfn (7%) and NIMFn (6%). Non-CV releases (e.g., Klamath-Trinity River Basin, Smith River, Oregon and Washington hatchery stocks) contributed 1% to the total harvest (Table 14).

#### Contribution of CV Release Types to Ocean Salmon Sport Fishery

| R <sub>type</sub> | Run  | CWT <sub>total</sub> | (% harvest) |
|-------------------|------|----------------------|-------------|
| CFHFh             | Fall | 1,911                | (5%)        |
| CFHFfn            | Fall | 2,673                | (7%)        |

|         |      |        |       |
|---------|------|--------|-------|
| FRHFk   | Fall | 6      | (<1%) |
| FRHFb   | Fall | 682    | (2%)  |
| FRHFfn  | Fall | 8,928  | (24%) |
| FRHFnc  | Fall | 2,640  | (7%)  |
| FRHFtib | Fall | 34     | (<1%) |
| NIMF    | Fall | 507    | (1%)  |
| NIMFn   | Fall | 2,209  | (6%)  |
| MOKF    | Fall | 8      | (<1%) |
| MOKFb   | Fall | 193    | (1%)  |
| MOKFn   | Fall | 3,545  | (9%)  |
| MOKFnc  | Fall | 464    | (1%)  |
| MOKFt   | Fall | 67     | (<1%) |
| MERF    | Fall | 464    | (1%)  |
| MERFt   | Fall | 306    | (1%)  |
| FRHS    | Spr  | 417    | (1%)  |
| FRHSn   | Spr  | 694    | (2%)  |
| SacW    | Wint | 3      | (<1%) |
| CFHLh   | Late | 72     | (<1%) |
| NonCV   |      | 469    | (1%)  |
| Total   |      | 25,828 | (69%) |

### California ocean commercial fishery

California trollers harvested over 110,500 Chinook salmon in the ocean commercial fishery during 2015. The total contribution of hatchery-origin salmon to the California ocean commercial fishery was 55%, ranging from 41% to 81% of the total harvest, depending on major port area (Fig. 19). Most of the harvest occurred in Fort Bragg (54%) and San Francisco (32%), followed by Monterey (13%) and Eureka-Crescent City (<1%) port areas (Table 15).

Of all hatchery release types, FRHFfn contributed the most (24%) to the total California commercial harvest, followed by MOKFn (8%) and CFHFh (5%). Non-CV releases (e.g., Klamath-Trinity River Basin, Smith River, Oregon and Washington hatchery stocks) contributed 4% to the total harvest (Table 16).

### Contribution of CV Release Types to Ocean Salmon Commercial Fishery

| R <sub>type</sub> | Run  | CWT <sub>total</sub> | (% harvest) |
|-------------------|------|----------------------|-------------|
| CFHFh             | Fall | 5,996                | (5%)        |
| CFHFfn            | Fall | 316                  | (<1%)       |
| FRHFk             | Fall | 20                   | (<1%)       |
| FRHFb             | Fall | 2,009                | (2%)        |
| FRHFfn            | Fall | 26,200               | (24%)       |
| FRHFnc            | Fall | 5,504                | (5%)        |



|         |      |        |       |
|---------|------|--------|-------|
| FRHFtib | Fall | 69     | (<1%) |
| NIMF    | Fall | 2,408  | (2%)  |
| NIMFn   | Fall | 2,129  | (2%)  |
| MOKF    | Fall | 6      | (<1%) |
| MOKFb   | Fall | 16     | (<1%) |
| MOKFn   | Fall | 8,366  | (8%)  |
| MOKFnc  | Fall | 29     | (<1%) |
| MOKFt   | Fall | 238    | (<1%) |
| MERF    | Fall | 29     | (<1%) |
| MERFt   | Fall | 1,361  | (1%)  |
| FRHS    | Spr  | 554    | (1%)  |
| FRHSn   | Spr  | 1,109  | (1%)  |
| SacW    | Wint | 3      | (<1%) |
| CFHLh   | Late | 374    | (<1%) |
| NonCV   |      | 4,331  | (4%)  |
| Total   |      | 61,037 | (55%) |

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

In 2015, CWTs from several experimental and net pen release types were recovered in both the CV escapement and ocean harvest. These included a new experimental barge study and a coastal net pen program utilizing fish from Mokelumne Hatchery. The barge study involved approximately 300,000 BY 2013 MOK fall-run salmon that were either: 1) released into the Mokelumne River directly at Miller's Ferry Bridge, 2) barged from Miller's Ferry Bridge to the San Francisco Bay and released at the Golden Gate Bridge, or 3) trucked to San Francisco Bay and loaded into the barge at Tiburon and released at the Golden Gate Bridge. An additional 240,000 BY 2013 MOK fall-run salmon were trucked to and released from net pens operated by the Monterey Bay Trout and Salmon Project (MBTSP) in Santa Cruz. Approximately 60,000 salmon were trucked to and released into Monterey Bay each week during May 2014. This is the first time since the MBTSP began coastal pen releases in the 1990s that fall-run salmon from Feather River Hatchery are not being used for this program. This was also the second year that CWTs from the Knaggs Ranch rice field study were recovered.

These experimental and net pen releases are differentiated into the following release types:

|        |                                                                                                             |
|--------|-------------------------------------------------------------------------------------------------------------|
| FRHFbb | Feather River Hatchery <b>F</b> all-run <b>b</b> arge study: trucked and released in SF <b>b</b> ay         |
| FRHFbg | Feather River Hatchery <b>F</b> all-run <b>b</b> arge study: barged to SF Bay and released                  |
| FRHFbr | Feather River Hatchery <b>F</b> all-run <b>b</b> arge study: released in-river (numerous sites on Sac R)    |
| FRHFkc | Feather River Hatchery <b>F</b> all-run rice field study: Elkhorn Boat Ramp ( <b>K</b> naggs control group) |
| FRHFkr | Feather River Hatchery <b>F</b> all-run rice field study: <b>K</b> naggs <b>R</b> anch (Yolo Bypass)        |
| FRHFnp | Feather River Hatchery <b>F</b> all-run net pen coastal releases – <b>P</b> illar Point                     |
| FRHFns | Feather River Hatchery <b>F</b> all-run net pen coastal releases – <b>S</b> anta Cruz                       |

MOKFbb Mokelumne River Hatchery Fall-run barge study: trucked and released in SF bay  
MOKFbg Mokelumne River Hatchery Fall-run barge study: barged to SF Bay and released  
MOKFbr Mokelumne River Hatchery Fall-run barge study: released in-river (Miller's Ferry, Mok R)  
MOKFns Mokelumne River Hatchery Fall-run net pen coastal releases – Santa Cruz

### Central Valley Escapement

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 <sub>type</sub> | Brdyr | Run  | # recoveries per<br>100K released | % stray |
|-------------------|-------|------|-----------------------------------|---------|
| CFHFn             | 2013  | Fall | 67                                | 79%     |
| FRHFbb            | 2013  | Fall | 23                                | 16%     |
| FRHFbg            | 2013  | Fall | 46                                | 5%      |
| FRHFbr            | 2013  | Fall | 38                                | 34%     |
| FRHFkr            | 2013  | Fall | 5                                 | 0%      |
| FRHFn             | 2013  | Fall | 83                                | 29%     |
| FRHFnp            | 2013  | Fall | 254                               | 32%     |
| NIMFn             | 2013  | Fall | 122                               | 32%     |
| MOKFbb            | 2013  | Fall | 72                                | 78%     |
| MOKFbg            | 2013  | Fall | 248                               | 48%     |
| MOKFbr            | 2013  | Fall | 8                                 | 0%      |
| MOKFn             | 2013  | Fall | 79                                | 61%     |
| MOKFns            | 2013  | Fall | 31                                | 79%     |

#### Age-3 CV Escapement recovery rate; percent stray

| R <sub>type</sub> | Brdyr | Run  | # recoveries per<br>100K released | % stray |
|-------------------|-------|------|-----------------------------------|---------|
| FRHFbb            | 2012  | Fall | 922                               | 49%     |
| FRHFbg            | 2012  | Fall | 1062                              | 36%     |
| FRHFbr            | 2012  | Fall | 2                                 | 0%      |
| FRHFkc            | 2012  | Fall | 32                                | 0%      |
| FRHFkr            | 2012  | Fall | 1                                 | 0%      |
| FRHFn             | 2012  | Fall | 577                               | 49%     |
| FRHFnp            | 2012  | Fall | 262                               | 58%     |
| FRHFns            | 2012  | Fall | 92                                | 35%     |
| NIMFn             | 2012  | Fall | 216                               | 16%     |
| MOKFn             | 2012  | Fall | 290                               | 54%     |

**Age-4 CV Escapement recovery rate; percent stray**

| <b>R<sub>type</sub></b> | <b>Brdyr</b> | <b>Run</b> | <b># recoveries per<br/>100K released</b> | <b>% stray</b> |
|-------------------------|--------------|------------|-------------------------------------------|----------------|
| FRHFbb                  | 2011         | Fall       | 54                                        | 24%            |
| FRHFbg                  | 2011         | Fall       | 88                                        | 50%            |
| FRHFbr                  | 2011         | Fall       | 155                                       | 22%            |
| FRHFn                   | 2011         | Fall       | 101                                       | 57%            |
| FRHFnp                  | 2011         | Fall       | 239                                       | 55%            |
| FRHFns                  | 2011         | Fall       | 26                                        | 68%            |
| NIMFn                   | 2011         | Fall       | 126                                       | 13%            |
| MOKFn                   | 2011         | Fall       | 27                                        | 63%            |

**Ocean Harvest**

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**

| <b>R<sub>type</sub></b> | <b>Brdyr</b> | <b>Run</b> | <b># recoveries per<br/>100K released</b> | <b>% sport</b> |
|-------------------------|--------------|------------|-------------------------------------------|----------------|
| CFHFn                   | 2013         | Fall       | 41                                        | 91%            |
| FRHFbb                  | 2013         | Fall       | 14                                        | 71%            |
| FRHFbg                  | 2013         | Fall       | 0                                         |                |
| FRHFbr                  | 2013         | Fall       | 19                                        | 100%           |
| FRHFkr                  | 2013         | Fall       | 9                                         | 100%           |
| FRHFn                   | 2013         | Fall       | 29                                        | 97%            |
| FRHFnp                  | 2013         | Fall       | 256                                       | 98%            |
| NIMFn                   | 2013         | Fall       | 45                                        | 97%            |
| MOKFbb                  | 2013         | Fall       | 87                                        | 100%           |
| MOKFbg                  | 2013         | Fall       | 117                                       | 91%            |
| MOKFbr                  | 2013         | Fall       | 5                                         | 0%             |
| MOKFn                   | 2013         | Fall       | 26                                        | 97%            |
| MOKFns                  | 2013         | Fall       | 206                                       | 94%            |

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

| <b>R<sub>type</sub></b> | <b>Brdyr</b> | <b>Run</b> | <b># recoveries per<br/>100K released</b> | <b>% sport</b> |
|-------------------------|--------------|------------|-------------------------------------------|----------------|
| FRHFbb                  | 2012         | Fall       | 1,433                                     | 20%            |
| FRHFbg                  | 2012         | Fall       | 1,300                                     | 25%            |
| FRHFbr                  | 2012         | Fall       | 25                                        | 38%            |
| FRHFkc                  | 2012         | Fall       | 40                                        | 13%            |
| FRHFkr                  | 2012         | Fall       | 5                                         | 0%             |
| FRHFn                   | 2012         | Fall       | 616                                       | 18%            |
| FRHFnp                  | 2012         | Fall       | 1,076                                     | 23%            |
| FRHFns                  | 2012         | Fall       | 1,259                                     | 17%            |
| NIMFn                   | 2012         | Fall       | 234                                       | 26%            |
| MOKFn                   | 2012         | Fall       | 234                                       | 18%            |

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

| <b>R<sub>type</sub></b> | <b>Brdyr</b> | <b>Run</b> | <b># recoveries per<br/>100K released</b> | <b>% sport</b> |
|-------------------------|--------------|------------|-------------------------------------------|----------------|
| FRHFbb                  | 2011         | Fall       | 125                                       | 7%             |
| FRHFbg                  | 2011         | Fall       | 122                                       | 21%            |
| FRHFbr                  | 2011         | Fall       | 110                                       | 8%             |
| FRHFn                   | 2011         | Fall       | 94                                        | 11%            |
| FRHFnp                  | 2011         | Fall       | 393                                       | 18%            |
| FRHFns                  | 2011         | Fall       | 293                                       | 14%            |
| NIMFn                   | 2011         | Fall       | 181                                       | 10%            |
| MOKFn                   | 2011         | Fall       | 30                                        | 12%            |

**2015 CFM ANALYSES KEY POINTS**

- Salmon escapement into CV hatcheries 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. Almost two-thirds of all hatchery-origin fish at MER were 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 predominantly hatchery-origin salmon with the exception of Cottonwood and Mill creeks. Net pen FRHFn was the hatchery release type most often observed in these rivers and creeks.

- Fall-run escapement into the Yuba River below DPD was predominantly natural-origin salmon while the Yuba River above the dam was primarily hatchery-origin. Net pen CNFHN, FRHFN and MOKFN were the predominate release types recovered in both sectors.
- 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 (Mokelumne, Stanislaus, Tuolumne and Merced rivers) was predominantly hatchery-origin salmon, the vast majority of which were net pen MOKFN releases. Trucked MERFt, along with net pen NIMFN, also contributed to hatchery-origin returns.
- Approximately three-fourths of the total 2015-2016 CV salmon escapement (all run-types) were hatchery-origin fish. Net pen FRHFN and MOKFN, along with hatchery CFHFh releases, contributed most to the total CV escapement. Trucked MERFt and MOKFt, along with net pen CFHFh, MOKFN and FRHFN releases, had the highest total stray proportions.
- For age-2 fall-run salmon, coastal net pen FRHFnc, net pen NIMFN and experimental barge study MOKFb releases had the highest CV recovery rates for their cohort. Trucked MERFt, coastal net pen MOKFnc, and net pen CFHFh had the highest stray proportions observed for age-2 releases.
- For age-3 fall-run salmon, coastal net pen FRHFnc, along with net pen FRHFN and MOKFN releases, had the highest CV recovery rates for their cohort. Trucked MERFt, net pen MOKFN and coastal net pen FRHFnc had the highest stray proportions observed for age-3 release types.
- For age-4 fall-run salmon, trucked MOKFt, net pen NIMFN and FRHFN, and coastal net pen FRHFnc had the highest CV recovery rates for their cohort. These same releases, with the exception of net pen NIMFN, also had the highest stray proportions observed for age-4 release types.
- Approximately three-fourths of the CV inland sport harvest was hatchery-origin fish. Net pen FRHFN, NIMFN, and MOKFN, along with hatchery CFHFh releases, contributed the most to the total harvest.
- More than half of the California ocean sport and commercial harvest was comprised of hatchery-origin fish. Net pen FRHFN, MOKFN and NIMFN, along with coastal net pen FRHFnc and hatchery CFHFh releases, contributed the most to the total harvest.
- 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 ocean recovery rate for coastal net pen Pillar Point FRHFnp and Santa Cruz MOKFns releases were very similar.
- Pillar Point coastal net pen FRHFnp releases had the highest CV recovery rates among all age-2 releases whereas relatively few Santa Cruz coastal net pen releases MOKFns returned

to the CV. The majority of Pillar Point FRHFnp recoveries occurred in the Feather River Basin whereas most of the Santa Cruz MOKFns recovered strayed outside the Mokelumne River.

- Among the barge study releases, salmon barged down the Mokelumne River (MOKFbg) had the highest age-2 CV recovery rate with moderate straying. This release also had the highest age-2 ocean recovery rate in this study group. Salmon trucked to and released into San Francisco Bay (MOKFbb) had the highest stray rate among all barge study releases. Salmon released as part of the Feather River barge study (FRHFbb, FRHFbg, and FRHFbr) had relatively low CV and ocean age-2 recovery rates, especially compared to previous reports.
- Salmon transported via barge (FRHFbg) or trucked and released (FRHFbb) into San Francisco Bay had the highest age-3 CV and ocean recovery rates among all experimental and net pen releases. Recoveries of age-3 salmon released in river (FRHFbr) as part of this study were minimal.
- Pillar Point coastal net pen FRHFnp releases had the highest CV and ocean recovery rates among all age-4 releases. Approximately half of the FRHFnp recoveries in the CV strayed outside of the Feather River Basin. Although the age-4 ocean recovery rate of Santa Cruz coastal net pen FRHFns was slightly lower than the Pillar Point releases, this release also had the lowest CV recovery and highest stray rate among all age-4 experimental and net pen releases.

## 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 no discussion section is included, as in earlier CFM reports, the authors plan to further analyze these data and draw general conclusions as these and additional tagged broods become complete. 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 ongoing 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 |
| RMPC       | 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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| Sampling Location                                              | Estimation and Sampling Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Agency |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| <b>Hatchery Spawners</b>                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |
| Coleman National Fish Hatchery (CFH) Fall and Late-Fall (2016) | Direct count. All fish examined and bio-sampled <sup>a/</sup> for fin-clips, tags, marks. Access upstream of the hatchery closed Aug 1-Sep 30. Fall-run period: Oct 6-Dec 3, Late-fall-run period: Dec 30 - Mar 9. 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, 580 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 - Mar 31. All ad-clipped fish sampled and heads collected for CWT recovery Mar 10 - 31 (after CFH spawning operations cease). Late-fall data from video weir counts during Apr-May added. Grilse cutoff: 580mm.                                                                                                                                                                                                                                                                                                                                                                                                      | FWS    |
| Keswick Fish Trap (KES) Winter                                 | Direct count. All fish examined and bio-sampled for fin-clips, tags, marks. All unmarked fish electronically sampled for presence of CWT and genetically tested to ensure winter-run broodstock. Grilse cutoff: 580mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FWS    |
| Feather River Hatchery (FRH) Spring and Fall                   | Direct count. All fish examined for fin-clips, tags, marks. Fish arriving at the hatchery May 21-Jul 2 (n~ 5,355) 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 14 and spring spawning began Sep 17. All spring-run fish bio-sampled until Sep 28 when the rate was reduced to 50%. Fall spawning occurred on Oct 1 for the cold water program and began normally on Oct 7. Systematic random bio-sample ~20% of all fish for fall-run. 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 2 - Dec 22. All fish examined for fin-clips, tags, marks. Systematic random bio-sample of 33.3% of total fish returning until November 19th when the rate was reduced to 20%. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 650 mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CDFW   |
| Mokelumne River Hatchery (MOK) Fall                            | Direct count. MOK open Oct 1 - Feb. 28. All fish examined for fin-clips, tags, marks. Systematic random bio-sample ~33% of total fish returning. All ad-clipped fish sampled and heads collected for CWT recovery. Grilse cutoff: 650 mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | CDFW   |
| Mokelumne Weir Fall                                            | Direct count. All fish examined for fin-clips, tags, marks. All ad-clipped fish were bio-sampled and heads processed for CWT recovery. Grilse cutoff: 650 mm females, 710 mm males.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CDFW   |
| Merced River Hatchery (MER) Fall                               | Direct count. MER open Nov 5-Dec 24. All fish examined for fin-clips, tags, marks. All ad-clipped fish were sampled and heads processed for CWT recovery. Grilse cutoff: 620 mm females, 700 mm males.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CDFW   |

<sup>a/</sup> 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 2015 CV Chinook natural escapement. (page 1 of 2)

| Sampling Location                                                        | Estimation and Sampling Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Agency       |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Natural Spawners</b>                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |
| Upper Sacramento River<br>Mainstem Winter, Fall, and<br>Late-Fall (2015) | Population estimate for each run produced utilizing five-step process:<br>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 <sup>al</sup> 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: 575 mm females, 610 mm males winter; 610 mm females, 670 mm males fall; 610 mm females, 610 mm males late-fall. | CDFW,<br>FWS |
| Clear Creek Fall                                                         | Video Station count used to estimate population. Supplemental bio-sampling survey used to estimate biological characteristics of the population (age, sex, hatchery-origin, spawn success). All fish in carcass survey 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: 610 mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | CDFW,<br>FWS |
| Cow Creek Fall                                                           | Video weir count in lower creek used to determine total escapement. Two kayak surveys conducted to collect bio-data from fresh fish. Less than 1% of total escapement sampled; opportunistic collection of CWTs. Grilse cutoff: 610 mm females, 670 mm males.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CDFW         |
| Battle Creek Fall                                                        | Video weir count (Aug 17 - Nov 24) 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CDFW         |
| Cottonwood Creek Fall                                                    | Video weir count (Sep 24 - Dec 11) 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, 670 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. Bio-sampling 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, 670 mm males.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CDFW         |
| 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. Kayak surveys conducted to collect bio-data from fresh fish. Approximately 1% of total escapement sampled; opportunistic collection of CWTs. Grilse cutoff: 610 mm females, 670 mm males.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CDFW         |

Table 1b. Estimation and sampling methods used for the 2015 CV Chinook natural escapement. (page 2 of 2)

| Sampling Location             | Estimation and Sampling Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Agency      |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Natural Spawners cont.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |
| 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: 620 mm females, 690 mm males.                                                                                                                                                                                                        | CDFW        |
| Nimbus Weir Fall              | Direct count. Installed Sept 4 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: 650 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: 620 mm females, 700 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: 620 mm females, 700 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: 620 mm females, 700 mm males.                                                                                                                                                                                                                                                     | CDFW        |

<sup>a/</sup> 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 2015 CV Chinook river sport harvest.

| <b>Sampling Location</b>                  | <b>Survey Design and Open Dates</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Agency</b> |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b><u>Sport Harvest</u></b>               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |
|                                           | <b>Survey Design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |
| 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          |
|                                           | <b>Open Dates</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
| 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.                                                                                                                                                                        |               |
| 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: 600 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.                                                                                                                                                                                            |               |
|                                           | <b>Bag and Size Limit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |
| 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, 2015.

| Major Port Area                             | Sport Fishery   |                          |            | Commercial Fishery       |                          |           |                     |
|---------------------------------------------|-----------------|--------------------------|------------|--------------------------|--------------------------|-----------|---------------------|
|                                             | Season          | Size Limit <sup>a/</sup> | Days Open  | Season                   | Size Limit <sup>a/</sup> | Days Open | Quota               |
| Eureka/Crescent City<br>(Klamath Mgmt Zone) | May 1 - Sep 7   | 20" TL                   | 130        | Sep 11 - 30              | 28" TL                   | 18        | 3,000 <sup>b/</sup> |
| Fort Bragg                                  | Apr 4 - Nov 8   | 20" TL                   | 219        | May 1 - 31               | 27" TL                   | 31        |                     |
|                                             |                 |                          |            | Jun 15 - 30              | 27" TL                   | 16        |                     |
|                                             |                 |                          |            | Jul 12 - Aug 26          | 27" TL                   | 46        |                     |
|                                             |                 |                          |            | Sep 1 - 30               | 27" TL                   | <u>30</u> |                     |
|                                             |                 |                          |            |                          |                          | 123       |                     |
| San Francisco                               | Apr 4 - Apr 30  | 24" TL                   | 27         | May 1 - 31               | 27" TL                   | 31        |                     |
|                                             | May 1 - Nov 8   | 20" TL                   | <u>184</u> | Jun 7 - 30               | 27" TL                   | 24        |                     |
|                                             |                 |                          | 211        | Jul 8 - Aug 29           | 27" TL                   | 53        |                     |
|                                             |                 |                          |            | Sep 1 - 30               | 26" TL                   | 30        |                     |
|                                             |                 |                          |            | Oct 1 - 15 <sup>c/</sup> | 26" TL                   | <u>11</u> |                     |
|                                             |                 |                          |            |                          |                          | 149       |                     |
| Monterey - North<br>(Pigeon Pt - Pt Sur)    | Apr 4 - May 31  | 24" TL                   | 58         | May 1 - 31               | 27" TL                   | 31        |                     |
|                                             | May 1 - Sep 7   | 20" TL                   | <u>99</u>  | Jun 7 - 30               | 27" TL                   | 24        |                     |
|                                             |                 |                          | 157        | Jul 8 - Aug 15           | 27" TL                   | <u>39</u> |                     |
|                                             |                 |                          |            |                          |                          | 94        |                     |
| Monterey - South<br>(Pt Sur - US / Mexico)  | Apr 4 - May 31  | 24" TL                   | 58         | May 1 - 31               | 27" TL                   | 31        |                     |
|                                             | May 1 - July 19 | 20" TL                   | <u>49</u>  | Jun 7 - 30               | 27" TL                   | 24        |                     |
|                                             |                 |                          | 107        | Jul 8 - 31               | 27" TL                   | <u>24</u> |                     |
|                                             |                 |                          |            |                          |                          | 79        |                     |
| California Total <sup>d/</sup>              |                 |                          | 717        |                          |                          | 384       |                     |

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/ California Total does not include days open in Monterey - South (subset of Monterey port area).

Table 3. Central Valley coded-wire tag (CWT) Chinook releases recovered in 2015 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 | Release locations / notes                                                   |
|-----------------------|------------|-----------------|--------------|----------|-----------|--------------|---------------------|-------|------------------|-----------------------------------------------------------------------------|
| FRHS                  | 2013       | FRH             | Fea R        | Spr      | 4         | 1,217,640    | 1,227,476           | 99%   | In-basin         | Feather River (Boyds Pump Ramp & Gridley)                                   |
| FRHSn                 | 2013       | FRH             | Fea R        | Spr      | 1         | 997,962      | 1,009,198           | 99%   | Bay pens         | Wickland Oil net pen releases                                               |
| CFHFh                 | 2013       | CFH             | Sac R        | Fall     | 4         | 1,125,706    | 4,506,160           | 25%   | Hatchery         | CFH only                                                                    |
| CFHFn                 | 2013       | CFH             | Sac R        | Fall     | 11        | 1,810,972    | 7,273,847           | 25%   | Bay pens         | San Pablo Bay net pen releases                                              |
| FRHFK                 | 2013       | FRH             | Fea R        | Fall     | 1         | 44,127       | 44,127              | 100%  | Experimental     | Yolo Bypass experimental (Knaggs Ranch rice field study)                    |
| FRHFB                 | 2013       | FRH             | Fea R        | Fall     | 3         | 300,145      | 301,417             | 100%  | Barge study      | 3 release sites: Sac R (Rio Vista), barged (SF Bay) & trucked (Tiburon)     |
| FRHFN                 | 2013       | FRH             | Fea R        | Fall     | 5         | 1,459,468    | 5,906,741           | 25%   | Bay pens         | San Pablo Bay net pen releases                                              |
| FRHFnc                | 2013       | FRH             | Fea R        | Fall     | 1         | 366,033      | 368,458             | 99%   | Coastal pens     | Pillar Point net pens; acclimated 1-2 weeks                                 |
| FRHFTib               | 2013       | FRH             | Fea R        | Fall     | 1         | 11,791       | 11,791              | 100%  | Bay pens         | Tiburon net pens; acclimated 1 week                                         |
| NIMFn                 | 2013       | NIM             | Ame R        | Fall     | 4         | 896,419      | 3,587,565           | 25%   | Bay pens         | Mare Island net pens                                                        |
| MOKFb                 | 2013       | MOK             | Mok R        | Fall     | 3         | 302,658      | 303,669             | 100%  | Barge study      | 3 release sites: Mok R (Miller's Ferry), barged (SF Bay) & trucked (Tiburo) |
| MOKFn                 | 2013       | MOK             | Mok R        | Fall     | 11        | 1,148,423    | 4,604,315           | 25%   | Bay pens         | Sherman Island net pens                                                     |
| MOKFnc                | 2013       | MOK             | Mok R        | Fall     | 1         | 239,294      | 240,497             | 99%   | Coastal pens     | Santa Cruz net pens; 60K released per week, acclimated a few hours          |
| MERFt                 | 2013       | MER             | Mer R        | Fall     | 3         | 393,182      | 1,501,007           | 26%   | Trucked          | San Joaquin River at Jersey Point and Mossdale                              |
| SJOx                  | 2013       | MER/FRH         | MER/FRH      | Fall/Spr | 7         | 139,393      | 184,393             | 76%   | Experimental     | San Joaquin River Conservation Hatchery experimental releases               |
| SacW                  | 2013       | LSH             | Sac R        | Wint     | 4         | 190,905      | 193,155             | 92%   | In-basin         | Sacramento River (Lake Redding Park)                                        |
| CFHLh                 | 2014       | CFH             | Sac R        | Late     | 14        | 1,056,322    | 1,094,719           | 96%   | Hatchery         | CFH (includes spring surrogate & small experimental releases)               |
| Total age 2 releases: |            |                 |              |          | 78        | 11,700,440   | 32,358,535          | 36%   |                  |                                                                             |

**Age 3 CWT releases**

| Release type*         | Brood year | Hatchery / wild | Stock origin | Run type | CWT codes | # CWT tagged | Total fish released | % CWT | Release strategy | Release locations / notes                                                |
|-----------------------|------------|-----------------|--------------|----------|-----------|--------------|---------------------|-------|------------------|--------------------------------------------------------------------------|
| FRHS                  | 2012       | FRH             | Fea R        | Spr      | 2         | 1,106,679    | 1,125,897           | 98%   | In-basin         | Feather River (Boyds Pump Ramp & Gridley net pens)                       |
| FRHSn                 | 2012       | FRH             | Fea R        | Spr      | 1         | 1,015,285    | 1,033,174           | 98%   | Bay pens         | Wickland Oil net pen releases                                            |
| CFHFh                 | 2012       | CFH             | Sac R        | Fall     | 14        | 2,956,348    | 11,873,864          | 25%   | Hatchery         | CFH only                                                                 |
| FRHFK                 | 2012       | FRH             | Fea R        | Fall     | 12        | 138,888      | 138,888             | 100%  | Experimental     | Yolo Bypass experimental (Knaggs Ranch rice field study)                 |
| FRHFB                 | 2012       | FRH             | Fea R        | Fall     | 3         | 293,784      | 299,404             | 98%   | Barge study      | 3 release sites: Sac R (Broderick), barged (SF Bay) & trucked (Ft Baker) |
| FRHFN                 | 2012       | FRH             | Fea R        | Fall     | 4         | 1,453,105    | 5,848,045           | 25%   | Bay pens         | San Pablo Bay net pen releases                                           |
| FRHFnc                | 2012       | FRH             | Fea R        | Fall     | 2         | 649,160      | 656,564             | 99%   | Coastal pens     | Santa Cruz and Pillar Point net pens; acclimated 1-14 days               |
| FRHFTib               | 2012       | FRH             | Fea R        | Fall     | 1         | 9,918        | 10,028              | 99%   | Bay pens         | Tiburon net pens                                                         |
| NIMF                  | 2012       | NIM             | Ame R        | Fall     | 3         | 1,026,596    | 3,277,594           | 31%   | In-basin         | American River (Jibboom Street bridge & Howe Ave launch ramp)            |
| NIMFn                 | 2012       | NIM             | Ame R        | Fall     | 1         | 182,413      | 734,906             | 25%   | Bay pens         | Mare Island net pens (19% transportation mortality prior to release)     |
| MOKF                  | 2012       | MOK             | Mok R        | Fall     | 1         | 99,548       | 100,306             | 99%   | In-basin         | Mokelumne Hatchery (yearlings)                                           |
| MOKFn                 | 2012       | MOK             | Mok R        | Fall     | 13        | 1,275,158    | 5,123,986           | 25%   | Bay pens         | Sherman Island net pens                                                  |
| MERFt                 | 2012       | MER             | Mer R        | Fall     | 4         | 325,953      | 1,384,973           | 24%   | Trucked          | San Joaquin River at Jersey Point and Mossdale                           |
| SacW                  | 2012       | LSH             | Sac R        | Wint     | 16        | 169,967      | 181,857             | 92%   | In-basin         | Sacramento River (Lake Redding Park)                                     |
| CFHLh                 | 2013       | CFH             | Sac R        | Late     | 14        | 960,075      | 984,977             | 97%   | Hatchery         | CFH (includes spring surrogate & small experimental releases)            |
| Total age 3 releases: |            |                 |              |          | 91        | 11,662,877   | 32,774,463          | 36%   |                  |                                                                          |

Table 3. Central Valley coded-wire tag (CWT) Chinook releases recovered in 2015 by age, run, stock, and release type. (Page 2 of 2)

**Age 4 CWT releases**

| Release type*         | Brood year | Hatchery | Stock origin | Run type | CWT codes | # CWT tagged | Total fish released | % CWT | Release strategy | Release locations / notes                                              |
|-----------------------|------------|----------|--------------|----------|-----------|--------------|---------------------|-------|------------------|------------------------------------------------------------------------|
| FRHS                  | 2011       | FRH      | Fea R        | Spr      | 2         | 1,088,286    | 1,110,709           | 98%   | In-basin         | Feather River (Boyds Pump Ramp & Thermolito Bypass)                    |
| FRHSn                 | 2011       | FRH      | Fea R        | Spr      | 1         | 1,125,189    | 1,134,280           | 99%   | Bay pens         | San Pablo Bay net pen releases                                         |
| CFHFh                 | 2011       | CFH      | Sac R        | Fall     | 28        | 3,117,042    | 12,508,161          | 25%   | Hatchery         | CFH only                                                               |
| FRHFf                 | 2011       | FRH      | Fea R        | Fall     | 1         | 10,218       | 10,218              | 100%  | Experimental     | Yolo Bypass experimental (Knaggs Ranch rice field study)               |
| FRHFb                 | 2011       | FRH      | Fea R        | Fall     | 3         | 297,089      | 297,969             | 100%  | Barge study      | 3 release sites: Sac R (Elkhorn), barged (SF Bay) & trucked (Ft Baker) |
| FRHFf                 | 2011       | FRH      | Fea R        | Fall     | 6         | 2,293,211    | 9,265,375           | 25%   | Bay pens         | San Pablo Bay net pen releases (approx 15% released directly into bay) |
| FRHFnc                | 2011       | FRH      | Fea R        | Fall     | 3         | 426,190      | 427,337             | 100%  | Coastal pens     | Santa Cruz and Pillar Point net pens; acclimated 1-14 days             |
| FRHFtib               | 2011       | FRH      | Fea R        | Fall     | 1         | 9,933        | 9,967               | 100%  | Bay pens         | Tiburon net pens                                                       |
| FeaFw                 | 2011       | wild     | Fea R        | Fall     | 23        | 156,526      | 159,811             | 98%   | In-basin         | Thermalito Bypass & Feather River Outlet launch ramp                   |
| NIMF                  | 2011       | NIM      | Ame R        | Fall     | 3         | 1,078,191    | 3,492,113           | 31%   | In-basin         | American River (Howe Ave launch ramp)                                  |
| NIMFn                 | 2011       | NIM      | Ame R        | Fall     | 2         | 328,073      | 1,312,930           | 25%   | Bay pens         | Mare Island net pens                                                   |
| MOKF                  | 2011       | MOK      | Mok R        | Fall     | 1         | 92,020       | 109,043             | 84%   | In-basin         | Mokelumne Hatchery (yearlings)                                         |
| MOKFn                 | 2011       | MOK      | Mok R        | Fall     | 21        | 1,487,132    | 5,973,754           | 25%   | Bay pens         | Sherman Island net pens                                                |
| MOKFt                 | 2011       | MOK      | Mok R        | Fall     | 2         | 110,737      | 448,659             | 25%   | Trucked          | Sherman Island, opposite Jersey Point                                  |
| MERF                  | 2011       | MER      | Mer R        | Fall     | 9         | 262,108      | 262,108             | 100%  | In-basin         | Merced River Hatchery and Hatfield State Area                          |
| SacW                  | 2011       | LSH      | Sac R        | Wint     | 18        | 185,313      | 194,264             | 92%   | In-basin         | Sacramento River (Lake Redding Park)                                   |
| CFHLh                 | 2012       | CFH      | Sac R        | Late     | 14        | 1,031,419    | 1,094,288           | 94%   | Hatchery         | CFH (includes spring surrogate & small experimental releases)          |
| Total age 4 releases: |            |          |              |          | 138       | 13,098,677   | 37,810,986          | 35%   |                  |                                                                        |

**Age 5 CWT releases**

| Release type* | Brood year | Hatchery | Stock origin | Run type | CWT codes | # CWT tagged | Total fish released | % CWT | Release strategy | Release locations / notes                                |
|---------------|------------|----------|--------------|----------|-----------|--------------|---------------------|-------|------------------|----------------------------------------------------------|
| FRHS          | 2010       | FRH      | Fea R        | Spr      | 2         | 1,170,340    | 1,181,710           | 99%   | In-basin         | Feather River (Boyds Pump Ramp)                          |
| CFHFh         | 2010       | CFH      | Sac R        | Fall     | 25        | 2,835,420    | 11,369,732          | 25%   | Hatchery         | CFH                                                      |
| CFHFf         | 2010       | CFH      | Sac R        | Fall     | 3         | 334,756      | 1,339,659           | 25%   | Bay pens         | Mare Island net pens                                     |
| FRHFf         | 2010       | FRH      | Fea R        | Fall     | 9         | 2,554,115    | 10,308,722          | 25%   | Bay pens         | San Pablo Bay net pens; Wickland Oil net pens            |
| NIMF          | 2010       | NIM      | Ame R        | Fall     | 3         | 1,014,340    | 3,259,868           | 31%   | In-basin         | American River (at Sunrise launch ramp & Discovery Park) |
| NIMFn         | 2010       | NIM      | Ame R        | Fall     | 0         | 368,363      | 1,595,731           | 23%   | Bay pens         | Wickland Oil net pens                                    |
| CFHLh         | 2011       | CFH      | Sac R        | Late     | 14        | 1,037,859    | 1,053,282           | 99%   | Hatchery         | CFH (includes spring surrogate releases)                 |

**\*CWT release types:**

**Sacramento River fall Chinook release types (SFC)**

|         |                                                                |
|---------|----------------------------------------------------------------|
| CFHFh   | Coleman National Fish Hatchery fall hatchery releases          |
| CFHFf   | Coleman National Fish Hatchery fall net pen releases           |
| FRHFf   | Feather River Hatchery fall experimental Knaggs Ranch releases |
| FRHFb   | Feather River Hatchery fall barge study releases               |
| FRHFf   | 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           |
| FeaFw   | Feather River fall wild                                        |
| NIMF    | Nimbus Fish Hatchery fall in-basin releases                    |
| NIMFn   | Nimbus Fish Hatchery fall net pens                             |

**Other CV Chinook release types (OCV)**

|        |                                                               |
|--------|---------------------------------------------------------------|
| MOKF   | Mokelumne Hatchery fall in-basin releases                     |
| MOKFb  | Mokelumne Hatchery fall barge study releases                  |
| MOKFn  | Mokelumne Hatchery fall net pen releases                      |
| MOKFnc | Mokelumne Hatchery fall coastal net pen releases (Santa Cruz) |
| 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)     |
| FRHS   | Feather River Hatchery spring in-basin releases               |
| FRHSn  | Feather River Hatchery spring net pen releases                |
| SacW   | Livingston Stone Hatchery winter in-basin releases            |
| CFHLh  | Coleman National Fish Hatchery late fall hatchery releases    |

**Table 4. Central Valley hatchery and natural escapement estimates, sport harvest, and sample data, 2015.**

| Central Valley Survey                     | Run                     | Total Escapement | Chinook Sampled <sup>a/</sup> | Observed Ad-Clips            | Heads Processed | Valid CWTs        | Sample rate (fe) | Ad-clips processed (fa) | Valid CWTs (fd) | CWT $F_{\text{sample}}$ |
|-------------------------------------------|-------------------------|------------------|-------------------------------|------------------------------|-----------------|-------------------|------------------|-------------------------|-----------------|-------------------------|
| <b><u>Hatchery Escapement</u></b>         |                         |                  |                               |                              |                 |                   |                  |                         |                 |                         |
| Keswick Dam Fish Trap                     | Winter                  | 257              | 257                           | 133                          | 132             | 127               | 1.000            | 0.992                   | 1.000           | 1.01                    |
| Feather River Hatchery                    | Spring                  | 3,386            | 3,386                         | 3,270                        | 3,270           | 3,227             | 1.000            | 1.000                   | 0.999           | 1.00                    |
| Coleman National Fish Hatchery            | Fall                    | 15,724           | 15,724                        | 3,123                        | 3,119           | 3,032             | 1.000            | 0.998                   | 0.995           | 1.01 <sup>b/</sup>      |
| Feather River Hatchery                    | Fall                    | 20,816           | 20,816                        | 9,070                        | 9,070           | 8,901             | 1.000            | 1.000                   | 0.998           | 1.00                    |
| Nimbus Fish Hatchery                      | Fall                    | 9,822            | 9,822                         | 2,273                        | 2,273           | 2,131             | 1.000            | 1.000                   | 0.964           | 1.04                    |
| Mokelumne River Hatchery                  | Fall                    | 8,298            | 8,298                         | 2,227                        | 2,227           | 2,181             | 1.000            | 1.000                   | 0.998           | 1.00                    |
| Merced River Hatchery                     | Fall                    | 1,198            | 1,198                         | 287                          | 286             | 261               | 1.000            | 0.997                   | 0.942           | 1.07                    |
| Coleman National Fish Hatchery            | Late-fall <sup>c/</sup> | 2,348            | 2,348                         | 2,297                        | 2,297           | 2,274             | 1.000            | 1.000                   | 0.997           | 1.00 <sup>b/</sup>      |
| Coleman National Fish Hatchery Trap       | Late-fall <sup>c/</sup> | 104              | 104                           | 103                          | 46              | 45                | 1.000            | 0.447                   | 1.000           | 2.24                    |
| Keswick Dam Fish Trap                     | Late-fall <sup>c/</sup> | 65               | 65                            | 4                            | 4               | 4                 | 1.000            | 1.000                   | 1.000           | 1.00                    |
| <b>Total Hatchery Escapement</b>          |                         | <b>62,018</b>    | <b>62,018</b>                 | <b>22,787</b>                | <b>22,724</b>   | <b>22,183</b>     |                  |                         |                 |                         |
| <b><u>Natural Area Escapement</u></b>     |                         |                  |                               |                              |                 |                   |                  |                         |                 |                         |
| Upper Sacramento River (above RBDD)       | Winter                  | 3,182            | 1,076                         | 195                          | 194             | 161               | 0.338            | 0.995                   | 1.000           | 3.23 <sup>d/</sup>      |
| Butte Creek                               | Spring                  | 413              | 185                           | 0                            | 0               | 0                 | 0.448            | -                       | -               | -                       |
| Upper Sacramento River (above RBDD)       | Fall                    | 28,668           | 3,175                         | 405                          | 404             | 381               | 0.111            | 0.998                   | 0.974           | 16.05 <sup>d/</sup>     |
| Clear Creek                               | Fall                    | 8,809            | 1,778                         | 271                          | 270             | 246               | 0.202            | 0.996                   | 0.946           | 8.30 <sup>f/</sup>      |
| Cow Creek                                 | Fall                    | 591              | 12                            | Video - no biodata collected |                 | 0                 | 0.020            | -                       | -               | -                       |
| Battle Creek                              | Fall                    | 3,631            | 3,631                         | Video - no biodata collected |                 | 112 <sup>e/</sup> | -                | -                       | -               | -                       |
| Cottonwood Creek                          | Fall                    | 604              | 33                            | 2                            | 2               | 2                 | 0.055            | 1.000                   | 1.000           | 18.30 <sup>f/</sup>     |
| Mill Creek                                | Fall                    | 1,033            | 62                            | 9                            | 9               | 8                 | 0.060            | 1.000                   | 1.000           | 15.65 <sup>f/</sup>     |
| Deer Creek                                | Fall                    | 612              | 51                            | 15                           | 15              | 15                | 0.083            | 1.000                   | 1.000           | 10.68 <sup>f/</sup>     |
| Butte Creek                               | Fall                    | 82               | 4                             | Video - no biodata collected |                 | 0                 | 0.049            | -                       | -               | -                       |
| Feather River                             | Fall                    | 20,566           | 3,578                         | 1,323                        | 1,323           | 1,238             | 0.174            | 1.000                   | 0.968           | 5.94                    |
| Yuba River above Daguerre Point Dam (DPD) | Fall                    | 4,981            | 148                           | 28                           | 28              | 28                | 0.030            | 1.000                   | 1.000           | 33.66 <sup>g/</sup>     |
| Yuba River below DPD                      | Fall                    | 2,569            | 237                           | 36                           | 36              | 32                | 0.092            | 1.000                   | 1.000           | 10.50 <sup>d/</sup>     |
| American River                            | Fall                    | 13,793           | 7,516                         | 1,374                        | 1,242           | 1,100             | 0.545            | 0.904                   | 0.967           | 2.23 <sup>d/</sup>      |
| Nimbus Fish Hatchery Weir                 | Fall                    | 1,946            | 1,946                         | 290                          | 290             | 247               | 1.000            | 1.000                   | 0.961           | 1.04                    |
| Mokelumne River                           | Fall                    | 4,581            | 4,581                         | 1,229                        | 194             | 178               | 1.000            | 0.158                   | 0.994           | 6.37 <sup>g/</sup>      |
| Stanislaus River                          | Fall                    | 6,136            | 794                           | 200                          | 200             | 190               | 0.129            | 1.000                   | 0.960           | 6.55 <sup>h/</sup>      |
| Tuolumne River                            | Fall                    | 113              | 45                            | 8                            | 8               | 8                 | 0.398            | 1.000                   | 1.000           | 2.51                    |
| Merced River                              | Fall                    | 1,247            | 443                           | 75                           | 75              | 69                | 0.355            | 1.000                   | 0.945           | 3.78 <sup>d/</sup>      |
| Upper Sacramento River (above RBDD)       | Late-fall <sup>c/</sup> | 3,085            | 637                           | 16                           | 16              | 13                | 0.206            | 1.000                   | 0.867           | 14.73 <sup>d/</sup>     |
| <b>Total Natural Area Escapement</b>      |                         | <b>106,642</b>   | <b>29,932</b>                 | <b>5,476</b>                 | <b>4,306</b>    | <b>4,028</b>      |                  |                         |                 |                         |
| <b><u>CV Sport Harvest</u></b>            |                         |                  |                               |                              |                 |                   |                  |                         |                 |                         |
| Sacramento River (above Feather River)    | Fall                    | 8,088            | 733                           | 155                          | 138             | 134               | 0.091            | 0.890                   | 0.993           | 12.49                   |
| Sacramento River (below Feather River)    | Fall                    | 6,205            | 232                           | 60                           | 60              | 57                | 0.037            | 1.000                   | 0.983           | 27.21                   |
| Feather River                             | Fall                    | 1,906            | 82                            | 32                           | 32              | 32                | 0.043            | 1.000                   | 1.000           | 21.81                   |
| American River                            | Fall                    | 6,630            | 322                           | 76                           | 75              | 75                | 0.049            | 0.987                   | 1.000           | 20.86                   |
| Mokelumne River                           | Fall                    | 1,281            | 101                           | 26                           | 26              | 26                | 0.079            | 1.000                   | 1.000           | 12.68                   |
| Sacramento River (above Feather River)    | Late-fall <sup>c/</sup> | 252              | 28                            | 11                           | 11              | 11                | 0.111            | 1.000                   | 1.000           | 9.00                    |
| <b>Total Sport Harvest</b>                |                         | <b>24,362</b>    | <b>1,498</b>                  | <b>360</b>                   | <b>342</b>      | <b>335</b>        |                  |                         |                 |                         |
| <b>Total Sampled</b>                      |                         | <b>93,448</b>    | <b>28,623</b>                 | <b>27,372</b>                | <b>26,546</b>   |                   |                  |                         |                 |                         |

a/ Number of Chinook salmon 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 2015 through early 2016 (return year 2016).

d/ Carcass 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., 37 CWTs recovered from washbacks on Stanislaus Weir).

**Table 5. Total harvest and sample data for 2015 Ocean Salmon Sport and Commercial Fisheries by major port area**

| Fishery - Port Area          | Ocean<br>Harvest     | Chinook<br>Sampled <sup>a/</sup> | Observed<br>Ad-Clips | Heads<br>Processed  | Valid<br>CWTs       | Sample<br>rate (fe) | Ad-clips<br>processed (fa) | Valid<br>CWTs (fd)  | CWT<br>$F_{\text{samp}}$ |
|------------------------------|----------------------|----------------------------------|----------------------|---------------------|---------------------|---------------------|----------------------------|---------------------|--------------------------|
| <b>California Sport</b>      |                      |                                  |                      |                     |                     |                     |                            |                     |                          |
| Eureka/Crescent              | 3,690                | 1,180                            | 261                  | 259                 | 239                 | 0.320               | 0.992                      | 0.992               | 3.18                     |
| Fort Bragg                   | 5,493                | 1,311                            | 303                  | 303                 | 277                 | 0.239               | 1.000                      | 0.965               | 4.34                     |
| San Francisco                | 25,227               | 8,474                            | 2,491                | 2,469               | 2,326               | 0.336               | 0.991                      | 0.970               | 3.10                     |
| Monterey                     | <u>3,070</u>         | <u>637</u>                       | <u>274</u>           | <u>271</u>          | <u>258</u>          | <u>0.207</u>        | <u>0.989</u>               | <u>0.977</u>        | 5.00                     |
|                              | <b>37,480</b>        | <b>11,602</b>                    | <b>3,329</b>         | <b>3,302</b>        | <b>3,100</b>        | <b>0.310</b>        | <b>0.992</b>               | <b>0.939</b>        |                          |
| <b>California Commercial</b> |                      |                                  |                      |                     |                     |                     |                            |                     |                          |
| Eureka/Crescent              | 46                   | 5                                | 1                    | 1                   | 1                   | 0.109               | 1.000                      | 1.000               | 9.17                     |
| Fort Bragg                   | 60,052               | 20,341                           | 3,390                | 3,384               | 2,965               | 0.339               | 0.998                      | 0.976               | 3.03                     |
| San Francisco                | 35,696               | 11,032                           | 2,750                | 2,748               | 2,603               | 0.309               | 0.999                      | 0.973               | 3.33                     |
| Monterey                     | <u>14,713</u>        | <u>5,612</u>                     | <u>1,925</u>         | <u>1,924</u>        | <u>1,832</u>        | <u>0.381</u>        | <u>0.999</u>               | <u>0.974</u>        | 2.70                     |
|                              | <b>110,507</b>       | <b>36,990</b>                    | <b>8,066</b>         | <b>8,057</b>        | <b>7,401</b>        | <b>0.335</b>        | <b>0.999</b>               | <b>0.919</b>        |                          |
| <b>California Total</b>      | <b>147,987</b>       | <b>48,592</b>                    | <b>11,395</b>        | <b>11,359</b>       | <b>10,501</b>       | <b>0.328</b>        | <b>0.997</b>               | <b>0.924</b>        |                          |
| <b>Oregon Sport</b>          | <b>6,685</b>         | <b>2,071</b>                     | <b>194</b>           | <b>194</b>          | <b>181</b>          | <b>0.310</b>        | <b>1.000</b>               | <b>0.995</b>        | 3.24                     |
| <b>Oregon Commercial</b>     | <u><b>93,377</b></u> | <u><b>28,203</b></u>             | <u><b>4,442</b></u>  | <u><b>4,440</b></u> | <u><b>4,262</b></u> | <u><b>0.302</b></u> | <u><b>1.000</b></u>        | <u><b>0.990</b></u> | 3.34                     |
| <b>Oregon Total</b>          | <b>100,062</b>       | <b>30,274</b>                    | <b>4,636</b>         | <b>4,634</b>        | <b>4,443</b>        | <b>0.303</b>        | <b>1.000</b>               | <b>0.959</b>        |                          |

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 2015.

| <u>Fall-run</u>                  |  | 2014                                   | 2013                                    | 2012                   | 2011                                  | 2010                                    | Total CV<br>CWTs | Total CV % |
|----------------------------------|--|----------------------------------------|-----------------------------------------|------------------------|---------------------------------------|-----------------------------------------|------------------|------------|
| Age                              |  | 1                                      | 2 <sup>a/</sup>                         | 3                      | 4 <sup>a/</sup>                       | 5                                       |                  |            |
| Raw CWT Recoveries               |  | 4<br>( <small>&lt;1%</small> )         | 3,712<br>(23%)                          | 9,425<br>(59%)         | 2,835<br>(18%)                        | 88<br>( <small>&lt;1%</small> )         | 16,064           | 61%        |
| Expanded CWT <sub>total</sub>    |  | <b>13</b><br>( <small>&lt;1%</small> ) | <b>24,835</b><br>(19%)                  | <b>76,266</b><br>(59%) | <b>26,960</b><br>(21%)                | <b>730</b><br>( <small>&lt;1%</small> ) | 128,805          | 89%        |
|                                  |  |                                        |                                         |                        |                                       |                                         |                  |            |
| <u>Spring-run</u>                |  |                                        | 2013                                    | 2012                   | 2011                                  | 2010                                    | Total CV<br>CWTs | Total CV % |
| Age                              |  |                                        | 2                                       | 3                      | 4                                     | 5                                       |                  |            |
| Raw CWT Recoveries               |  |                                        | 45<br>( <small>&lt;1%</small> )         | 5,800<br>(74%)         | 1,976<br>(25%)                        | 18<br>( <small>&lt;1%</small> )         | 7,839            | 30%        |
| Expanded CWT <sub>total</sub>    |  |                                        | <b>111</b><br>( <small>&lt;1%</small> ) | <b>8,477</b><br>(73%)  | <b>3,052</b><br>(26%)                 | <b>43</b><br>( <small>&lt;1%</small> )  | 11,683           | 8%         |
|                                  |  |                                        |                                         |                        |                                       |                                         |                  |            |
| <u>Late-Fall-run</u>             |  |                                        | 2014                                    | 2013                   | 2012                                  | 2011                                    | Total CV<br>CWTs | Total CV % |
| Age                              |  |                                        | 2                                       | 3                      | 4                                     | 5                                       |                  |            |
| Raw CWT Recoveries               |  |                                        | 796<br>(34%)                            | 469<br>(20%)           | 1,041<br>(44%)                        | 49<br>(2%)                              | 2,355            | 9%         |
| Expanded CWT <sub>total</sub>    |  |                                        | <b>932</b><br>(32%)                     | <b>582</b><br>(20%)    | <b>1,347</b><br>(46%)                 | <b>60</b><br>(2%)                       | 2,922            | 2%         |
|                                  |  |                                        |                                         |                        |                                       |                                         |                  |            |
| <u>Winter-run</u>                |  | 2014                                   | 2013                                    | 2012                   | 2011                                  | 2010                                    | Total CV<br>CWTs | Total CV % |
| Age                              |  | 1                                      | 2                                       | 3                      | 4                                     | 5                                       |                  |            |
| Raw CWT Recoveries               |  | 6<br>(2%)                              | 4<br>(1%)                               | 277<br>(96%)           | 1<br>( <small>&lt;1%</small> )        |                                         | 288              | 1.1%       |
| Expanded CWT <sub>total</sub>    |  | <b>9</b><br>(1%)                       | <b>6</b><br>( <small>&lt;1%</small> )   | <b>676</b><br>(97%)    | <b>3</b><br>( <small>&lt;1%</small> ) |                                         | 694              | 0.5%       |
|                                  |  |                                        |                                         |                        |                                       |                                         |                  |            |
| <u>All Runs</u>                  |  |                                        |                                         |                        |                                       |                                         | Total CV<br>CWTs | Total CV % |
| Age                              |  | 1                                      | 2 <sup>a/</sup>                         | 3                      | 4 <sup>a/</sup>                       | 5                                       |                  |            |
| Raw CWT Recoveries               |  | 10<br>( <small>&lt;1%</small> )        | 4,557<br>(17%)                          | 15,971<br>(60%)        | 5,853<br>(22%)                        | 155<br>( <small>&lt;1%</small> )        | 26,546           | 100%       |
| CV Expanded CWT <sub>total</sub> |  | <b>22</b><br>( <small>&lt;1%</small> ) | <b>25,884</b><br>(18%)                  | <b>86,001</b><br>(60%) | <b>31,363</b><br>(22%)                | <b>833</b><br>( <small>&lt;1%</small> ) | 144,103          | 100%       |

a/ Includes one age-2 and three age-4 fall-run Chinook released from northern California hatcheries.

Table 7. Raw and expanded Chinook CWT recoveries in 2015 California ocean fisheries by run type and brood year.

|                                              |  |                       |                        |                        |                     |                     |                 |
|----------------------------------------------|--|-----------------------|------------------------|------------------------|---------------------|---------------------|-----------------|
| <b><u>Fall-run</u></b>                       |  | 2013                  | 2012                   | 2011                   | 2010                | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  | 1,096<br>(12%)        | 6,755<br>(75%)         | 1,173<br>(13%)         | 22<br>(<1%)         | 9,046               | 86%             |
| Expanded CWTtotal                            |  | <b>9,386</b><br>(12%) | <b>58,048</b><br>(74%) | <b>11,184</b><br>(14%) | <b>223</b><br>(<1%) | 78,841              | 91%             |
| <b><u>Spring-run</u></b>                     |  | 2013                  | 2012                   | 2011                   | 2010                | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  | 54<br>(6%)            | 749<br>(85%)           | 78<br>(9%)             | 1<br>(<1%)          | 882                 | 8%              |
| Expanded CWTtotal                            |  | <b>175</b><br>(6%)    | <b>2,367</b><br>(85%)  | <b>229</b><br>(8%)     | <b>3</b><br>(<1%)   | 2,773               | 3%              |
| <b><u>Late-Fall-run</u></b>                  |  | 2014                  | 2013                   | 2012                   | 2011                | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  | 2<br>(1%)             | 17<br>(12%)            | 122<br>(86%)           | 1<br>(<1%)          | 142                 | 1%              |
| Expanded CWTtotal                            |  | <b>8</b><br>(2%)      | <b>59</b><br>(13%)     | <b>376</b><br>(84%)    | <b>3</b>            | 446                 | 1%              |
| <b><u>Winter-run</u></b>                     |  | 2014                  | 2013                   | 2012                   | 2011                | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  |                       | 1<br>(50%)             | 1<br>(50%)             |                     | 2                   | 0.02%           |
| Expanded CWTtotal                            |  |                       | <b>3</b><br>(49%)      | <b>3</b><br>(51%)      |                     | 5                   | 0.01%           |
| <b><u>Non-CV stocks</u></b>                  |  | 2013                  | 2012                   | 2011                   | 2010                | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  | 1<br>(<1%)            | 46<br>(11%)            | 382<br>(89%)           |                     | 429                 | 4%              |
| Expanded CWTtotal                            |  | <b>11</b><br>(<1%)    | <b>585</b><br>(12%)    | <b>4,204</b><br>(88%)  |                     | 4,800               | 6%              |
| <b><u>All Runs</u></b>                       |  |                       |                        |                        |                     | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                          |  | 2                     | 3                      | 4                      | 5                   |                     |                 |
| Raw CWT Recoveries                           |  | 1,153<br>(11%)        | 7,568<br>(72%)         | 1,756<br>(17%)         | 24<br>(<1%)         | 10,501              | 100%            |
| Expanded CWTtotal                            |  | <b>9,580</b><br>(11%) | <b>61,061</b><br>(70%) | <b>15,996</b><br>(18%) | <b>228</b><br>(<1%) | 86,866              | 100%            |
| CV Expanded CWTtotal<br>proportion CV stocks |  | 9,569<br>(100%)       | 60,476<br>(99%)        | 11,792<br>(74%)        | 228<br>(100%)       | 82,065              | 94%             |

Table 8. Raw and expanded Chinook CWT recoveries in 2015 Oregon ocean fisheries by run type and brood year.

| <b><u>Fall-run</u></b>                                     |  | 2013               | 2012                   | 2011                   | 2010                 | Total Ocean<br>CWTs | Total<br>Ocean% |
|------------------------------------------------------------|--|--------------------|------------------------|------------------------|----------------------|---------------------|-----------------|
| Age                                                        |  | 2                  | 3                      | 4                      | 5                    |                     |                 |
| Raw CWT Recoveries                                         |  | 14<br>(<1%)        | 1,406<br>(60%)         | 892<br>(38%)           | 21<br>(<1%)          | 2,333               | 53%             |
| Expanded CWT <sub>total</sub>                              |  | <b>93</b><br>(<1%) | <b>12,891</b><br>(57%) | <b>9,560</b><br>(42%)  | <b>236</b><br>(1%)   | 22,780              | 48%             |
| <b><u>Spring-run</u></b>                                   |  | 2013               | 2012                   | 2011                   | 2010                 | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                                        |  | 2                  | 3                      | 4                      | 5                    |                     |                 |
| Raw CWT Recoveries                                         |  |                    | 128<br>(75%)           | 42<br>(25%)            |                      | 170                 | 4%              |
| Expanded CWT <sub>total</sub>                              |  |                    | <b>451</b><br>(73%)    | <b>164</b><br>(27%)    |                      | 614                 | 1%              |
| <b><u>Late-Fall-run</u></b>                                |  | 2014               | 2013                   | 2012                   | 2011                 | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                                        |  | 2                  | 3                      | 4                      | 5                    |                     |                 |
| Raw CWT Recoveries                                         |  |                    |                        | 27<br>(93%)            | 2<br>(7%)            | 29                  | 1%              |
| Expanded CWT <sub>total</sub>                              |  |                    |                        | <b>89</b><br>(<1%)     | <b>8</b><br>(92%)    | 97                  | 0.2%            |
| <b><u>Non-CV stocks</u></b>                                |  | 2013               | 2012                   | 2011                   | 2010                 | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                                        |  | 2                  | 3                      | 4                      | 5                    |                     |                 |
| Raw CWT Recoveries                                         |  |                    | 568<br>(30%)           | 990<br>(52%)           | 353<br>(18%)         | 1,911               | 43%             |
| Expanded CWT <sub>total</sub>                              |  |                    | <b>14,186</b><br>(59%) | <b>7,802</b><br>(32%)  | <b>2,231</b><br>(9%) | 24,219              | 51%             |
| <b><u>All Runs</u></b>                                     |  | 2013               | 2012                   | 2011                   | 2010                 | Total Ocean<br>CWTs | Total<br>Ocean% |
| Age                                                        |  | 2                  | 3                      | 4                      | 5                    |                     |                 |
| Raw CWT Recoveries                                         |  | 14<br>(<1%)        | 2,102<br>(47%)         | 1,951<br>(44%)         | 376<br>(8%)          | 4,443               | 100%            |
| Expanded CWT <sub>total</sub>                              |  | <b>93</b><br>(<1%) | <b>27,527</b><br>(58%) | <b>17,614</b><br>(37%) | <b>2,475</b><br>(5%) | 47,709              | 100%            |
| CV Expanded CWT <sub>total</sub><br>(proportion CV stocks) |  | 93<br>(100%)       | 13,341<br>(48%)        | 9,812<br>(56%)         | 244<br>(10%)         | 23,491              | 49%             |



Table 9. Percentage of inland CWT<sub>total</sub> recoveries by location, run, and release type<sup>a/</sup> in hatchery returns, natural escapement and sport harvest during 2015.

| Location                                        | Run                     | SacW | CFH   |       |       | FRH  |       |       |       |       |        | NIM  |       | MOK  |       |       | MER  |       | Total %  |         | Total Run |         |
|-------------------------------------------------|-------------------------|------|-------|-------|-------|------|-------|-------|-------|-------|--------|------|-------|------|-------|-------|------|-------|----------|---------|-----------|---------|
|                                                 |                         |      | CFHLh | CFHFh | CFHFh | FRHS | FRHSn | FRHFk | FRHFb | FRHFh | FRHFnc | NIMF | NIMFn | MOKF | MOKFn | MOKFe | MERF | MERFt | Hatchery | Natural |           |         |
| <b>Hatchery Spawners</b>                        |                         |      |       |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       |          |         |           |         |
| Keswick Dam Fish Trap                           | Winter                  | 53%  |       |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       | 53%      | 47%     | 257       |         |
| Feather River Hatchery                          | Spring                  |      |       |       |       | 60%  | 37%   |       | 0%    | 1%    |        |      |       |      |       |       |      |       | 98%      | 2%      | 3,386     |         |
| Coleman National Fish Hatchery                  | Fall                    |      |       | 60%   | 3%    |      | -     |       | 1%    | 9%    | 1%     | 0%   | -     |      | 0%    | -     |      | 0%    | 74%      | 26%     | 15,724    |         |
| Feather River Hatchery                          | Fall                    |      |       | 0%    | 2%    | 10%  | 10%   | 0%    | 4%    | 58%   | 4%     | 0%   | 1%    | -    | 1%    | 0%    | 1%   |       | 90%      | 10%     | 20,816    |         |
| Nimbus Fish Hatchery                            | Fall                    |      | -     |       | 2%    |      |       |       | -     | 3%    | 0%     | 24%  | 24%   | 0%   | 24%   | 2%    | 3%   |       | 83%      | 17%     | 9,822     |         |
| Mokelumne River Hatchery                        | Fall                    |      | -     |       | 3%    |      | -     |       | 0%    | 3%    | 0%     |      | 10%   | 1%   | 69%   | 3%    | 5%   |       | 96%      | 4%      | 8,298     |         |
| Merced River Hatchery                           | Fall                    |      |       |       | 4%    |      |       |       |       | 6%    | 1%     |      | 3%    |      | 62%   | 2%    | 12%  |       | 88%      | 12%     | 1,198     |         |
| Coleman National Fish Hatchery                  | Late-fall <sup>b/</sup> |      | 100%  |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       | 100%     |         | 2,348     |         |
| Coleman Hatchery Fish Trap                      | Late-fall <sup>b/</sup> |      | 100%  |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       | 100%     |         | 104       |         |
| Keswick Dam Fish Trap                           | Late-fall <sup>b/</sup> |      | 6%    |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       | 6%       | 94%     | 65        |         |
| <b>Total Hatchery Fall Run</b>                  |                         |      | -     | 17%   | 3%    | 4%   | 4%    | -     | 2%    | 25%   | 2%     | 4%   | 6%    | 0%   | 16%   | 1%    |      | 2%    | 85%      | 15%     | 55,858    |         |
| <b>Natural Spawners</b>                         |                         |      |       |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       |          |         |           |         |
| Upper Sacramento River                          | Winter                  | 18%  |       |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       | 18%      | 82%     | 3,182     |         |
| Upper Sacramento River                          | Fall                    |      |       | 8%    | 2%    |      | 1%    |       | 2%    | 52%   | 3%     |      |       |      |       |       |      |       | 68%      | 32%     | 28,668    |         |
| Clear Creek                                     | Fall                    |      |       | 8%    | 4%    |      | 1%    |       | 3%    | 55%   | 3%     |      |       |      |       |       |      |       | 74%      | 26%     | 8,809     |         |
| Battle Creek                                    | Fall <sup>c/</sup>      |      |       | 60%   | 3%    |      |       |       | 1%    | 9%    | 1%     | 0%   | -     |      | 0%    |       | 0%   |       | 74%      | 26%     | 3,631     |         |
| Cottonwood Creek                                | Fall                    |      |       |       | 12%   |      |       |       |       |       | 3%     |      |       |      |       |       |      |       | 15%      | 85%     | 604       |         |
| Deer Creek                                      | Fall                    |      |       |       | 14%   |      |       |       |       | 77%   | 2%     |      |       |      | 7%    |       |      |       | 100%     |         | 612       |         |
| Mill Creek                                      | Fall                    |      |       | 6%    | 6%    |      |       |       |       | 30%   | 2%     |      |       |      |       |       |      |       | 44%      | 56%     | 1,033     |         |
| Feather River                                   | Fall                    |      |       | 0%    | 2%    | 8%   | 8%    |       | 3%    | 57%   | 3%     | 1%   | 0%    |      | 1%    | -     | 1%   |       | 83%      | 17%     | 20,566    |         |
| Yuba River above DPD                            | Fall                    |      |       |       | 19%   |      | 1%    |       | 1%    | 11%   | 2%     | 9%   | 3%    |      | 12%   | 3%    |      |       | 60%      | 40%     | 4,981     |         |
| Yuba River below DPD                            | Fall                    |      |       |       | 11%   |      |       |       | 0%    | 15%   | 1%     |      | 3%    |      | 10%   | 1%    | 4%   |       | 46%      | 54%     | 2,569     |         |
| American River                                  | Fall                    |      | -     |       | 2%    |      |       |       | -     | 1%    | 0%     | 23%  | 21%   | -    | 15%   | 1%    | 1%   |       | 65%      | 35%     | 13,793    |         |
| Nimbus Fish Hatchery Weir                       | Fall                    |      |       |       | 5%    | 0%   | 1%    |       | 0%    | 3%    | 0%     | 1%   | 23%   | 0%   | 8%    | 1%    | 1%   |       | 43%      | 57%     | 1,946     |         |
| Mokelumne River                                 | Fall                    |      |       |       | 2%    |      |       |       |       | 2%    | 0%     |      | 10%   | 1%   | 68%   | 6%    | 5%   |       | 94%      | 6%      | 4,581     |         |
| Stanislaus River                                | Fall                    |      |       |       | 3%    |      |       |       |       | 2%    | 0%     |      | 1%    |      | 66%   | 3%    | 3%   |       | 78%      | 22%     | 6,136     |         |
| Tuolumne River                                  | Fall                    |      |       |       |       |      |       |       |       |       |        |      | 9%    |      | 47%   |       | 10%  |       | 65%      | 35%     | 113       |         |
| Merced River                                    | Fall                    |      |       |       | 1%    |      |       |       |       | 4%    | 0%     |      | 1%    |      | 62%   | 4%    | 0%   | 9%    | 81%      | 19%     | 1,247     |         |
| Upper Sacramento River                          | Late-fall <sup>b/</sup> |      | 6%    |       |       |      |       |       |       |       |        |      |       |      |       |       | 2%   |       | 8%       | 92%     | 3,085     |         |
| <b>Total Natural Area Fall-run<sup>d/</sup></b> |                         |      | -     | 5%    | 3%    | 2%   | 2%    |       | 1%    | 34%   | 2%     | 4%   | 4%    | 0%   | 11%   | 1%    | -    | 1%    | 71%      | 29%     | 99,289    |         |
| In-basin CWT <sub>total</sub>                   | All                     | 0%   | 2%    | 12%   | 1%    | 5%   | 4%    | -     | 1%    | 21%   | 1%     | 5%   | 5%    | 0%   | 7%    | 0%    | -    | 0%    | 65%      | 35%     | 120,292   |         |
| Stray CWT <sub>total</sub>                      | All                     |      | -     | 2%    | 8%    | -    | 1%    |       | 2%    | 49%   | 3%     | 1%   | 4%    | -    | 24%   | 2%    |      | 4%    | 100%     |         | 47,373    |         |
| <b>Total CV Spawners</b>                        |                         |      | 0%    | 2%    | 9%    | 3%   | 3%    | 3%    | -     | 1%    | 29%    | 2%   | 4%    | 5%   | 0%    | 12%   | 1%   | -     | 1%       | 75%     | 25%       | 167,665 |
| <b>CV Sport Harvest</b>                         |                         |      |       |       |       |      |       |       |       |       |        |      |       |      |       |       |      |       |          |         |           |         |
| Upper Sacramento River                          | Fall                    |      |       | 40%   | 1%    |      | 1%    |       | 2%    | 28%   | 1%     |      |       |      |       |       |      |       | 73%      | 27%     | 8,088     |         |
| Lower Sacramento River                          | Fall                    |      | 3%    |       | 9%    |      |       |       | 1%    | 28%   | 3%     |      | 21%   |      | 9%    | 1%    | 2%   |       | 77%      | 23%     | 6,205     |         |
| Feather River                                   | Fall                    |      |       |       | 5%    | 4%   | 6%    |       | 6%    | 74%   | 1%     |      |       |      |       |       | 5%   |       | 100%     |         | 1,906     |         |
| American River                                  | Fall                    |      |       |       | 3%    | 1%   | 4%    |       | 1%    | 5%    | 0%     | 12%  | 25%   |      | 23%   |       | 1%   |       | 75%      | 25%     | 6,630     |         |
| Mokelumne River                                 | Fall                    |      | 1%    |       |       |      |       |       |       | 8%    |        |      | 12%   |      | 72%   | 1%    | 4%   |       | 98%      | 2%      | 1,281     |         |
| Upper Sacramento River                          | Late-fall <sup>b/</sup> |      | 37%   |       |       |      |       |       |       | 14%   |        |      |       |      |       |       |      |       | 51%      | 49%     | 252       |         |
| <b>Total Sport Harvest</b>                      |                         |      | 1%    | 13%   | 3%    | 1%   | 2%    |       | 2%    | 24%   | 1%     | 3%   | 13%   |      | 12%   | 0%    |      | 2%    | 78%      | 22%     | 24,362    |         |

a/ Any values less than 0.05% of CWT<sub>total</sub> are displayed as "-"; values equal or greater than 0.05% but less than 0.5% of CWT<sub>total</sub> are displayed as 0%.

b/ Late-fall hatchery returns, natural escapement, and sport harvest occurred in late fall 2015 (return year 2016).

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/ Total Natural Area Fall-run does not include unsampled escapement into Cow Creek (n=591) and Butte Creek (n=82).

Note: Recoveries of Mokelumne Hatchery MOKFb (age-2 barge study releases) and MOKFt (age-4 trucked releases) merged into MOKFe.

Table 10. Fall- and late-fall-run Chinook salmon escapement at Coleman National Fish Hatchery in 2015 based on run-timing and CWT stock composition.

**Calculation of CFH sample expansion factors based on run-timing only****2015 CFH fall-run escapement (Oct 6, 2015 - Dec 3, 2015)**

| Run timing<br>(CWT sample rate) | Escapement<br>N | Chinook<br>sampled (n) | Observed<br>ad-clips | Heads<br>processed | CWTs<br>recovered | Valid<br>CWTs | Sample<br>rate (fe) | Ad-clips<br>processed (fa) | Valid<br>CWTs (fd) | $F_{\text{samp}}$ | Avg<br>$F_{\text{prod}}$ | $\sum_{i=1}^m CWT_{\text{total},i}$ | Hatchery<br>proportion |
|---------------------------------|-----------------|------------------------|----------------------|--------------------|-------------------|---------------|---------------------|----------------------------|--------------------|-------------------|--------------------------|-------------------------------------|------------------------|
| Oct 6 - Dec 3 (100%)            | 15,806          | 15,806                 | 3,204                | 3,200              | 3,128             | 3,113         | 100%                | 99.9%                      | 99.5%              | 1.01              | 3.742                    | 11,763                              | 74.4%                  |

**2016 CFH late-fall-run escapement (Dec 23, 2015 - Mar 9, 2016)**

| Run timing<br>(CWT sample rate) | Escapement<br>N | Chinook<br>sampled | Observed<br>ad-clips | Heads<br>processed | CWTs<br>recovered | Valid<br>CWTs | Sample<br>rate (fe) | Ad-clips<br>processed (fa) | Valid<br>CWTs (fd) | $F_{\text{samp}}$ | Avg<br>$F_{\text{prod}}$ | $\sum_{i=1}^m CWT_{\text{total},i}$ | Hatchery<br>proportion |
|---------------------------------|-----------------|--------------------|----------------------|--------------------|-------------------|---------------|---------------------|----------------------------|--------------------|-------------------|--------------------------|-------------------------------------|------------------------|
| Dec 23 - Mar 9 (100%)           | 2,266           | 2,266              | 2,216                | 2,216              | 2,199             | 2,193         | 100%                | 100.0%                     | 99.7%              | 1.00              | 1.046                    | 2,294                               | >100%                  |

|                        |               |               |              |              |              |              |  |  |  |  |  |  |  |
|------------------------|---------------|---------------|--------------|--------------|--------------|--------------|--|--|--|--|--|--|--|
| <b>Total CFH count</b> | <b>18,072</b> | <b>18,072</b> | <b>5,420</b> | <b>5,416</b> | <b>5,327</b> | <b>5,306</b> |  |  |  |  |  |  |  |
|------------------------|---------------|---------------|--------------|--------------|--------------|--------------|--|--|--|--|--|--|--|

**Final CFH escapement based on CWT stock segregation****2015 CFH fall-run escapement**

| Run timing     | Escapement<br>N | Chinook<br>sampled | Observed<br>ad-clips | Heads<br>processed | CWTs<br>recovered | Fall<br>CWTs | Sample<br>rate (fe) | Ad-clips<br>processed (fa) | Valid<br>CWTs (fd) | $F_{\text{samp}}$ | Avg<br>$F_{\text{prod}}$ | $\sum_{i=1}^m CWT_{\text{total},i}$ | Hatchery<br>proportion |
|----------------|-----------------|--------------------|----------------------|--------------------|-------------------|--------------|---------------------|----------------------------|--------------------|-------------------|--------------------------|-------------------------------------|------------------------|
| Oct 6 - Jan 27 | 15,724          | 15,724             | 3,123                | 3,119              | 3,047             | 3,032        | 100%                | 99.8719%                   | 99.5%              | 1.01              | 3.824                    | 11,712                              | 74.5%                  |

**2016 CFH late-fall-run escapement**

| Run timing     | Escapement<br>N | Chinook<br>sampled | Observed<br>ad-clips | Heads<br>processed | CWTs<br>recovered | Late fall<br>CWTs | Sample<br>rate (fe) | Ad-clips<br>processed (fa) | Valid<br>CWTs (fd) | $F_{\text{samp}}$ | Avg<br>$F_{\text{prod}}$ | $\sum_{i=1}^m CWT_{\text{total},i}$ | Hatchery<br>proportion |
|----------------|-----------------|--------------------|----------------------|--------------------|-------------------|-------------------|---------------------|----------------------------|--------------------|-------------------|--------------------------|-------------------------------------|------------------------|
| Nov 11 - Mar 9 | 2,348           | 2,348              | 2,297                | 2,297              | 2,280             | 2,274             | 100%                | 100.0%                     | 99.7%              | 1.00              | 1.030                    | 2,348                               | 100%                   |

|                        |               |               |              |              |              |              |  |  |  |  |  |  |  |
|------------------------|---------------|---------------|--------------|--------------|--------------|--------------|--|--|--|--|--|--|--|
| <b>Total CFH count</b> | <b>18,072</b> | <b>18,072</b> | <b>5,420</b> | <b>5,416</b> | <b>5,327</b> | <b>5,306</b> |  |  |  |  |  |  |  |
|------------------------|---------------|---------------|--------------|--------------|--------------|--------------|--|--|--|--|--|--|--|

Table 11. Total inland CWT<sub>total</sub> recoveries by location, run, and release type<sup>a/</sup> in hatchery returns, natural escapement and sport harvest during 2015.

|                                           |                         |      | CFH   |        |        | FRH   |       |       |       |        |        | NIM   |       | MOK    |        |        | MER   |       |       | Total CWT <sub>total</sub> |         | Total   |         |         |        |       |       |
|-------------------------------------------|-------------------------|------|-------|--------|--------|-------|-------|-------|-------|--------|--------|-------|-------|--------|--------|--------|-------|-------|-------|----------------------------|---------|---------|---------|---------|--------|-------|-------|
| Location                                  | Run                     | SacW | CFHLh | CFHFh  | CFHFh  | FRHS  | FRHSn | FRHFk | FRHFb | FRHFh  | FRHFnc | NIMF  | NIMFn | MOKF   | MOKFn  | MOKFe  | MERF  | MERFt | nonCV | Hatchery                   | Natural | Run     |         |         |        |       |       |
| <b>Hatchery Spawners</b>                  |                         |      |       |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         |         |         |         |        |       |       |
| Keswick Dam Fish Trap                     | Winter                  | 136  |       |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            | 136     | 121     | 257     |         |        |       |       |
| Feather River Hatchery                    | Spring                  |      |       |        |        | 2,023 | 1,256 | 4     |       | 24     |        |       |       |        |        |        |       |       |       |                            | 3,307   | 79      | 3,386   |         |        |       |       |
| Coleman National Fish Hatchery            | Fall                    |      | 9,500 | 483    |        | 2     |       |       |       |        |        | 88    | 1,489 | 105    | 8      | 4      | 12    |       | 1     |                            | 19      |         | 11,711  | 4,013   | 15,724 |       |       |
| Feather River Hatchery                    | Fall                    |      | 20    | 462    |        | 2,080 | 1,992 | 18    | 863   | 12,043 | 794    | 51    | 172   | 1      | 139    | 11     |       | 153   |       |                            | 18,799  | 2,017   | 20,816  |         |        |       |       |
| Nimbus Fish Hatchery                      | Fall                    |      | 1     | 217    |        | 4     |       |       |       |        |        | 251   | 25    | 2,324  | 2,392  | 9      | 2,378 | 183   | 339   | 5                          | 8,129   | 1,693   | 9,822   |         |        |       |       |
| Mokelumne River Hatchery                  | Fall                    |      | 1     | 265    |        | 2     |       |       |       |        |        | 5     | 282   | 31     |        | 833    | 107   | 5,757 | 212   |                            | 456     |         | 7,951   | 347     | 8,298  |       |       |
| Merced River Hatchery                     | Fall                    |      | 43    |        |        |       |       |       |       |        |        | 69    | 6     | 34     |        | 741    |       | 24    |       | 142                        |         | 1,058   | 140     | 1,198   |        |       |       |
| Coleman National Fish Hatchery            | Late-fall <sup>b/</sup> |      | 2,348 |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         | 2,348   |         |         | 2,348  |       |       |
| Coleman Hatchery Fish Trap                | Late-fall <sup>b/</sup> |      | 104   |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         | 104     |         |         | 104    |       |       |
| Keswick Dam Fish Trap                     | Late-fall <sup>b/</sup> |      | 4     |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         | 4       | 61      | 65      |        |       |       |
| Total Hatchery Fall Run                   |                         |      | 2     | 9,520  | 1,470  | 2,080 | 1,996 | 18    | 960   | 14,134 | 961    | 2,383 | 3,435 | 117    | 9,027  | 431    |       | 1,109 | 5     |                            | 47,648  | 8,210   | 55,858  |         |        |       |       |
| <b>Natural Spawners</b>                   |                         |      |       |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         |         |         |         |        |       |       |
| Upper Sacramento River                    | Winter                  | 558  |       |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            | 558     | 2,624   | 3,182   |         |        |       |       |
| Upper Sacramento River                    | Fall                    |      | 2,382 | 453    |        | 392   |       |       |       |        |        | 602   |       | 14,784 | 760    |        |       |       |       |                            |         | 19,373  | 9,295   | 28,668  |        |       |       |
| Clear Creek                               | Fall                    |      | 666   | 368    |        | 85    |       |       |       |        |        | 235   |       | 4,875  | 259    |        |       |       |       |                            |         | 6,488   | 2,321   | 8,809   |        |       |       |
| Battle Creek                              | Fall <sup>c/</sup>      |      | 2,191 | 111    |        |       |       |       |       |        |        | 21    |       | 343    | 25     | 2      | 1     | 3     |       | 4                          |         | 2,701   | 930     | 3,631   |        |       |       |
| Cottonwood Creek                          | Fall                    |      | 73    |        |        |       |       |       |       |        |        |       |       | 18     |        |        |       |       |       |                            |         | 92      | 512     | 604     |        |       |       |
| Deer Creek                                | Fall                    |      | 86    |        |        |       |       |       |       |        |        | 472   |       | 11     |        |        | 43    |       |       |                            |         | 612     |         |         | 612    |       |       |
| Mill Creek                                | Fall                    |      | 63    | 63     |        |       |       |       |       |        |        | 314   |       | 16     |        |        |       |       |       |                            |         | 455     | 578     | 1,033   |        |       |       |
| Feather River                             | Fall                    |      | 24    | 453    |        | 1,599 | 1,603 | 523   |       | 11,762 | 527    | 131   | 71    | 119    |        | 6      |       | 137   | 24    | 16,979                     | 3,587   | 20,566  |         |         |        |       |       |
| Yuba River above DPD                      | Fall                    |      | 945   |        |        | 34    |       |       |       |        |        | 68    | 544   | 103    | 439    | 135    | 575   |       | 136   |                            | 2,978   | 2,003   | 4,981   |         |        |       |       |
| Yuba River below DPD                      | Fall                    |      | 295   |        |        |       |       |       |       |        |        | 11    |       | 380    | 32     | 84     |       | 253   |       | 21                         | 93      |         | 1,168   | 1,401   | 2,569  |       |       |
| American River                            | Fall                    |      | 2     | 215    |        |       |       |       |       |        |        | 4     |       | 179    | 9      | 3,209  | 2,926 | 5     | 2,049 | 162                        | 176     | 3       | 8,939   | 4,854   | 13,793 |       |       |
| Nimbus Fish Hatchery Weir                 | Fall                    |      | 104   |        |        | 4     | 25    | 7     |       | 50     | 6      | 13    | 449   | 1      | 147    | 16     | 14    |       |       |                            |         | 838     | 1,108   | 1,946   |        |       |       |
| Mokelumne River                           | Fall                    |      | 103   |        |        |       |       |       |       |        |        | 77    |       | 6      | 460    |        | 50    | 3,102 | 284   | 247                        |         | 4,329   | 252     | 4,581   |        |       |       |
| Stanislaus River                          | Fall                    |      | 184   |        |        |       |       |       |       |        |        | 106   |       | 20     | 53     |        | 4,057 |       | 198   | 180                        |         | 4,798   | 1,338   | 6,136   |        |       |       |
| Tuolumne River                            | Fall                    |      |       |        |        |       |       |       |       |        |        |       |       |        | 10     | 53     |       | 11    |       |                            | 74      | 39      | 113     |         |        |       |       |
| Merced River                              | Fall                    |      | 15    |        |        |       |       |       |       |        |        | 46    |       | 4      | 15     |        | 774   |       | 50    | 4                          | 107     |         | 1,014   | 233     | 1,247  |       |       |
| Upper Sacramento River                    | Late-fall <sup>b/</sup> |      | 186   |        |        |       |       |       |       |        |        |       |       |        |        |        |       | 65    |       |                            |         | 251     | 2,834   | 3,085   |        |       |       |
| Total Natural Area Fall-run <sup>d/</sup> |                         |      | 2     | 5,326  | 3,468  | 1,603 | 2,139 | 1,471 |       | 33,932 | 1,796  | 3,794 | 4,204 | 56     | 11,175 | 873    | 4     | 969   | 27    |                            | 70,838  | 28,451  | 99,289  |         |        |       |       |
| In-basin CWT <sub>total</sub>             | All                     | 558  | 2,642 | 14,073 | 1,047  | 5,702 | 4,885 | 18    | 1,469 | 24,753 | 1,456  | 5,546 | 5,767 | 157    | 8,859  | 496    | 4     | 249   |       |                            | 77,681  | 42,611  | 120,292 |         |        |       |       |
| Stray CWT <sub>total</sub>                | All                     |      | 4     | 773    | 3,891  | 4     | 506   |       | 966   | 23,337 | 1,301  | 631   | 1,872 | 16     | 11,343 | 808    |       | 1,894 | 32    |                            | 47,373  |         | 47,373  |         |        |       |       |
| Total CV Spawners                         |                         |      | 558   | 2,646  | 14,846 | 4,938 | 5,706 | 5,391 | 18    | 2,435  | 48,090 | 2,757 | 6,177 | 7,639  | 173    | 20,202 | 1,304 | 4     | 2,143 | 32                         |         | 125,054 | 42,611  | 167,665 |        |       |       |
| %stray                                    |                         |      | 0%    | 0.2%   | 5%     | 79%   | 0%    | 9%    | 0%    | 40%    | 49%    | 47%   | 10%   | 25%    | 9%     | 56%    | 62%   | 0%    | 88%   |                            | 38%     |         | 28%     |         |        |       |       |
| <b>CV Sport Harvest</b>                   |                         |      |       |        |        |       |       |       |       |        |        |       |       |        |        |        |       |       |       |                            |         |         |         |         |        |       |       |
| Upper Sacramento River                    | Fall                    |      | 3,256 |        |        | 50    | 89    |       | 152   |        | 2,263  | 50    |       |        |        |        |       |       |       |                            |         | 5,860   | 2,228   | 8,088   |        |       |       |
| Lower Sacramento River                    | Fall                    |      | 169   | 545    |        |       |       |       |       |        |        |       | 82    |        | 1,753  | 165    | 1,308 |       | 547   |                            | 82      | 130     |         | 4,781   | 1,424  | 6,205 |       |
| Feather River                             | Fall                    |      | 87    |        |        | 67    | 111   | 110   |       | 1,405  |        | 22    |       |        |        |        |       |       |       |                            | 104     |         |         | 1,906   |        |       | 1,906 |
| American River                            | Fall                    |      | 168   |        |        | 85    | 234   | 63    |       | 337    |        | 21    | 796   | 1,672  | 1,507  |        |       |       |       | 92                         |         |         | 4,974   | 1,656   | 6,630  |       |       |
| Mokelumne River                           | Fall                    |      | 14    |        |        |       |       |       |       |        |        |       | 102   |        |        |        | 152   |       | 917   | 13                         | 56      |         | 1,253   | 28      | 1,281  |       |       |
| Upper Sacramento River                    | Late-fall <sup>b/</sup> |      | 93    |        |        |       |       |       |       |        |        |       | 36    |        |        |        |       |       |       |                            |         |         | 129     | 123     | 252    |       |       |
| Total Sport Harvest                       |                         |      | 276   | 3,256  | 850    | 152   | 434   | 407   |       | 5,896  | 258    | 796   | 3,132 | 2,971  |        | 95     | 382   |       |       |                            |         | 18,903  | 5,459   | 24,362  |        |       |       |

a/ Release types defined in Table 3; recoveries of Mokelumne Hatchery MOKFb (age-2 barge study releases) and MOKFt (age-4 trucked releases) merged into MOKFe.

b/ Late-fall hatchery returns, natural escapement, and sport harvest occurred in late fall 2015 (return year 2016).

c/ Battle Creek natural escapement CWT<sub>total</sub> based on hatchery proportions at CFH (FWS staff, per. comm).

d/ Total Natural Area Fall-run does not include unsampled escapement into Cow Creek (n=591) and Butte Creek (n=82).

Table 12. CWT recovery rate (recoveries per 100,000 CWTs released) by release type, brood year and recovery location in 2015. (page 1 of 2)

**Age 2 CWT recoveries**

| Release type       | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |       |     |       |     |     |     |          | CV CWT <sub>samp</sub> totals |          |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |          |       |       |     |     |    |    |     |     |
|--------------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-------|-----|-------|-----|-----|-----|----------|-------------------------------|----------|----------|------------|---------------------------|---------------------------------|----------|-------|-------|-----|-----|----|----|-----|-----|
|                    |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea   | Yub | Ame   | Mok | Mer | SJ  | In-basin | Stray                         | CV total | In-basin |            |                           | Stray                           | CV total | Ocean |       |     |     |    |    |     |     |
| FRHS               | 2013       | Spr      | 1,217,640    |                                                                 |        |                        |       |     |       |     |     |     |          | 26                            | 2        | 28       | 7%         | 68                        | 2                               | 0        | 2     | 6     |     |     |    |    |     |     |
| FRHSn              | 2013       | Spr      | 997,962      |                                                                 |        |                        |       |     |       |     |     |     |          | 36                            | 4        | 40       | 10%        | 105                       | 4                               | 0        | 4     | 11    |     |     |    |    |     |     |
| CFHFh              | 2013       | Fall     | 1,125,706    | 201                                                             |        |                        |       |     |       |     |     |     |          | 201                           | 0        | 201      | 0%         | 61                        | 18                              | 0        | 18    | 5     |     |     |    |    |     |     |
| CFHFh              | 2013       | Fall     | 1,810,972    | 147                                                             | 112    | 138                    | 228   | 309 | 134   | 91  | 14  | 46  | 259      | 961                           | 1,220    | 79%      | 736        | 14                        | 53                              | 67       | 41    |       |     |     |    |    |     |     |
| FRHFk              | 2013       | Fall     | 44,127       |                                                                 |        |                        |       |     |       |     |     |     |          | 2                             | 0        | 2        | 0%         | 4                         | 5                               | 0        | 5     | 9     |     |     |    |    |     |     |
| FRHFtib            | 2013       | Fall     | 11,791       | 5                                                               |        |                        |       |     |       |     |     |     |          | 9                             | 6        | 15       |            | 30                        |                                 |          |       |       |     |     |    |    |     |     |
| FRHFB              | 2013       | Fall     | 300,145      | 6                                                               | 8      |                        |       |     | 88    | 2   |     | 2   |          | 88                            | 19       | 106      | 18%        | 33                        | 29                              | 6        | 35    | 11    |     |     |    |    |     |     |
| FRHFh              | 2013       | Fall     | 1,459,468    | 52                                                              | 144    | 77                     | 801   | 67  | 27    | 36  | 6   | 7   | 868      | 349                           | 1,217    | 29%      | 422        | 59                        | 24                              | 83       | 29    |       |     |     |    |    |     |     |
| FRHFnc             | 2013       | Fall     | 366,033      | 44                                                              | 80     | 84                     | 607   | 21  | 34    | 35  | 4   | 20  | 628      | 301                           | 930      | 32%      | 938        | 172                       | 82                              | 254      | 256   |       |     |     |    |    |     |     |
| NIMFn              | 2013       | Fall     | 896,419      |                                                                 |        |                        |       |     |       |     |     |     |          | 31                            | 55       | 742      | 248        | 9                         | 7                               | 742      | 349   | 1,091 | 32% | 405 | 83 | 39 | 122 | 45  |
| MOKFB              | 2013       | Fall     | 302,658      | 1                                                               | 9      |                        |       |     | 21    | 87  | 156 | 19  | 39       | 156                           | 176      | 332      | 53%        | 212                       | 52                              | 58       | 110   | 70    |     |     |    |    |     |     |
| MOKFn              | 2013       | Fall     | 1,148,423    | 1                                                               | 6      |                        |       |     | 44    | 87  | 358 | 138 | 278      | 358                           | 554      | 912      | 61%        | 303                       | 31                              | 48       | 79    | 26    |     |     |    |    |     |     |
| MOKFnc             | 2013       | Fall     | 239,294      |                                                                 |        |                        |       |     |       |     |     |     |          | 2                             | 34       | 12       | 15         | 2                         | 9                               | 15       | 59    | 74    | 79% | 493 | 6  | 25 | 31  | 206 |
| MERFt              | 2013       | Fall     | 393,182      |                                                                 |        |                        |       |     |       |     |     |     |          | 1                             | 5        |          | 20         | 3                         | 13                              | 3        | 39    | 43    | 92% | 2   | 1  | 10 | 11  | 1   |
| SacW <sup>b/</sup> | 2013       | Wint     | 190,905      | 14                                                              |        |                        |       |     |       |     |     |     |          | 14                            | 0        | 14       | 0%         | 3                         | 8                               | 0        | 8     | 1     |     |     |    |    |     |     |
| CFHLh              | 2014       | Late     | 1,056,322    | 789                                                             | 15     | 1                      |       |     |       |     |     |     |          |                               | 804      | 1        | 805        | 0%                        | 7                               | 76       | 0     | 76    | 1   |     |    |    |     |     |
| Total              |            |          | 11,561,047   | 1,246                                                           | 366    | 308                    | 1,845 | 551 | 1,136 | 965 | 196 | 418 | 4,211    | 2,820                         | 7,031    | 40%      | 3,823      |                           |                                 |          |       |       |     |     |    |    |     |     |

**Age 3 CWT recoveries**

| Release type       | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |        |     |       |       |     |     |          | CV CWT <sub>samp</sub> totals |          |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |          |       |      |
|--------------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|--------|-----|-------|-------|-----|-----|----------|-------------------------------|----------|----------|------------|---------------------------|---------------------------------|----------|-------|------|
|                    |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea    | Yub | Ame   | Mok   | Mer | SJ  | In-basin | Stray                         | CV total | In-basin |            |                           | Stray                           | CV total | Ocean |      |
| FRHS               | 2012       | Spr      | 1,106,679    |                                                                 |        |                        | 3,495  |     | 1     |       |     |     |          | 3,495                         | 1        | 3,496    | 0%         | 848                       | 316                             | 0        | 316   | 77   |
| FRHSn              | 2012       | Spr      | 1,015,285    | 2                                                               | 305    | 66                     | 4,026  | 34  | 20    | 2     |     |     |          | 4,060                         | 396      | 4,455    | 9%         | 1,916                     | 400                             | 39       | 439   | 189  |
| CFHFh              | 2012       | Fall     | 2,956,348    | 1,473                                                           | 80     | 90                     | 1      |     |       |       |     |     |          | 1,553                         | 91       | 1,645    | 6%         | 1,418                     | 53                              | 3        | 56    | 48   |
| FRHFk              | 2012       | Fall     | 138,888      |                                                                 |        |                        | 16     |     |       |       |     |     |          | 16                            | 0        | 16       | 0%         | 23                        | 12                              | 0        | 12    | 17   |
| FRHFtib            | 2012       | Fall     | 9,918        |                                                                 |        | 17                     | 14     |     |       |       |     |     |          | 14                            | 17       | 31       |            | 81                        |                                 |          |       |      |
| FRHfb              | 2012       | Fall     | 293,784      | 92                                                              | 546    | 174                    | 1,057  | 78  | 8     | 1     |     |     |          | 1,135                         | 821      | 1,956    | 42%        | 2,714                     | 386                             | 280      | 666   | 924  |
| FRHFh              | 2012       | Fall     | 1,453,105    | 360                                                             | 2,520  | 1,080                  | 4,101  | 162 | 75    | 51    | 18  | 20  |          | 4,262                         | 4,124    | 8,386    | 49%        | 8,957                     | 293                             | 284      | 577   | 616  |
| FRHFnc             | 2012       | Fall     | 649,160      | 57                                                              | 465    | 168                    | 482    | 111 | 6     | 2     | 6   |     |          | 594                           | 704      | 1,298    | 54%        | 7,418                     | 91                              | 109      | 200   | 1143 |
| NIMF               | 2012       | Fall     | 1,026,596    | 2                                                               |        |                        | 42     | 67  | 1,343 |       |     |     |          | 1,343                         | 112      | 1,455    | 8%         | 1,011                     | 131                             | 11       | 142   | 98   |
| NIMFn              | 2012       | Fall     | 182,413      | 1                                                               |        |                        | 7      |     | 330   | 49    | 1   | 7   |          | 330                           | 65       | 394      | 16%        | 428                       | 181                             | 36       | 217   | 234  |
| MOKF               | 2012       | Fall     | 99,548       |                                                                 |        |                        | 1      |     | 9     | 83    |     |     |          | 83                            | 10       | 92       | 10%        | 9                         | 83                              | 10       | 93    | 9    |
| MOKFn              | 2012       | Fall     | 1,275,158    | 2                                                               |        | 11                     | 49     | 143 | 875   | 1,693 | 220 | 698 |          | 1,693                         | 1,998    | 3,692    | 54%        | 2,990                     | 133                             | 157      | 290   | 234  |
| MERFt              | 2012       | Fall     | 325,953      | 5                                                               | 15     |                        | 65     | 21  | 115   | 143   | 56  | 35  |          | 56                            | 399      | 455      | 88%        | 447                       | 17                              | 122      | 139   | 137  |
| SacW <sup>b/</sup> | 2012       | Wint     | 169,967      |                                                                 | 631    |                        |        |     |       |       |     |     |          | 631                           | 0        | 631      | 0%         | 3                         | 371                             | 0        | 371   | 2    |
| CFHLh              | 2013       | Late     | 960,075      | 467                                                             |        |                        |        |     | 3     |       |     |     |          | 467                           | 3        | 470      | 0.7%       | 58                        | 49                              | 0        | 49    | 6    |
| Total              |            |          | 11,662,877   | 2,463                                                           | 4,561  | 1,606                  | 13,356 | 616 | 2,785 | 2,024 | 302 | 759 |          | 19,732                        | 8,741    | 28,473   | 31%        | 28,320                    |                                 |          |       |      |

Table 12. CWT recovery rate (recoveries per 100,000 CWTs released) by release type, brood year and recovery location in 2015. (page 2 of 2)

**Age 4 CWT recoveries**

| Release type       | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |       |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|--------------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-------|-----|-----|-----|-----|----|-------------------------------|-------|----------|------------|---------------------------|---------------------------------|-------|----------|-------|
|                    |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea   | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |            |                           | In-basin                        | Stray | CV total | Ocean |
| FRHS               | 2011       | Spr      | 1,088,286    |                                                                 |        |                        | 2,051 |     | 1   |     |     |    | 2,051                         | 1     | 2,052    | 0%         | 254                       | 188                             | 0     | 188      | 23    |
| FRHSn              | 2011       | Spr      | 1,125,189    |                                                                 | 80     | 17                     | 698   |     | 1   |     |     |    | 698                           | 98    | 796      | 12%        | 132                       | 62                              | 9     | 71       | 12    |
| CFHFh              | 2011       | Fall     | 3,117,042    | 1,208                                                           | 465    | 91                     | 10    |     |     |     |     |    | 1,674                         | 101   | 1,775    | 6%         | 1,172                     | 54                              | 3     | 57       | 38    |
| FRHFtib            | 2011       | Fall     | 9,933        | 1                                                               |        |                        |       |     |     |     |     |    | 0                             | 1     | 1        |            | 3                         |                                 |       |          |       |
| FRHFb              | 2011       | Fall     | 297,089      | 2                                                               | 48     | 33                     | 206   |     | 5   | 1   |     |    | 206                           | 90    | 296      | 30%        | 354                       | 69                              | 30    | 99       | 119   |
| FRHFn              | 2011       | Fall     | 2,293,211    | 41                                                              | 1,011  | 250                    | 984   |     | 16  | 2   |     |    | 984                           | 1,321 | 2,304    | 57%        | 2,163                     | 43                              | 58    | 101      | 94    |
| FRHFnc             | 2011       | Fall     | 426,190      | 27                                                              | 209    | 50                     | 220   |     |     |     |     |    | 220                           | 286   | 506      | 57%        | 1,435                     | 52                              | 67    | 119      | 337   |
| NIMF               | 2011       | Fall     | 1,078,191    |                                                                 |        |                        | 14    | 67  | 350 |     |     |    | 350                           | 81    | 431      | 19%        | 247                       | 32                              | 8     | 40       | 23    |
| NIMFn              | 2011       | Fall     | 328,073      |                                                                 |        |                        | 23    |     | 361 | 26  | 2   | 3  | 361                           | 54    | 415      | 13%        | 593                       | 110                             | 16    | 126      | 181   |
| MOKF               | 2011       | Fall     | 92,020       |                                                                 |        |                        |       |     | 5   | 63  |     |    | 63                            | 5     | 68       | 8%         | 11                        | 68                              | 6     | 74       | 12    |
| MOKFn              | 2011       | Fall     | 1,487,132    |                                                                 |        |                        | 9     | 11  | 169 | 150 | 19  | 46 | 150                           | 253   | 403      | 63%        | 444                       | 10                              | 17    | 27       | 30    |
| MOKFt              | 2011       | Fall     | 110,737      |                                                                 |        |                        | 2     | 34  | 67  | 84  | 13  | 39 | 84                            | 155   | 239      | 65%        | 123                       | 76                              | 140   | 216      | 111   |
| MERF               | 2011       | Fall     | 262,108      |                                                                 |        |                        |       |     |     |     | 4   |    | 4                             | 0     | 4        | 0%         | 4                         | 1                               | 0     | 1        | 2     |
| SacW <sup>b/</sup> | 2011       | Wint     | 185,313      |                                                                 | 3      |                        |       |     |     |     |     |    | 3                             | 0     | 3        | 0%         | 0                         | 2                               | 0     | 2        | 0     |
| CFHLh              | 2012       | Late     | 1,031,419    | 1,061                                                           | 166    |                        |       |     |     |     |     |    | 1,227                         | 0     | 1,227    | 0.00%      | 440                       | 119                             | 0     | 119      | 43    |
|                    |            | Total    | 12,931,933   | 2,342                                                           | 1,983  | 441                    | 4,216 | 111 | 975 | 326 | 38  | 88 | 8,074                         | 2,446 | 10,520   | 23%        | 7,375                     |                                 |       |          |       |

**Age 5 CV recoveries**

| Release<br>type | Brood<br>year | Run<br>type | # CWT<br>tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |     |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV<br>Stray | Ocean<br>CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|-----------------|---------------|-------------|-----------------|-----------------------------------------------------------------|--------|------------------------|-----|-----|-----|-----|-----|----|-------------------------------|-------|----------|---------------|------------------------------|---------------------------------|-------|----------|-------|
|                 |               |             |                 | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |               |                              | In-basin                        | Stray | CV total | Ocean |
| FRHS            | 2010          | Spr         | 1,170,340       |                                                                 |        |                        | 20  |     |     |     |     |    | 20                            | 0     | 20       | 0%            | 3                            | 2                               | 0     | 2        | 0.2   |
| CFHFh           | 2010          | Fall        | 2,835,420       | 32                                                              | 48     |                        |     |     |     |     |     |    | 80                            | 0     | 80       | 0%            | 20                           | 3                               | 0     | 3        | 1     |
| CFHFn           | 2010          | Fall        | 334,756         | 1                                                               |        | 8                      |     |     |     |     |     |    | 1                             | 8     | 10       | 87%           | 16                           | 0                               | 3     | 3        | 5     |
| FRHFn           | 2010          | Fall        | 2,554,115       | 1                                                               |        |                        | 32  |     | 2   |     | 4   |    | 32                            | 7     | 39       | 18%           | 59                           | 1                               | 0     | 2        | 2     |
| NIMF            | 2010          | Fall        | 1,014,340       |                                                                 |        |                        | 1   |     | 12  |     |     |    | 12                            | 1     | 13       | 8%            | 10                           | 1                               | 0     | 1        | 1     |
| NIMFn           | 2010          | Fall        | 368,363         |                                                                 |        |                        |     |     | 5   |     |     |    | 5                             | 0     | 5        | 0%            | 3                            | 2                               | 0     | 2        | 1     |
| CFHLh           | 2011          | Late        | 1,037,859       | 58                                                              |        |                        |     |     |     |     |     |    | 58                            | 0     | 58       | 0%            | 11                           | 6                               | 0     | 6        | 1     |

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 (i.e., brood year 2012 = age-4 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            |
| FRHFk   | Feather River Hatchery fall Knaggs Ranch experimental releases      |
| FRHftib | Feather River Hatchery fall Tiburon net pen releases                |
| FRHFb   | Feather River Hatchery fall barge study releases                    |
| FRHFn   | Feather River Hatchery fall bay net pen releases                    |
| FRHFnc  | Feather River Hatchery fall coastal net pen releases (Pillar Point) |
| 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                     |
| MOKFb  | Mokelumne River Hatchery fall barge study releases                  |
| MOKFn  | Mokelumne River Hatchery fall bay net pen releases                  |
| MOKFnc | Mokelumne River Hatchery fall coastal net pen releases (Santa Cruz) |
| 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<sub>total</sub> recoveries by port area, month and release type<sup>a/</sup> in 2015 California ocean salmon sport fishery.

| CFH                            |       |       |       | FRH <sup>fb</sup> |       |       |       |       |        | NFH  |       | MOK <sup>fb</sup> |       |       |        | MER   | Non | Total | Total %  |         | Total           |
|--------------------------------|-------|-------|-------|-------------------|-------|-------|-------|-------|--------|------|-------|-------------------|-------|-------|--------|-------|-----|-------|----------|---------|-----------------|
| SacW                           | CFHLh | CFHFh | CFHFh | FRHS              | FRHSn | FRHFk | FRHFb | FRHFh | FRHFnc | NIMF | NIMFn | MOKF              | MOKFb | MOKFn | MOKFnc | MERFt | CV  | CV    | Hatchery | Natural | Harvest         |
| California Sport Harvest       |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| Eureka/Crescent City           |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| May                            | 0%    | 7%    |       | 1%                | 2%    |       | 1%    | 20%   | 4%     | 4%   | 6%    | 2%                |       | 12%   |        | 2%    | 15% | 61%   | 76%      | 24%     | 900             |
| Jun                            |       | 14%   | 7%    | 1%                |       |       | 2%    | 19%   | 5%     | 4%   |       |                   |       | 3%    | 2%     |       |     | 57%   | 57%      | 43%     | 279             |
| Jul                            | 0%    | 1%    | 6%    | 1%                | 0%    |       | 2%    | 14%   | 2%     |      | 4%    |                   | 2%    | 8%    | 1%     |       | 6%  | 40%   | 47%      | 53%     | 1,088           |
| Aug                            | 0%    | 3%    | 7%    | 0%                | 1%    |       | 0%    | 19%   | 4%     | 4%   | 5%    | 0%                | 1%    | 9%    | 2%     |       | 4%  | 55%   | 59%      | 41%     | 1,407           |
| Sep                            |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          | 100%    | 16              |
| Total                          | 0%    | 4%    | 5%    | 1%                | 1%    |       | 1%    | 18%   | 3%     | 3%   | 4%    | 1%                | 1%    | 9%    | 1%     | 0%    | 7%  | 52%   | 59%      | 41%     | 3,690<br>(10%)  |
| Fort Bragg                     |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| Apr                            |       |       |       | 3%                | 5%    |       | 2%    | 15%   | 3%     | 4%   |       |                   |       | 9%    |        |       | 4%  | 40%   | 44%      | 56%     | 394             |
| May                            | 1%    | 4%    |       | 2%                | 1%    |       |       | 24%   | 4%     |      | 4%    |                   |       | 8%    |        |       |     | 47%   | 47%      | 53%     | 331             |
| Jun                            |       | 7%    |       |                   |       |       |       | 30%   | 6%     |      |       |                   |       |       |        |       | 2%  | 43%   | 46%      | 54%     | 215             |
| Jul                            |       | 4%    | 4%    | 0%                |       |       | 2%    | 27%   | 5%     | 1%   | 4%    | 1%                |       | 7%    | 1%     |       | 3%  | 57%   | 60%      | 40%     | 3,071           |
| Aug                            |       | 6%    | 11%   |                   |       |       | 2%    | 26%   | 6%     | 1%   | 6%    |                   |       | 12%   | 1%     |       | 3%  | 69%   | 73%      | 27%     | 1,295           |
| Sep                            |       |       | 14%   |                   |       |       |       | 7%    | 5%     |      | 20%   |                   | 2%    | 22%   | 2%     | 8%    |     | 79%   | 79%      | 21%     | 187             |
| Total                          | 0%    | 4%    | 6%    | 0%                | 0%    |       | 2%    | 25%   | 5%     | 1%   | 5%    | 0%                | 0%    | 9%    | 1%     | 0%    | 3%  | 58%   | 61%      | 39%     | 5,493<br>(15%)  |
| San Francisco                  |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| Apr                            | 0%    | 7%    |       | 7%                | 8%    |       | 4%    | 28%   | 6%     | 1%   | 1%    | 0%                |       | 3%    |        | 2%    | 0%  | 68%   | 68%      | 32%     | 933             |
| May                            | 0%    | 5%    | 2%    | 3%                | 4%    |       | 3%    | 28%   | 9%     | 1%   | 2%    |                   |       | 12%   |        | 2%    | 1%  | 72%   | 73%      | 27%     | 1,072           |
| Jun                            | 0%    | 4%    | 8%    | 2%                | 4%    | 0%    | 2%    | 27%   | 6%     | 1%   | 4%    |                   | 0%    | 9%    | 1%     | 1%    |     | 72%   | 72%      | 28%     | 2,396           |
| Jul                            | 0%    | -     | 5%    | 0%                | 1%    |       | 2%    | 26%   | 8%     | 0%   | 7%    |                   | 1%    | 8%    | 2%     | 1%    | 0%  | 71%   | 71%      | 29%     | 5,126           |
| Aug                            |       | 7%    | 12%   | 0%                | 0%    | 0%    | 2%    | 23%   | 10%    | 1%   | 8%    |                   | 0%    | 8%    | 2%     |       | 0%  | 75%   | 75%      | 25%     | 6,113           |
| Sep                            |       | 3%    | 9%    | 0%                | 0%    |       | 0%    | 22%   | 8%     | 1%   | 5%    | 0%                | 1%    | 13%   | 1%     | 1%    |     | 66%   | 66%      | 34%     | 8,014           |
| Oct                            | 1%    | 1%    | 1%    | 0%                | 0%    |       | 0%    | 3%    | 1%     | 5%   | 24%   | 1%                | 1%    | 29%   | 2%     | 5%    |     | 74%   | 74%      | 26%     | 1,573           |
| Total                          | -     | 0%    | 5%    | 1%                | 1%    | -     | 2%    | 23%   | 8%     | 1%   | 7%    | 0%                | 1%    | 11%   | 2%     | 1%    | 0%  | 70%   | 71%      | 29%     | 25,227<br>(67%) |
| Monterey                       |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| Apr                            |       | 9%    |       | 8%                | 18%   |       | 5%    | 39%   | 7%     |      |       |                   |       | 1%    |        |       |     | 87%   | 87%      | 13%     | 1,697           |
| May                            |       | 5%    |       | 4%                | 1%    |       | 12%   | 66%   | 2%     | 4%   |       |                   |       | 5%    |        |       | 1%  | 99%   | 100%     | 0%      | 490             |
| Jun                            |       | 11%   |       |                   |       |       | 4%    | 26%   | 7%     | 5%   | 8%    |                   |       |       |        |       |     | 59%   | 59%      | 41%     | 543             |
| Jul                            |       | 36%   |       |                   |       |       | 2%    | 9%    | 11%    |      |       |                   |       |       |        |       |     | 58%   | 58%      | 42%     | 313             |
| Aug                            |       |       |       |                   |       |       |       |       | 68%    |      |       |                   |       |       |        |       |     | 68%   | 68%      | 32%     | 27              |
| Total                          |       | 11%   |       | 5%                | 10%   |       | 5%    | 38%   | 7%     | 1%   | 1%    |                   |       | 1%    |        |       | 0%  | 81%   | 81%      | 19%     | 3,070<br>(8%)   |
| California Total Sport Harvest |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| -                              | 0%    | 5%    | 7%    | 1%                | 2%    | -     | 2%    | 24%   | 7%     | 1%   | 6%    | 0%                | 1%    | 9%    | 1%     | 1%    | 1%  | 68%   | 69%      | 31%     | 37,480          |
| Oregon Total Sport Harvest     |       |       |       |                   |       |       |       |       |        |      |       |                   |       |       |        |       |     |       |          |         |                 |
| -                              | 1%    | 0%    |       | 0%                |       |       | 0%    | 3%    | 1%     | 0%   | 1%    |                   | -     | 1%    | 0%     | 0%    | 9%  | 7%    | 16%      | 84%     | 6,685           |

a/ Any values less than 0.05% of CWT<sub>total</sub> are displayed as "-"; values equal or greater than 0.05% but less than 0.5% of CWT<sub>total</sub> are displayed as 0%.

b/ In 2015, several hatch\_grps were grouped together in ocean fisheries: FRHFh includes FRHFt, MOKF includes MOKFt.

Table 14. Total CWT<sub>total</sub> recoveries by port area, month and release type in 2015 California ocean salmon sport fishery.

| CFH                            |       |       |       | FRH <sup>a</sup> |       |       |       |       |        | NFH   |       | MOK <sup>a</sup> |       |       |        | MER   | Non | Total  | Total CWT <sub>total</sub> |         | Total       |              |
|--------------------------------|-------|-------|-------|------------------|-------|-------|-------|-------|--------|-------|-------|------------------|-------|-------|--------|-------|-----|--------|----------------------------|---------|-------------|--------------|
| SacW                           | CFHLh | CFHFh | CFHFh | FRHS             | FRHSn | FRHFk | FRHFb | FRHFh | FRHFnc | NIMF  | NIMFn | MOKF             | MOKFb | MOKFn | MOKFnc | MERFt | CV  | CV     | Hatchery                   | Natural | Harvest     |              |
| California Sport Harvest       |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Eureka/Crescent City           |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| May                            | 4     | 60    |       | 6                | 22    |       | 11    | 181   | 39     | 33    | 50    | 17               |       | 109   |        | 18    | 136 | 549    | 685                        | 215     | 900         |              |
| Jun                            |       | 40    | 19    | 4                |       |       | 5     | 53    | 14     | 12    |       |                  |       | 9     | 5      |       |     | 160    | 160                        | 119     | 279         |              |
| Jul                            | 3     | 11    | 68    | 7                | 3     |       | 18    | 152   | 23     |       | 45    |                  | 18    | 84    | 7      |       | 71  | 439    | 510                        | 578     | 1,088       |              |
| Aug                            | 3     | 41    | 105   | 3                | 12    |       | 3     | 272   | 51     | 51    | 70    | 3                | 16    | 122   | 26     |       | 51  | 778    | 829                        | 578     | 1,407       |              |
| Sep                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            | 16      | 16          |              |
| Total                          | 10    | 152   | 192   | 19               | 37    |       | 38    | 657   | 127    | 96    | 164   | 19               | 34    | 324   | 38     | 18    | 258 | 1,925  | 2,184                      | 1,506   | 3,690 (10%) |              |
| Fort Bragg                     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Apr                            |       |       |       | 10               | 20    |       | 7     | 57    | 13     | 14    |       |                  |       | 36    |        |       | 14  | 158    | 172                        | 222     | 394         |              |
| May                            | 3     | 13    |       | 7                | 3     |       |       | 78    | 12     |       | 13    |                  |       | 26    |        |       |     | 156    | 156                        | 175     | 331         |              |
| Jun                            |       | 16    |       |                  |       |       |       | 65    | 12     |       |       |                  |       |       |        |       | 5   | 93     | 98                         | 117     | 215         |              |
| Jul                            |       | 137   | 136   | 5                |       |       | 59    | 822   | 163    | 29    | 137   | 20               |       | 215   | 20     |       | 104 | 1,742  | 1,846                      | 1,225   | 3,071       |              |
| Aug                            |       | 71    | 141   |                  |       |       | 22    | 340   | 72     | 9     | 74    |                  |       | 158   | 9      |       | 44  | 897    | 941                        | 354     | 1,295       |              |
| Sep                            |       |       | 26    |                  |       |       |       | 14    | 9      |       | 37    |                  | 3     | 41    | 3      | 15    |     | 148    | 148                        | 39      | 187         |              |
| Oct                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Total                          | 3     | 237   | 303   | 22               | 24    |       | 89    | 1,376 | 281    | 52    | 261   | 20               | 3     | 477   | 32     | 15    | 167 | 3,194  | 3,362                      | 2,131   | 5,493 (15%) |              |
| San Francisco                  |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Apr                            | 2     | 67    |       | 68               | 79    |       | 40    | 261   | 52     | 11    | 7     | 2                |       | 31    |        | 18    | 2   | 635    | 637                        | 296     | 933         |              |
| May                            | 3     | 57    | 18    | 33               | 45    |       | 36    | 295   | 94     | 15    | 24    |                  |       | 131   |        | 25    | 9   | 777    | 786                        | 286     | 1,072       |              |
| Jun                            | 11    | 102   | 185   | 51               | 102   | 2     | 53    | 643   | 148    | 34    | 104   |                  | 8     | 225   | 14     | 30    |     | 1,713  | 1,713                      | 683     | 2,396       |              |
| Jul                            | 3     | 3     | 280   | 528              | 8     | 35    | 98    | 1,313 | 403    | 12    | 377   |                  | 44    | 386   | 100    | 47    | 14  | 3,637  | 3,651                      | 1,475   | 5,126       |              |
| Aug                            | 11    | 404   | 718   | 26               | 23    | 4     | 128   | 1,417 | 638    | 82    | 478   |                  | 26    | 465   | 136    |       | 15  | 4,556  | 4,572                      | 1,541   | 6,113       |              |
| Sep                            | 16    | 255   | 716   | 23               | 27    |       | 29    | 1,790 | 661    | 85    | 374   | 20               | 61    | 1,015 | 118    | 82    |     | 5,271  | 5,271                      | 2,743   | 8,014       |              |
| Oct                            | 13    | 14    | 14    | 3                | 7     |       | 3     | 55    | 21     | 76    | 379   | 14               | 17    | 449   | 27     | 71    |     | 1,161  | 1,161                      | 412     | 1,573       |              |
| Nov                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Total                          | 3     | 58    | 1,179 | 2,179            | 212   | 318   | 6     | 387   | 5,773  | 2,016 | 315   | 1,743            | 36    | 157   | 2,702  | 394   | 273 | 39     | 17,751                     | 17,791  | 7,436       | 25,227 (67%) |
| Monterey                       |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Apr                            |       | 149   |       | 143              | 309   |       | 80    | 663   | 117    |       |       |                  |       | 19    |        |       |     | 1,481  | 1,481                      | 216     | 1,697       |              |
| May                            |       | 22    |       | 20               | 6     |       | 60    | 326   | 11     | 18    |       |                  |       | 22    |        |       | 5   | 486    | 490                        |         | 490         |              |
| Jun                            |       | 59    |       |                  |       |       | 20    | 140   | 35     | 25    | 41    |                  |       |       |        |       |     | 321    | 321                        | 222     | 543         |              |
| Jul                            |       | 112   |       |                  |       |       | 7     | 28    | 35     |       |       |                  |       |       |        |       |     | 182    | 182                        | 131     | 313         |              |
| Aug                            |       |       |       |                  |       |       |       |       | 18     |       |       |                  |       |       |        |       |     | 18     | 18                         | 9       | 27          |              |
| Sep                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Oct                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| Total                          |       | 342   |       | 163              | 315   |       | 168   | 1,156 | 217    | 43    | 41    |                  |       | 42    |        |       | 5   | 2,488  | 2,493                      | 577     | 3,070 (8%)  |              |
| California Total Sport Harvest |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
| 3                              | 72    | 1,911 | 2,673 | 417              | 694   | 6     | 682   | 8,963 | 2,640  | 507   | 2,209 | 75               | 193   | 3,545 | 464    | 306   | 469 | 25,359 | 25,828                     | 11,652  | 37,480      |              |
| Oregon Total Sport Harvest     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |     |        |                            |         |             |              |
|                                | 2     | 41    | 10    |                  | 3     |       | 14    | 198   | 39     | 17    | 38    |                  | 3     | 72    | 5      | 8     | 613 | 450    | 1,063                      | 5,622   | 6,685       |              |

a/ In 2015, several hatch\_grps were grouped together in ocean fisheries: FRHFh includes FRHFt, MOKF includes MOKFt.

Table 15. Percentage of CWT<sub>total</sub> recoveries by port area, month and release type<sup>a/</sup> in 2015 California ocean salmon commercial fishery.

|                                     | CFH      |       |       | FRH <sup>b</sup> |      |       |       |       |       | NFH    |      | MOK <sup>b</sup> |      |       |       | MER    | Non   | Total | Total % |          | Total   |                 |                 |            |
|-------------------------------------|----------|-------|-------|------------------|------|-------|-------|-------|-------|--------|------|------------------|------|-------|-------|--------|-------|-------|---------|----------|---------|-----------------|-----------------|------------|
|                                     | SacW     | CFHLh | CFHFh | CFHFh            | FRHS | FRHSn | FRHFk | FRHFb | FRHFh | FRHFnc | NIMF | NIMFn            | MOKF | MOKFb | MOKFn | MOKFnc | MERFt | CV    | CV      | Hatchery | Natural | Harvest         |                 |            |
| California Commercial Harvest       |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
| Eureka/Crescent City                |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
| Sep                                 |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         | 80%      |         | 80%             | 20%             | 46<br>(1%) |
| Fort Bragg                          |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
| Jun                                 |          | 0%    | 6%    | 0%               | 0%   | 1%    | -     | 2%    | 26%   | 4%     | 3%   | 2%               | 0%   |       | 5%    |        | 1%    | 6%    | 50%     | 55%      | 45%     | 11,317          |                 |            |
| Jul                                 |          | 0%    | 3%    |                  | 0%   | 0%    |       | 1%    | 22%   | 4%     | 2%   | 2%               |      |       | 11%   |        | 2%    | 4%    | 49%     | 54%      | 46%     | 5,333           |                 |            |
| Aug                                 |          | 0%    | 4%    |                  |      | 0%    |       | 1%    | 26%   | 7%     | 2%   | 2%               | 0%   |       | 11%   |        | 2%    | 2%    | 55%     | 58%      | 42%     | 3,848           |                 |            |
| Sep                                 |          | 0%    |       | 1%               | 0%   |       |       |       | 16%   | 4%     | 13%  |                  | 1%   |       | 25%   |        | 3%    |       | 64%     | 64%      | 36%     | 1,008           |                 |            |
| Total                               |          | 0%    | 4%    | 0%               | 1%   | 1%    | -     | 1%    | 16%   | 3%     | 2%   | 1%               | 0%   |       | 5%    |        | 1%    | 6.5%  | 35%     | 41%      | 59%     | 60,052<br>(54%) |                 |            |
| San Francisco                       |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
| May -                               |          | 1%    | 8%    |                  | 1%   | 2%    |       | 2%    | 30%   | 8%     | 2%   | 3%               | 0%   |       | 7%    |        | 1%    | 2%    | 66%     | 68%      | 32%     | 7,407           |                 |            |
| Jun                                 |          | 1%    | 4%    |                  | 1%   | 1%    | 0%    | 2%    | 36%   | 6%     | 2%   | 2%               |      |       | 10%   |        | 1%    | 4%    | 67%     | 70%      | 30%     | 4,762           |                 |            |
| Jul                                 |          | 0%    | 9%    |                  | 0%   | 0%    |       | 3%    | 28%   | 6%     | 3%   | 2%               |      |       | 9%    |        | 2%    | 1%    | 63%     | 65%      | 35%     | 4,456           |                 |            |
| Aug                                 |          |       | 11%   | 0%               | 0%   | 0%    | -     | 2%    | 38%   | 6%     | 1%   | 1%               |      |       | 6%    | 0%     | 1%    | -     | 67%     | 67%      | 33%     | 7,055           |                 |            |
| Sep                                 |          | 0%    | 4%    | 2%               | -    |       |       | 0%    | 27%   | 5%     | 4%   | 2%               |      | 0%    | 20%   | 0%     | 4%    |       | 68%     | 68%      | 32%     | 9,399           |                 |            |
| Oct                                 |          | 0%    | 2%    | 1%               |      |       |       |       | 2%    | 0%     | 10%  | 15%              | 2%   | 0%    | 37%   |        | 8%    |       | 76%     | 76%      | 24%     | 2,617           |                 |            |
| Total -                             |          | 0%    | 7%    | 1%               | 0%   | 1%    | -     | 2%    | 29%   | 6%     | 3%   | 3%               | 0%   | -     | 13%   | 0%     | 2%    | 1%    | 67%     | 68%      | 32%     | 35,696<br>(32%) |                 |            |
| T-20                                | Monterey |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
|                                     | May      |       | 1%    | 10%              | 0%   | 2%    | 3%    | -     | 6%    | 40%    | 9%   | 1%               | 2%   | 0%    |       | 4%     |       | 0%    | 0%      | 79%      | 79%     | 21%             | 7,608           |            |
|                                     | Jun      |       | 0%    | 9%               |      | 0%    | 0%    | 0%    | 5%    | 45%    | 10%  | 4%               | 2%   | 0%    |       | 6%     |       | 1%    | 0%      | 81%      | 81%     | 19%             | 3,410           |            |
|                                     | Jul      |       | 0%    | 9%               |      | 0%    | 0%    |       | 3%    | 43%    | 12%  | 2%               | 4%   | 0%    |       | 11%    |       | 1%    |         | 86%      | 86%     | 14%             | 3,131           |            |
|                                     | Aug      |       | 1%    | 4%               |      |       |       |       | 1%    | 25%    | 19%  | 2%               | 2%   | 2%    |       | 17%    |       |       |         | 73%      | 73%     | 27%             | 564             |            |
|                                     | Total    |       | 1%    | 10%              | 0%   | 1%    | 2%    | -     | 5%    | 41%    | 10%  | 2%               | 2%   | 0%    |       | 7%     |       | 1%    | 0%      | 81%      | 81%     | 19%             | 14,713<br>(13%) |            |
| California Total Commercial Harvest |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
| -                                   |          | 0%    | 5%    | 0%               | 1%   | 1%    | -     | 2%    | 24%   | 5%     | 2%   | 2%               | 0%   | -     | 8%    | -      | 1%    | 4%    | 51%     | 55%      | 45%     | 110,507         |                 |            |
| Oregon Total Commercial Harvest     |          |       |       |                  |      |       |       |       |       |        |      |                  |      |       |       |        |       |       |         |          |         |                 |                 |            |
|                                     |          | 0%    | 3%    | -                | 0%   | 0%    | -     | 0%    | 12%   | 2%     | 1%   | 1%               | 0%   |       | 3%    |        | 0%    | 24%   | 25%     | 49%      | 51%     | 93,377          |                 |            |

a/ Any values less than 0.05% of CWT<sub>total</sub> are displayed as "-"; values equal or greater than 0.05% but less than 0.5% of CWT<sub>total</sub> are displayed as 0%.

b/ In 2015, several hatch\_grps were grouped together in ocean fisheries: FRHFh includes FRHFtib, MOKF includes MOKFt .



Table 16. Total CWT<sub>total</sub> recoveries by port area, month and release type in 2015 California ocean salmon commercial fishery.

| CFH                                 |       |       |       | FRH <sup>a</sup> |       |       |       |       |        | NFH   |       | MOK <sup>a</sup> |       |       |        | MER   | Non    | Total  | Total CWT <sub>total</sub> |         | Total   |         |
|-------------------------------------|-------|-------|-------|------------------|-------|-------|-------|-------|--------|-------|-------|------------------|-------|-------|--------|-------|--------|--------|----------------------------|---------|---------|---------|
| SacW                                | CFHLh | CFHFh | CFHFn | FRHS             | FRHSn | FRHFk | FRHFb | FRHFh | FRHFnc | NIMF  | NIMFn | MOKF             | MOKFb | MOKFn | MOKFnc | MERFt | CV     | CV     | Hatchery                   | Natural | Harvest |         |
| California Commercial Harvest       |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
| Eureka/Crescent City                |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
| Sep                                 |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       | 37     |        | 37                         | 9       | 46      |         |
| Fort Bragg                          |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         | (<1%)   |         |
| Jun                                 |       | 31    | 649   | 12               | 24    | 80    | 3     | 176   | 2,932  | 477   | 327   | 232              | 15    |       | 569    | 92    | 651    | 5,617  | 6,268                      | 5,049   | 11,317  |         |
| Jul                                 |       | 9     | 181   |                  | 17    | 17    |       | 71    | 1,196  | 224   | 115   | 99               |       |       | 576    | 126   | 224    | 2,629  | 2,853                      | 2,480   | 5,333   |         |
| Aug                                 |       | 7     | 168   |                  |       | 6     |       | 35    | 987    | 251   | 96    | 70               | 3     |       | 440    | 71    | 90     | 2,133  | 2,224                      | 1,625   | 3,848   |         |
| Sep                                 |       | 4     |       | 13               | 4     |       |       |       | 157    | 40    | 132   |                  | 13    |       | 253    | 29    |        | 644    | 644                        | 364     | 1,008   |         |
| Total                               |       | 147   | 2,205 | 46               | 303   | 626   | 3     | 681   | 9,830  | 1,945 | 1,008 | 702              | 125   |       | 2,728  | 488   | 3,887  | 20,837 | 24,725                     | 35,327  | 60,052  |         |
|                                     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         | (54%)   |         |
| San Francisco                       |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
| May 3                               |       | 63    | 604   |                  | 73    | 141   |       | 180   | 2,219  | 558   | 168   | 248              | 32    |       | 530    | 73    | 146    | 4,893  | 5,039                      | 2,368   | 7,407   |         |
| Jun                                 |       | 33    | 205   |                  | 36    | 56    | 8     | 112   | 1,720  | 278   | 83    | 95               |       |       | 490    | 53    | 174    | 3,169  | 3,343                      | 1,419   | 4,762   |         |
| Jul                                 |       | 16    | 388   |                  | 6     | 17    |       | 151   | 1,252  | 282   | 143   | 97               |       |       | 405    | 68    | 55     | 2,825  | 2,880                      | 1,576   | 4,456   |         |
| Aug                                 |       |       | 802   | 16               | 4     | 4     | 3     | 152   | 2,684  | 428   | 86    | 59               |       |       | 455    | 4     | 58     | 4,753  | 4,757                      | 2,298   | 7,055   |         |
| Sep                                 |       | 21    | 352   | 221              | 4     |       |       | 24    | 2,514  | 484   | 335   | 227              |       | 5     | 1,834  | 25    | 334    | 6,380  | 6,380                      | 3,019   | 9,399   |         |
| Oct                                 |       | 6     | 43    | 21               |       |       |       |       | 43     | 11    | 266   | 383              | 43    | 11    | 958    |       | 212    | 1,995  | 1,995                      | 622     | 2,617   |         |
| Total 3                             |       | 140   | 2,393 | 258              | 123   | 219   | 11    | 618   | 10,431 | 2,042 | 1,080 | 1,108            | 75    | 16    | 4,671  | 29    | 798    | 379    | 24,015                     | 24,394  | 11,302  | 35,696  |
|                                     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         | (32%)   |         |
| Monterey                            |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
| May                                 |       | 60    | 776   | 13               | 115   | 256   | 3     | 464   | 3,012  | 690   | 106   | 140              | 13    |       | 318    | 24    | 25     | 5,990  | 6,015                      | 1,593   | 7,608   |         |
| Jun                                 |       | 9     | 321   |                  | 11    | 5     | 3     | 157   | 1,520  | 330   | 124   | 52               | 10    |       | 207    | 23    | 3      | 2,772  | 2,775                      | 635     | 3,410   |         |
| Jul                                 |       | 15    | 277   |                  | 2     | 2     |       | 83    | 1,333  | 391   | 77    | 115              | 9     |       | 346    | 28    |        | 2,680  | 2,680                      | 451     | 3,131   |         |
| Aug                                 |       | 3     | 24    |                  |       |       |       | 6     | 142    | 107   | 12    | 12               | 12    |       | 95     |       |        | 412    | 412                        | 152     | 564     |         |
| Total                               |       | 87    | 1,398 | 13               | 127   | 263   | 6     | 710   | 6,007  | 1,518 | 319   | 319              | 44    |       | 967    | 76    | 28     | 11,853 | 11,881                     | 2,832   | 14,713  |         |
|                                     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         | (13%)   |         |
| California Total Commercial Harvest |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
| 3                                   |       | 374   | 5,996 | 316              | 554   | 1,109 | 20    | 2,009 | 26,269 | 5,504 | 2,408 | 2,129            | 244   | 16    | 8,366  | 29    | 1,361  | 4,331  | 56,706                     | 61,037  | 49,470  | 110,507 |
| Oregon Total Commercial Harvest     |       |       |       |                  |       |       |       |       |        |       |       |                  |       |       |        |       |        |        |                            |         |         |         |
|                                     |       | 95    | 2,765 | 18               | 224   | 387   | 1     | 438   | 11,379 | 1,735 | 1,137 | 1,352            | 200   |       | 3,044  | 266   | 22,577 | 23,041 | 45,618                     | 47,759  | 93,377  |         |

a/ In 2015, several hatch\_grps were grouped together in ocean fisheries: FRHFh includes FRHFb, MOKF includes MOKFt.

**Table 17. CWT recovery rate (recoveries per 100,000 CWTs released) for Experimental & Net Pen release types in 2015.** (page 1 of 2)

| <b>Age 2 CWT recoveries</b> |            |          |              | <b>Central Valley total recoveries (CWT<sub>samp</sub>) by basin</b> |        |                        |     |     |     |     |     |     | <b>CV CWT<sub>samp</sub> totals</b> |       |          | <b>% CV Stray</b> | <b>Ocean CWT<sub>samp</sub></b> | <b>Recovery rate per 100K released</b> |       |          |       |
|-----------------------------|------------|----------|--------------|----------------------------------------------------------------------|--------|------------------------|-----|-----|-----|-----|-----|-----|-------------------------------------|-------|----------|-------------------|---------------------------------|----------------------------------------|-------|----------|-------|
| Release type                | Brood year | Run type | # CWT tagged | Bat Cr                                                               | Up Sac | Nat crks <sup>a/</sup> | Fea | Yub | Ame | Mok | Mer | SJ  | In-basin                            | Stray | CV total |                   |                                 | In-basin                               | Stray | CV total | Ocean |
| CFHFn                       | 2013       | Fall     | 1,810,972    | 147                                                                  | 112    | 138                    | 228 | 309 | 134 | 91  | 14  | 46  | 259                                 | 961   | 1,220    | 79%               | 736                             | 14                                     | 53    | 67       | 41    |
| FRHFbb                      | 2013       | Fall     | 100,227      | 4                                                                    |        |                        | 19  |     |     |     |     |     | 19                                  | 4     | 23       | 16%               | 14                              | 19                                     | 4     | 23       | 14    |
| FRHFbg                      | 2013       | Fall     | 100,564      | 1                                                                    |        |                        | 44  |     |     | 1   |     |     | 44                                  | 2     | 46       | 5%                | 0                               | 44                                     | 2     | 46       | 0     |
| FRHFbr                      | 2013       | Fall     | 99,354       | 1                                                                    |        | 8                      | 25  |     | 2   | 1   |     |     | 25                                  | 13    | 38       | 34%               | 19                              | 25                                     | 13    | 38       | 19    |
| FRHFtib                     | 2013       | Fall     | 11,791       | 5                                                                    |        |                        | 9   |     |     | 1   |     |     | 9                                   | 6     | 15       | 40%               | 30                              | 76                                     | 51    | 127      | 255   |
| FRHFkr                      | 2013       | Fall     | 44,127       |                                                                      |        |                        | 2   |     |     |     |     |     | 2                                   | 0     | 2        | 0%                | 4                               | 5                                      | 0     | 5        | 9     |
| FRHFfn                      | 2013       | Fall     | 1,459,468    | 52                                                                   | 144    | 77                     | 801 | 67  | 27  | 36  | 6   | 7   | 868                                 | 349   | 1,217    | 29%               | 422                             | 59                                     | 24    | 83       | 29    |
| FRHFnp                      | 2013       | Fall     | 366,033      | 44                                                                   | 80     | 84                     | 607 | 21  | 34  | 35  | 4   | 20  | 628                                 | 301   | 930      | 32%               | 938                             | 172                                    | 82    | 254      | 256   |
| NIMFn                       | 2013       | Fall     | 896,419      |                                                                      |        |                        | 31  | 55  | 742 | 248 | 9   | 7   | 742                                 | 349   | 1,091    | 32%               | 405                             | 83                                     | 39    | 122      | 45    |
| MOKFbb                      | 2013       | Fall     | 101,051      |                                                                      |        |                        | 1   | 11  | 23  | 16  | 9   | 13  | 16                                  | 56    | 72       | 78%               | 88                              | 16                                     | 56    | 72       | 87    |
| MOKFbg                      | 2013       | Fall     | 101,426      | 1                                                                    |        |                        | 8   | 11  | 64  | 132 | 10  | 26  | 132                                 | 120   | 252      | 48%               | 119                             | 130                                    | 118   | 248      | 117   |
| MOKFbr                      | 2013       | Fall     | 100,181      |                                                                      |        |                        |     |     |     | 8   |     |     | 8                                   | 0     | 8        | 0%                | 5                               | 8                                      | 0     | 8        | 5     |
| MOKFn                       | 2013       | Fall     | 1,148,423    | 1                                                                    |        |                        | 6   | 44  | 87  | 358 | 138 | 278 | 358                                 | 554   | 912      | 61%               | 303                             | 31                                     | 48    | 79       | 26    |
| MOKFns                      | 2013       | Fall     | 239,294      |                                                                      |        |                        | 2   | 34  | 12  | 15  | 2   | 9   | 15                                  | 59    | 74       | 79%               | 493                             | 6                                      | 25    | 31       | 206   |

| <b>Age 3 CWT recoveries</b> |            |          |              | <b>Central Valley total recoveries (CWT<sub>samp</sub>) by basin</b> |        |                        |       |     |     |       |     |     | <b>CV CWT<sub>samp</sub> totals</b> |       |          | <b>% CV Stray</b> | <b>Ocean CWT<sub>samp</sub></b> | <b>Recovery rate per 100K released</b> |       |          |       |
|-----------------------------|------------|----------|--------------|----------------------------------------------------------------------|--------|------------------------|-------|-----|-----|-------|-----|-----|-------------------------------------|-------|----------|-------------------|---------------------------------|----------------------------------------|-------|----------|-------|
| Release type                | Brood year | Run type | # CWT tagged | Bat Cr                                                               | Up Sac | Nat crks <sup>a/</sup> | Fea   | Yub | Ame | Mok   | Mer | SJ  | In-basin                            | Stray | CV total |                   |                                 | In-basin                               | Stray | CV total | Ocean |
| FRHFbb                      | 2012       | Fall     | 97,760       | 52                                                                   | 321    | 66                     | 458   |     | 2   | 1     |     |     | 458                                 | 443   | 901      | 49%               | 1,401                           | 469                                    | 453   | 922      | 1433  |
| FRHFbg                      | 2012       | Fall     | 99,192       | 40                                                                   | 225    | 108                    | 597   | 78  | 6   |       |     |     | 675                                 | 379   | 1,053    | 36%               | 1,289                           | 680                                    | 382   | 1062     | 1300  |
| FRHFbr                      | 2012       | Fall     | 96,832       |                                                                      |        |                        | 2     |     |     |       |     |     | 2                                   | 0     | 2        | 0%                | 24                              | 2                                      | 0     | 2        | 25    |
| FRHFtib                     | 2012       | Fall     | 9,918        |                                                                      |        | 17                     | 14    |     |     |       |     |     | 14                                  | 17    | 31       | 54%               | 81                              | 141                                    | 167   | 308      | 817   |
| FRHFkc                      | 2012       | Fall     | 46,492       |                                                                      |        |                        | 15    |     |     |       |     |     | 15                                  | 0     | 15       | 0%                | 19                              | 32                                     | 0     | 32       | 40    |
| FRHFkr                      | 2012       | Fall     | 92,396       |                                                                      |        |                        | 1     |     |     |       |     |     | 1                                   | 0     | 1        | 0%                | 5                               | 1                                      | 0     | 1        | 5     |
| FRHFfn                      | 2012       | Fall     | 1,453,105    | 360                                                                  | 2,520  | 1,080                  | 4,101 | 162 | 75  | 51    | 18  | 20  | 4,262                               | 4,124 | 8,386    | 49%               | 8,957                           | 293                                    | 284   | 577      | 616   |
| FRHFnp                      | 2012       | Fall     | 412,360      | 47                                                                   | 417    | 151                    | 409   | 44  | 4   | 2     | 6   |     | 453                                 | 628   | 1,081    | 58%               | 4,436                           | 110                                    | 152   | 262      | 1076  |
| FRHFns                      | 2012       | Fall     | 236,800      | 10                                                                   | 48     | 17                     | 74    | 67  | 2   |       |     |     | 141                                 | 77    | 218      | 35%               | 2,982                           | 60                                     | 32    | 92       | 1259  |
| NIMFn                       | 2012       | Fall     | 182,413      | 1                                                                    |        |                        | 7     |     | 330 | 49    | 1   | 7   | 330                                 | 65    | 394      | 16%               | 428                             | 181                                    | 35    | 216      | 234   |
| MOKFn                       | 2012       | Fall     | 1,275,158    | 2                                                                    |        | 11                     | 49    | 143 | 875 | 1,693 | 220 | 698 | 1,693                               | 1,998 | 3,692    | 54%               | 2,990                           | 133                                    | 157   | 290      | 234   |

**Table 17. CWT recovery rate (recoveries per 100,000 CWTs released) for Experimental & Net Pen release types in 2015.** (page 2 of 2)

**Age 4 CWT recoveries**

| Release type | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |     |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|--------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-----|-----|-----|-----|-----|----|-------------------------------|-------|----------|------------|---------------------------|---------------------------------|-------|----------|-------|
|              |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |            |                           | In-basin                        | Stray | CV total | Ocean |
| FRHFbb       | 2011       | Fall     | 98,241       | 1                                                               |        | 8                      | 41  |     | 3   |     |     |    | 41                            | 13    | 54       | 24%        | 122                       | 41                              | 13    | 54       | 125   |
| FRHFbg       | 2011       | Fall     | 98,947       | 1                                                               | 16     | 25                     | 44  |     |     | 1   |     |    | 44                            | 43    | 87       | 50%        | 121                       | 44                              | 44    | 88       | 122   |
| FRHFbr       | 2011       | Fall     | 99,901       |                                                                 | 32     |                        | 121 |     | 2   |     |     |    | 121                           | 34    | 156      | 22%        | 110                       | 121                             | 34    | 155      | 110   |
| FRHFn        | 2011       | Fall     | 2,293,211    | 41                                                              | 1,011  | 250                    | 984 |     | 16  | 2   |     |    | 984                           | 1,321 | 2,304    | 57%        | 2,163                     | 43                              | 58    | 101      | 94    |
| FRHFnp       | 2011       | Fall     | 185,303      | 25                                                              | 177    | 42                     | 200 |     |     |     |     |    | 200                           | 243   | 443      | 55%        | 729                       | 108                             | 131   | 239      | 393   |
| FRHFns       | 2011       | Fall     | 240,887      | 2                                                               | 32     | 8                      | 20  |     |     |     |     |    | 20                            | 43    | 63       | 68%        | 706                       | 8                               | 18    | 26       | 293   |
| NIMFn        | 2011       | Fall     | 328,073      |                                                                 |        |                        | 23  |     | 361 | 26  | 2   | 3  | 361                           | 54    | 415      | 13%        | 593                       | 110                             | 16    | 126      | 181   |
| MOKFn        | 2011       | Fall     | 1,487,132    |                                                                 |        |                        | 9   | 11  | 169 | 150 | 19  | 46 | 150                           | 253   | 403      | 63%        | 444                       | 10                              | 17    | 27       | 30    |

<sup>a/</sup> 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                                         | FRHFnp | Feather River Hatchery fall coastal net pen releases - Pillar Point                   |
| FRHFbb  | Feather River Hatchery fall barge study: trucked & released in SF Bay (Ft Baker, Tiburon)        | FRHFns | Feather River Hatchery fall coastal net pen releases - Santa Cruz                     |
| FRHFbg  | Feather River Hatchery fall barge study: barged to SF Bay and released                           | NIMFn  | Nimbus Hatchery fall bay net pens releases                                            |
| FRHFbr  | Feather River Hatchery fall barge study: in-river releases (numerous sites Sac R.)               | MOKFbb | Mokelumne River Hatchery fall barge study: trucked & released in SF Bay (Tiburon)     |
| FRHFTib | Feather River Hatchery fall Tiburon net pen releases                                             | MOKFbg | Mokelumne River Hatchery fall barge study: barged to SF Bay and released              |
| FRHFkc  | Feather Feather River Hatchery fall rice field study: Elkhorn boat ramp Sac River(control group) | MOKFbr | Mokelumne River Hatchery fall barge study: in-river releases (Miller's Ferry, Mok R.) |
| FRHFkr  | Feather Feather River Hatchery fall rice field study: Yolo Bypass Knaggs Ranch rice field        | MOKFn  | Mokelumne River Hatchery fall bay net pen releases                                    |
| FRHFn   | Feather River Hatchery fall bay net pen releases                                                 | MOKFns | Mokelumne River Hatchery fall coastal net pen releases - Santa Cruz                   |

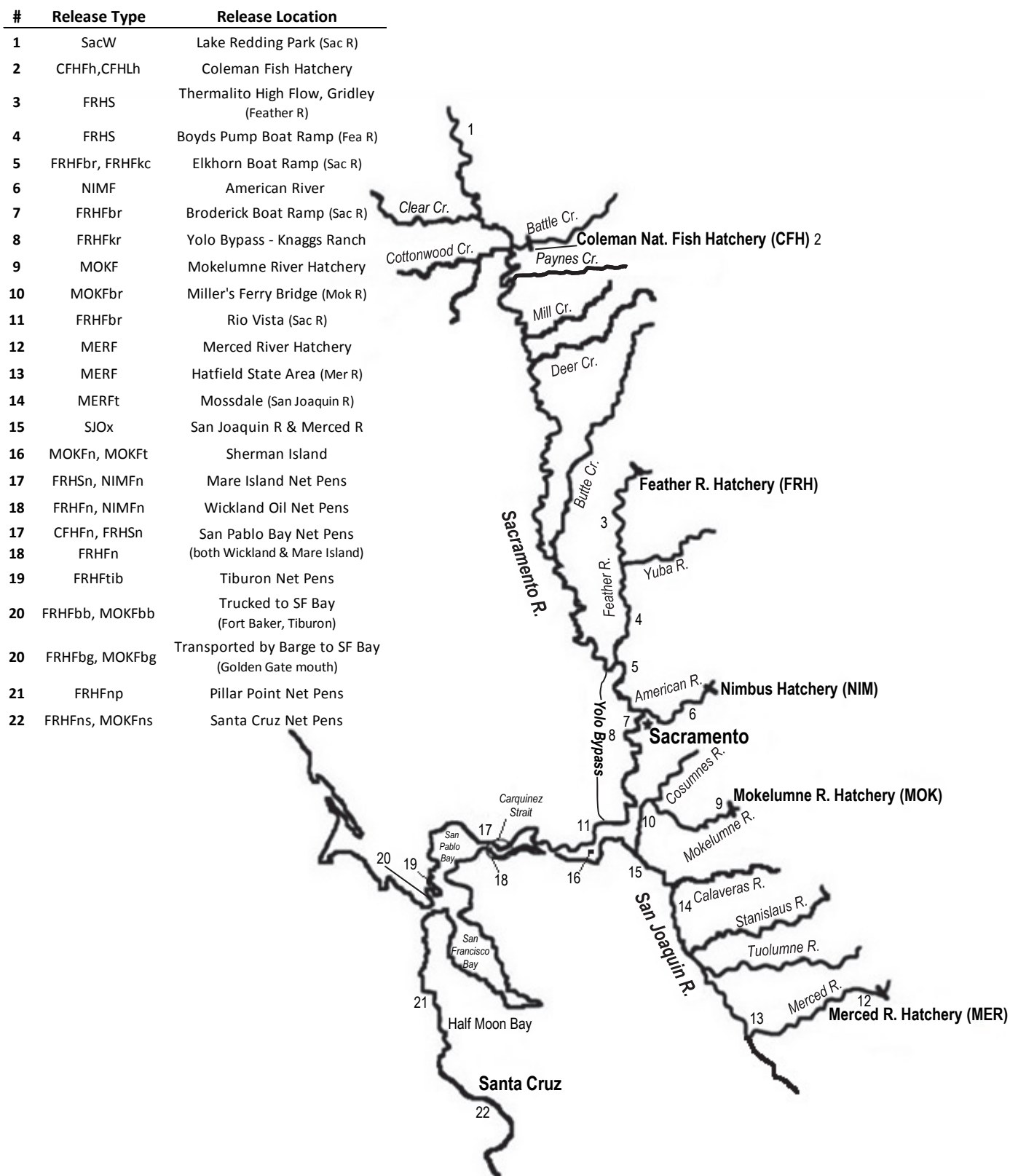


Figure 1. Map of release locations for CV hatchery release types, brood years 2010-2013.

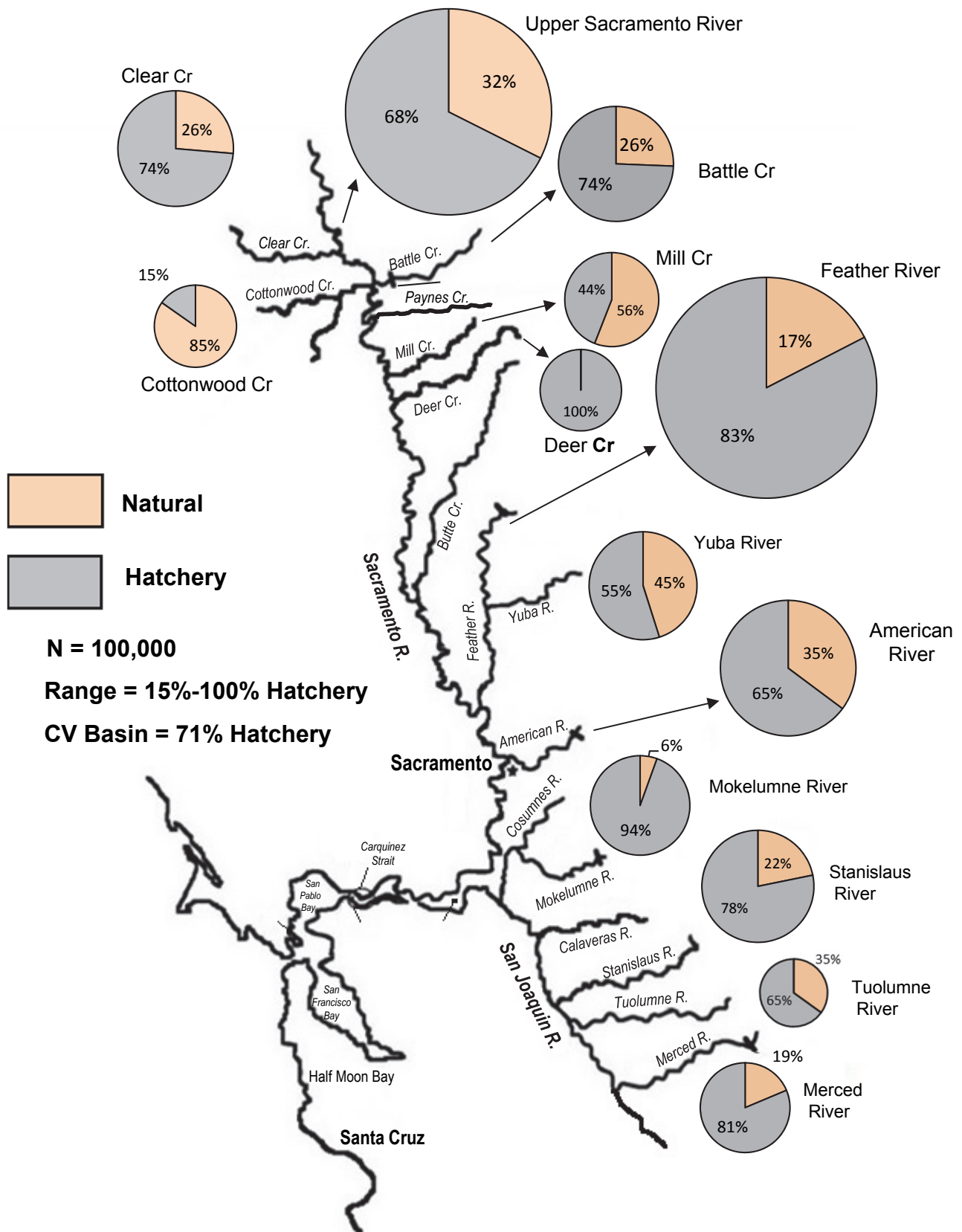


Figure 2. Fall-run CV Natural Area Escapement, Hatchery and Natural Proportions, 2015.

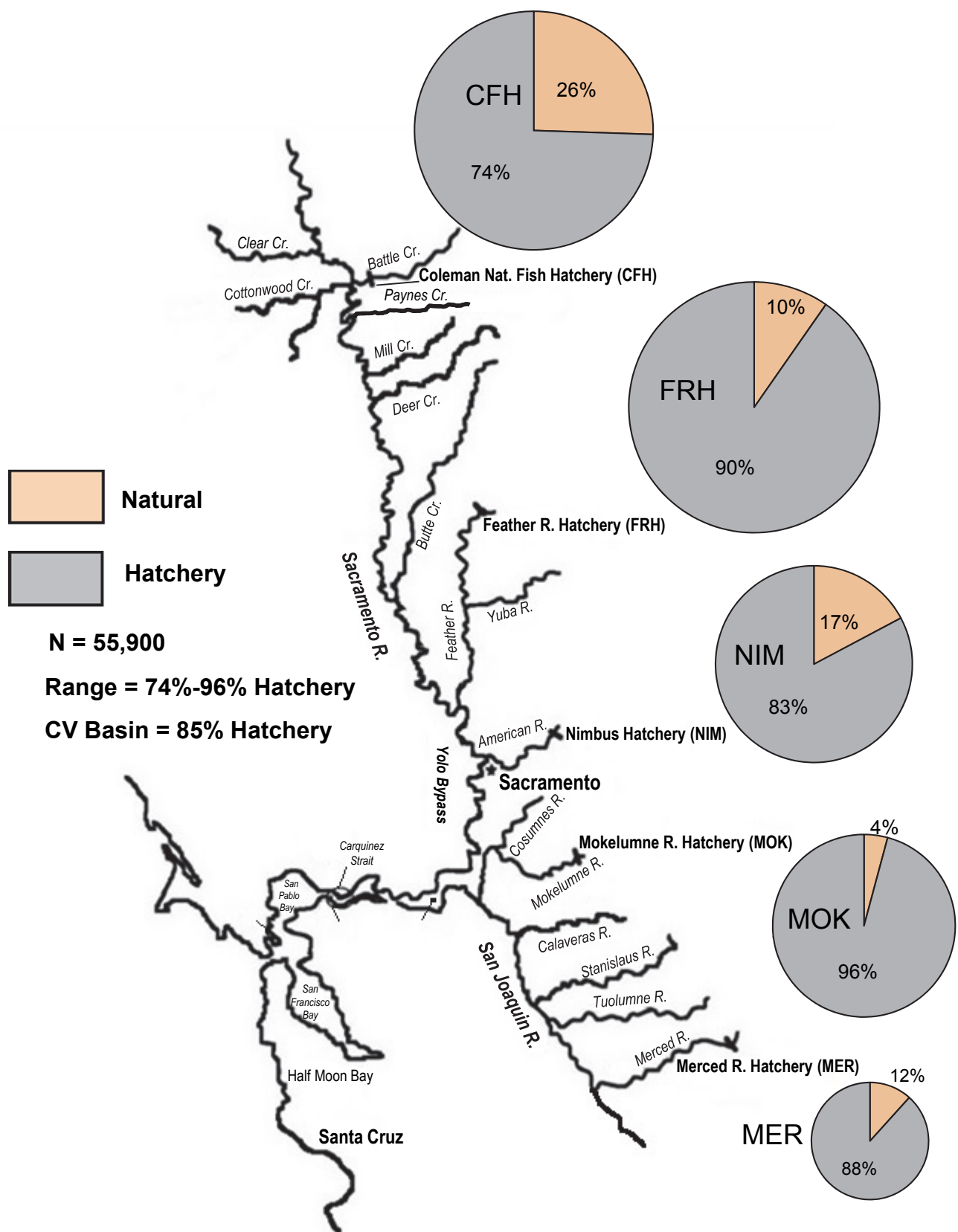


Figure 3. Fall-run CV Hatchery Escapement, Hatchery and Natural Proportions, 2015.

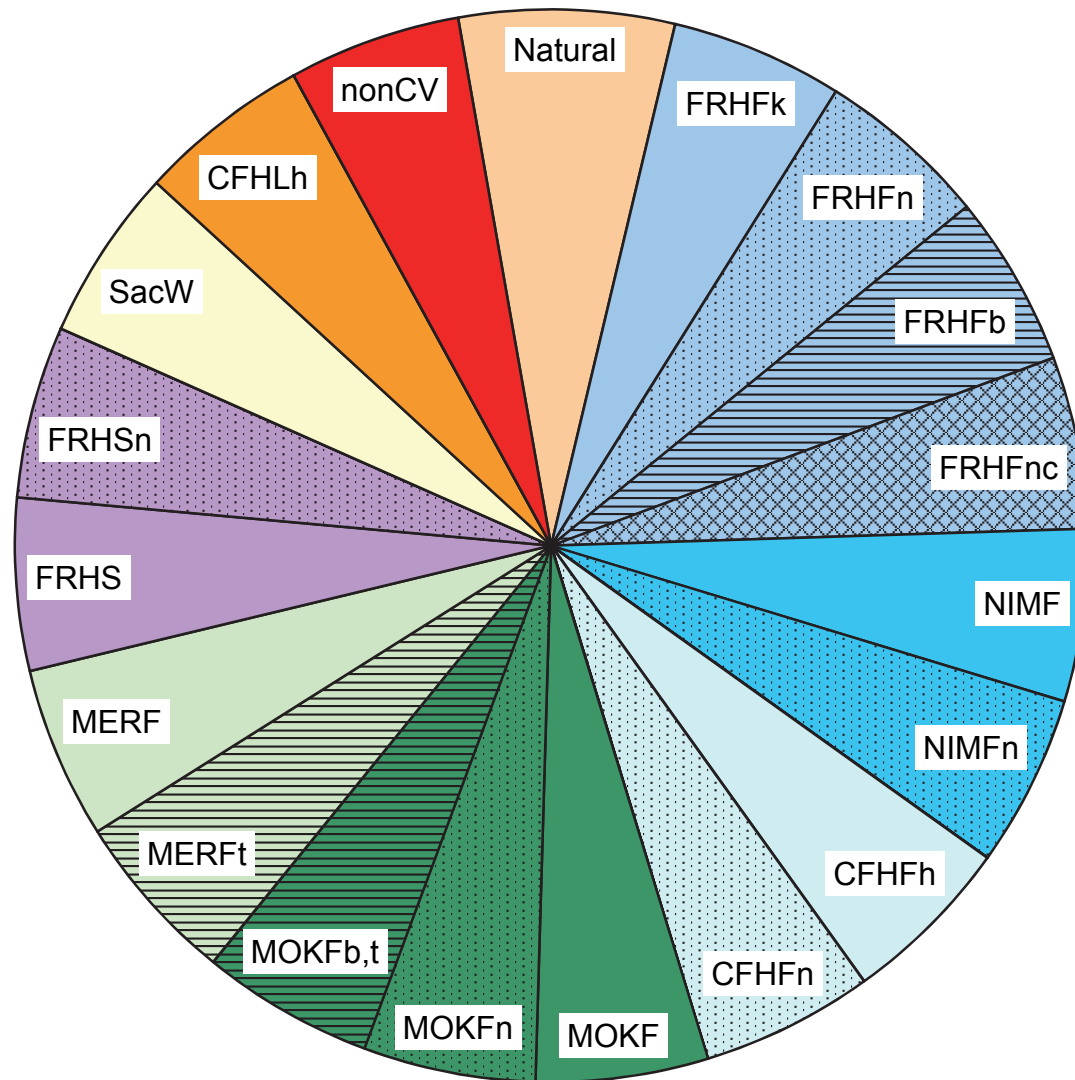
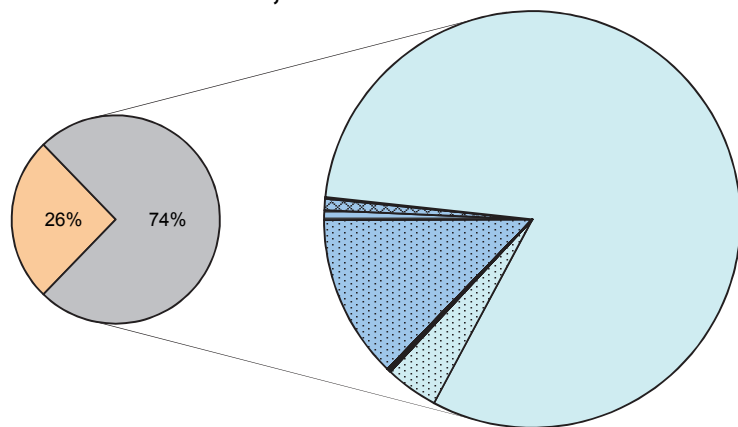
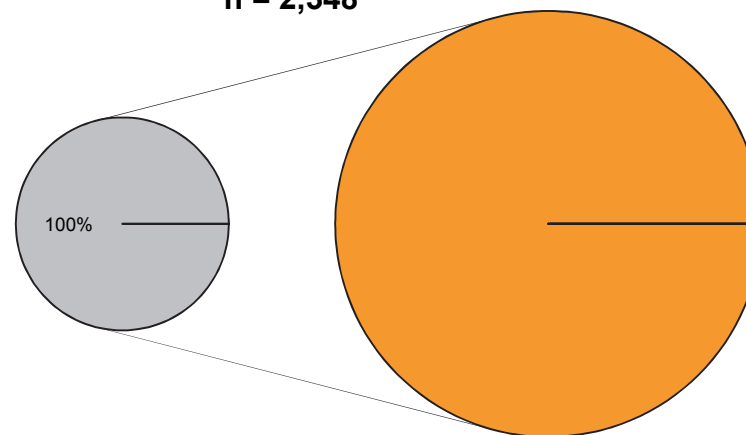


Figure 4. Color and pattern scheme used in all pie chart figures for Central Valley hatchery release types, brood years 2010-2013.

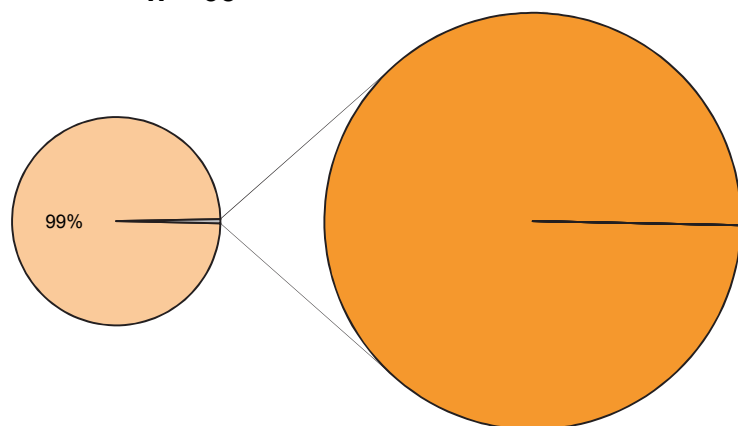
**Coleman National Fish Hatchery fall 2015**  
n = 15,724



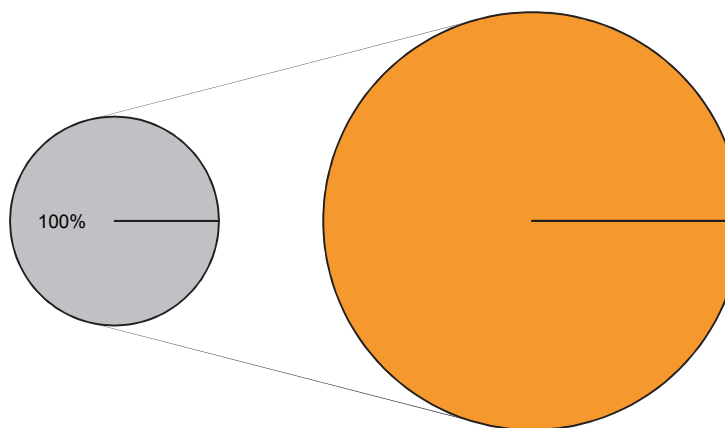
**Coleman National Fish Hatchery late-fall 2016**  
n = 2,348



**Keswick Dam Trap late-fall 2016**  
n = 65



**Battle Creek (above CNFH) late-fall 2016**  
n = 104

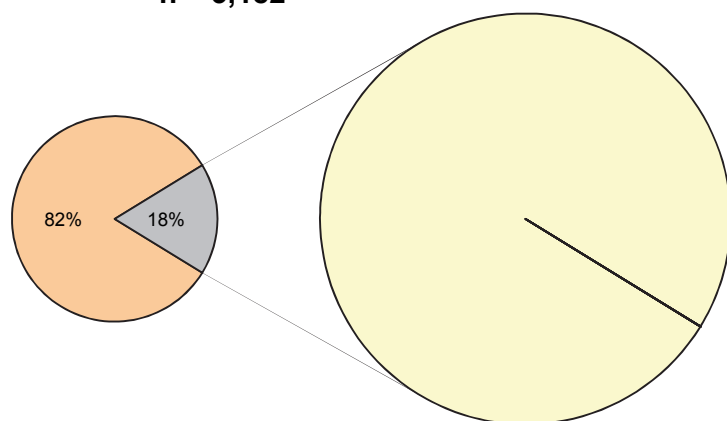


Natural FRHFk FRHFn FRHFb FRHFnc NIMF NIMFn CFHFh CFHFn MOKF  
 MOKFn MOKFb,t MERFt MERF FRHS FRHSn SacW CFHLh nonCV

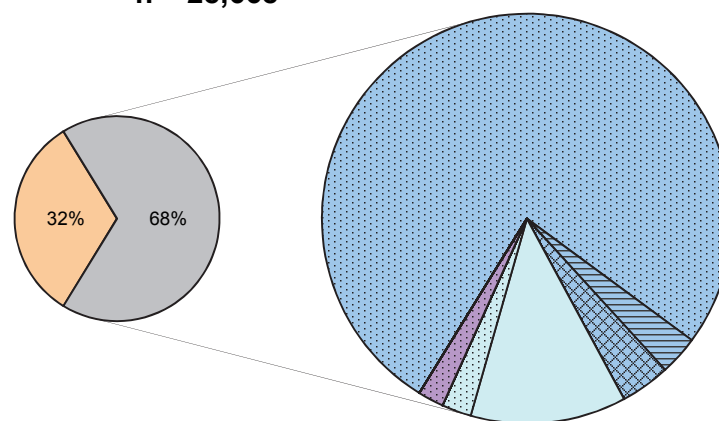
Figure 5. Proportion of hatchery- and natural-origin fish at Coleman National Fish Hatchery, 2015-16.



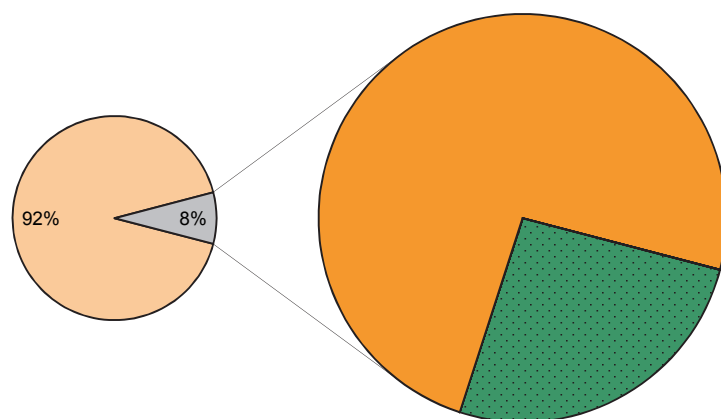
**Upper Sacramento River winter carcass**  
n = 3,182



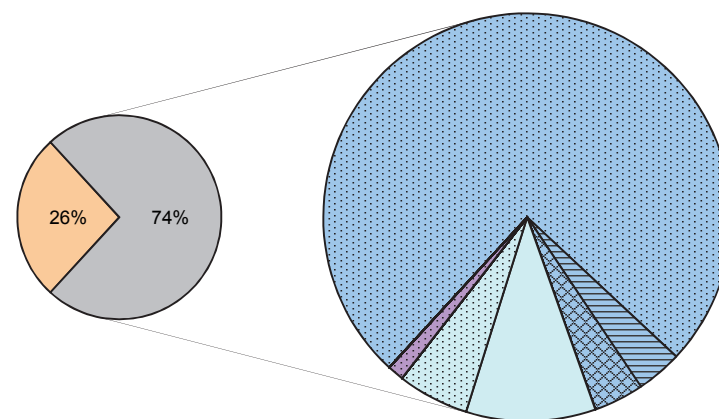
**Upper Sacramento River fall carcass**  
n = 28,668



**Upper Sacramento River late-fall carcass 2016**  
n = 3,085



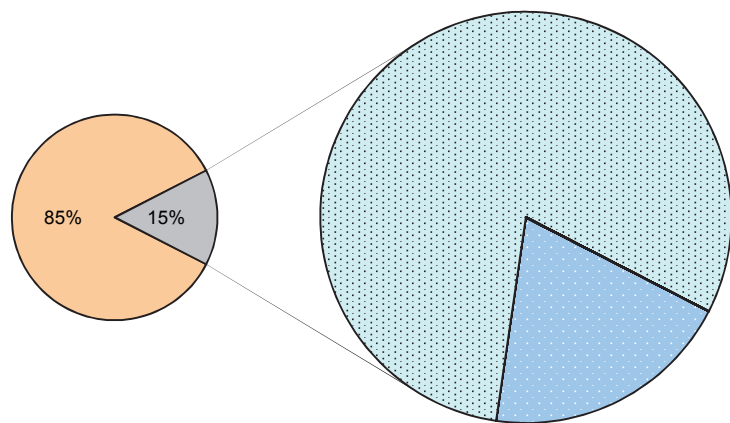
**Clear Creek fall carcass**  
n = 8,809



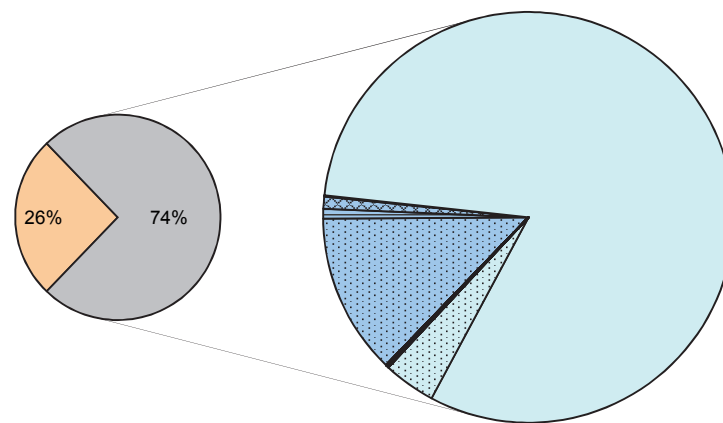
Natural FRHFK FRHFn FRHFb FRHFnc NIMF NIMFn CFHFh CFHFn MOKF  
 MOKFn MOKFb,t MERFt MERF FRHS FRHSn SacW CFHLh nonCV

Figure 6. Proportion of hatchery- and natural-origin fish in Upper Sacramento River & tributaries, 2015. (page 1 of 2)

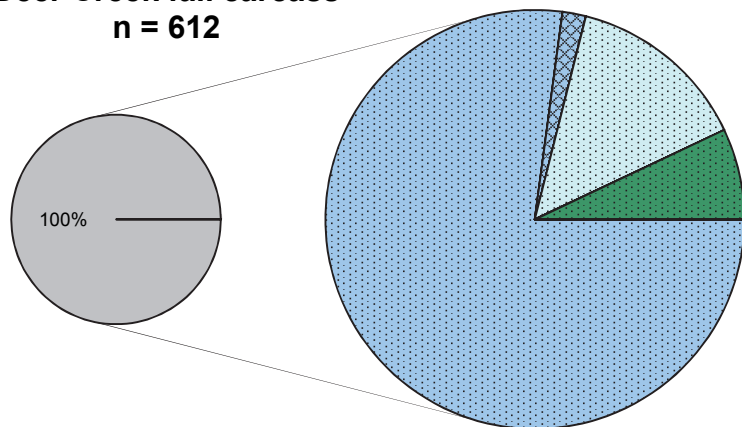
**Cottonwood Creek fall carcass**  
n = 604



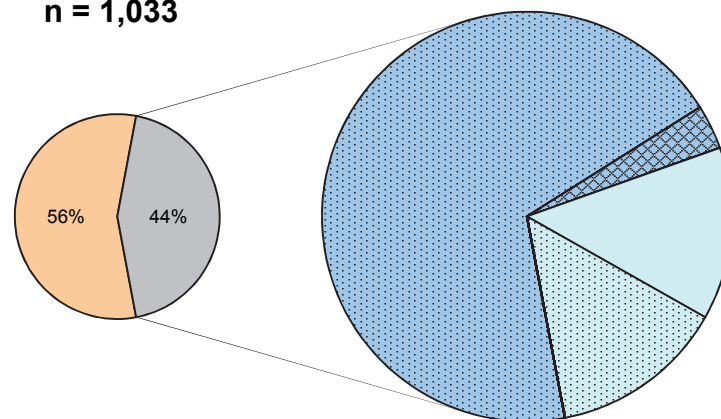
**Battle Creek fall spawners**  
n = 3,631



**Deer Creek fall carcass**  
n = 612



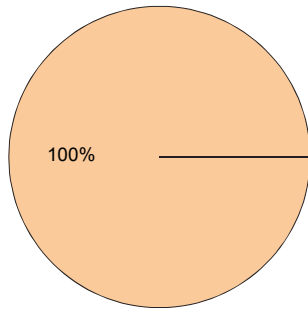
**Mill Creek fall carcass**  
n = 1,033



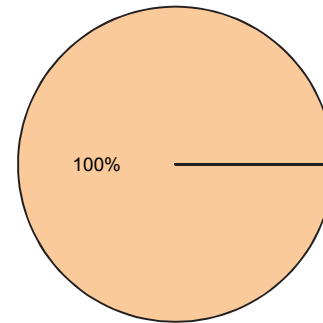
Natural FRHFn FRHFn FRHFn FRHFn NIMF NIMFn CFHFn CFHFn MOKF  
 MOKFn MOKFb,t MERFt MERF FRHS FRHSn SacW CFHLh nonCV

Figure 6. Proportion of hatchery- and natural-origin fish in Upper Sacramento River & tributaries, 2015. (page 2 of 2)

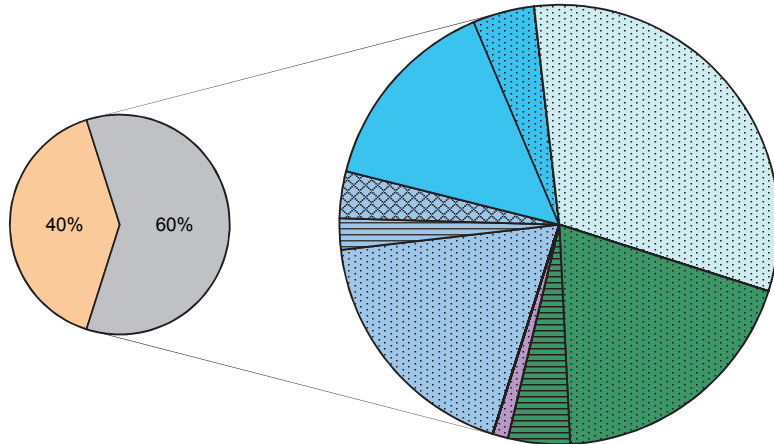
**Butte Creek Spring carcass**  
n = 5,083



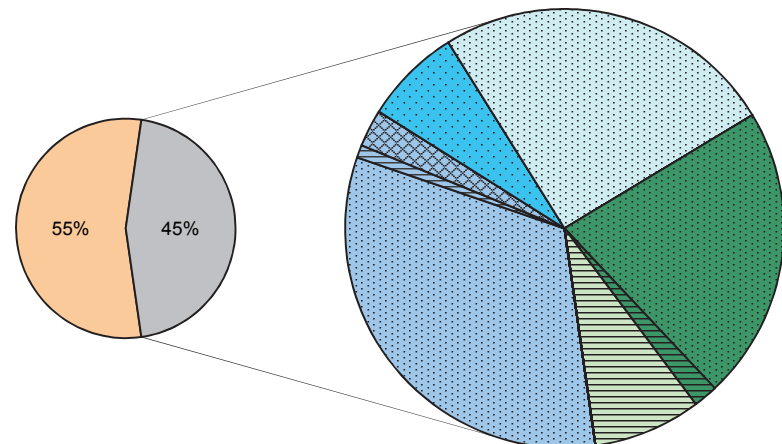
**Butte Creek fall carcass**  
n = 82



**Yuba River carcass (above DPD)**  
n = 4,981



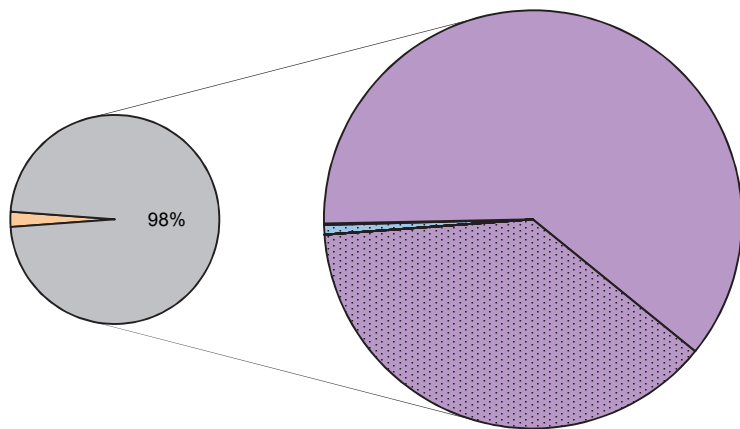
**Yuba River carcass (below DPD)**  
n = 2,569



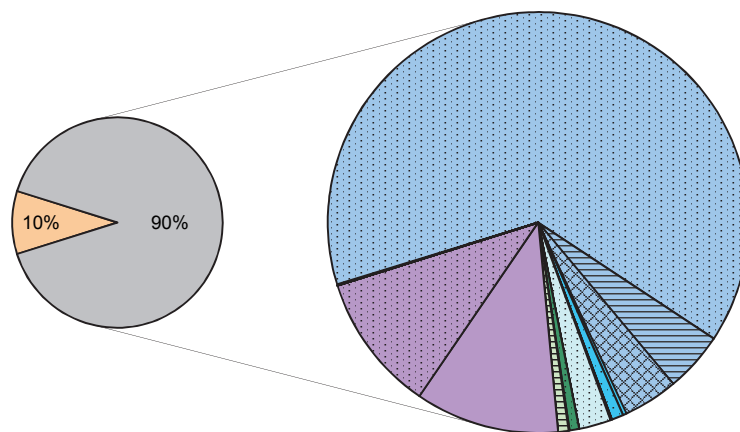
|         |         |       |       |        |       |       |       |       |      |
|---------|---------|-------|-------|--------|-------|-------|-------|-------|------|
| Natural | FRHFk   | FRHFh | FRHFb | FRHFnc | NIMF  | NIMFn | CFHFh | CFHFh | MOKF |
| MOKFn   | MOKFb,t | MERFt | MERF  | FRHS   | FRHSn | SacW  | CFHLh | nonCV |      |

Figure 7. Proportion of hatchery- and natural-origin fish in Butte Creek & Yuba River, 2015.

**Feather River Hatchery spring**  
n = 3,386



**Feather River Hatchery fall**  
n = 20,816



**Feather River fall carcass**  
n = 20,566

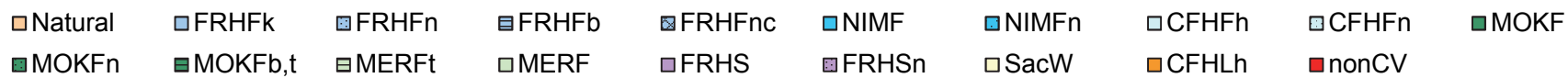
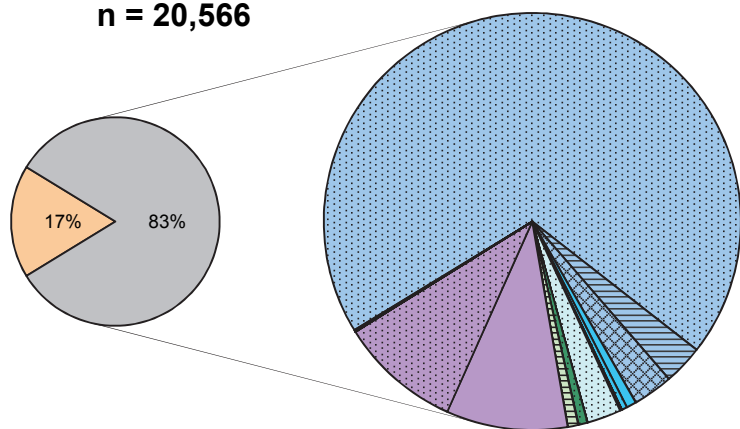
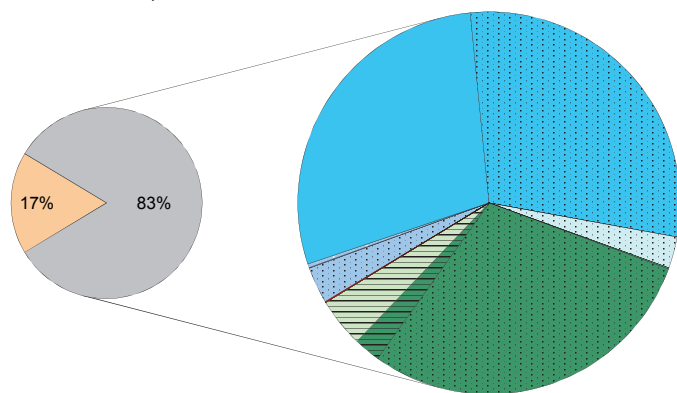
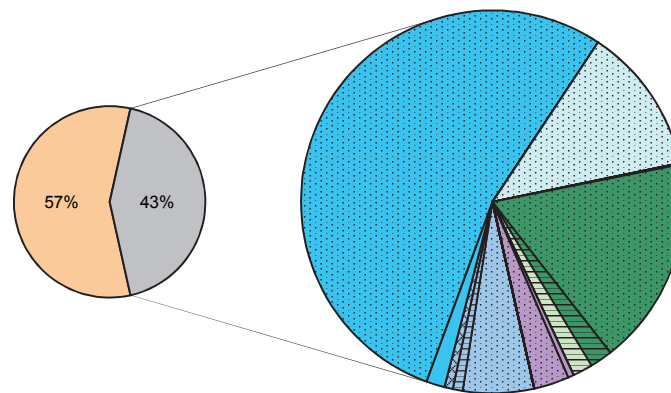


Figure 8. Proportion of hatchery- and natural-origin fish in the Feather River Basin, 2015.

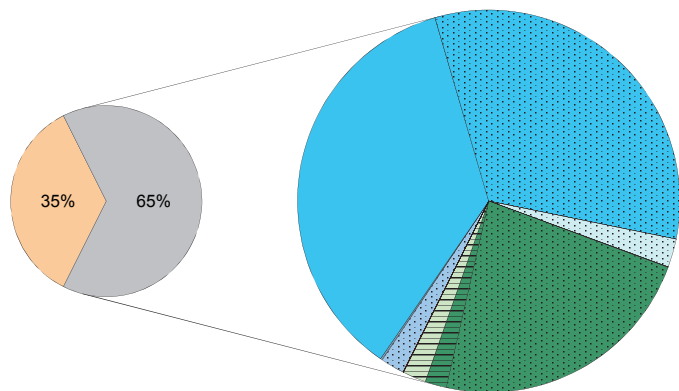
**Nimbus Hatchery fall**  
n = 9,822



**Nimbus Hatchery Weir**  
n = 1,946



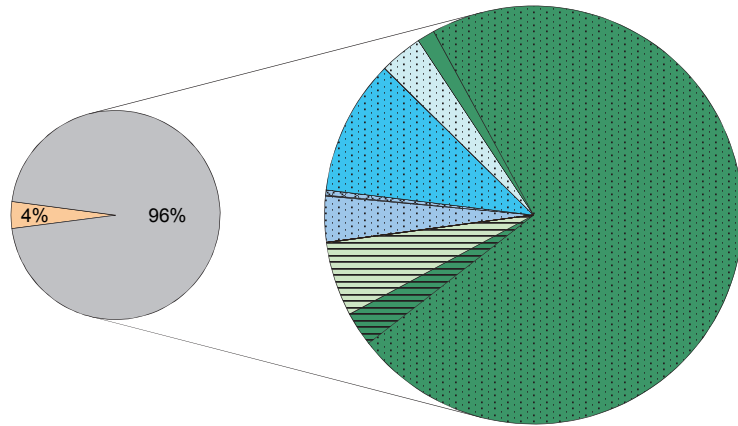
**American River fall carcass**  
n = 13,793



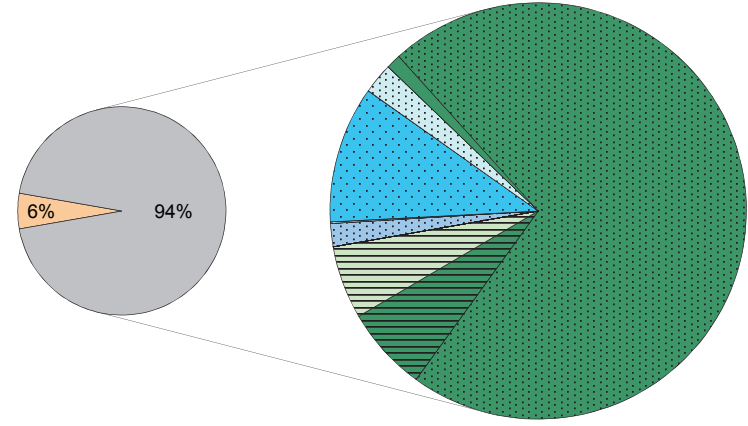
Natural   FRHFk   FRHFh   FRHFb   FRHFnc   NIMF   NIMFn   CFHFh   CFHFh   MOKF  
 MOKFn   MOKFb,t   MERFt   MERF   FRHS   FRHSn   SacW   CFHLh   nonCV

Figure 9. Proportion of hatchery- and natural-origin fish in the American River Basin, 2015.

**Mokelumne Hatchery fall**  
n = 8,298



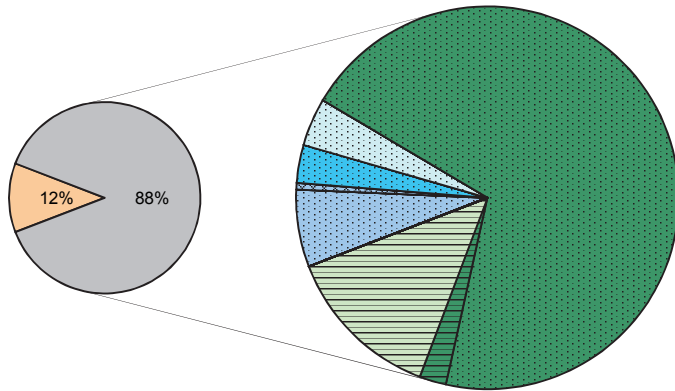
**Mokelumne River fall carcass**  
n = 4,581



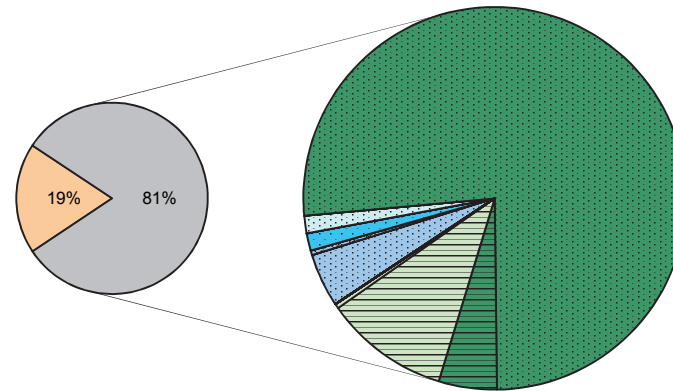
Natural
  FRHFk
  FRHFn
  FRHFb
  FRHFnc
  NIMF
  NIMFn
  CFHFh
  CFHFnc
  CFHFn
  MOKF
  MOKFb,t
  MERFt
  MERF
  FRHS
  FRHSn
  SacW
  CFHLh
  nonCV

Figure 10. Proportion of hatchery- and natural-origin fish in the Mokelumne River Basin, 2015.

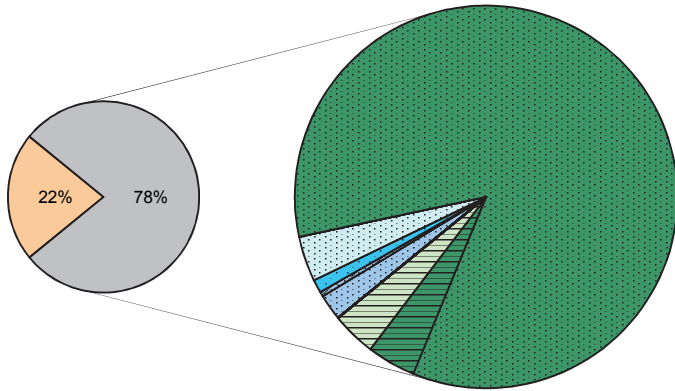
**Merced River Hatchery fall**  
n = 1,198



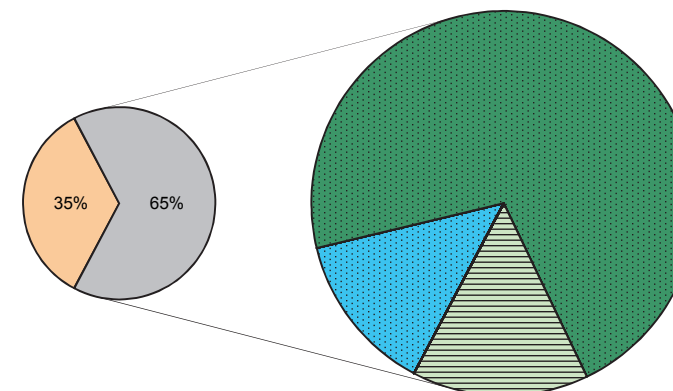
**Merced River fall carcass**  
n = 1,247



**Stanislaus River fall carcass**  
n = 6,136



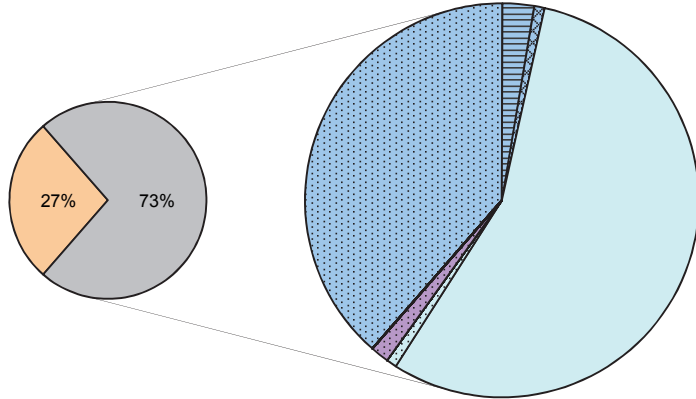
**Tuolumne River fall carcass**  
n = 113



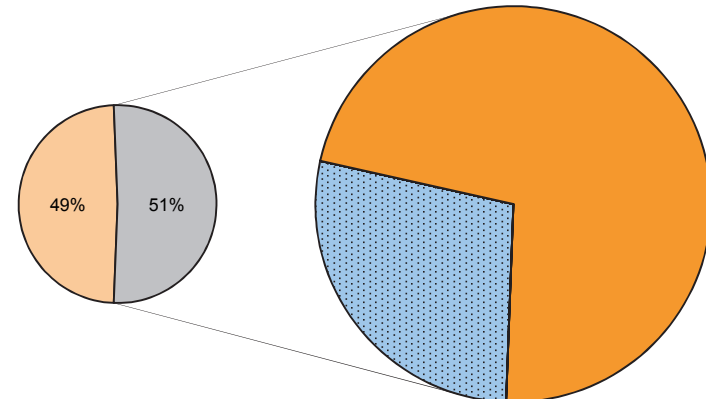
Natural   FRHFk   FRHFh   FRHFb   FRHFnc   NIMF   NIMFn   CFHFh   CFHFh   MOKF  
 MOKFn   MOKFb,t   MERFt   MERF   FRHS   FRHSn   SacW   CFHLh   nonCV

Figure 11. Proportion of hatchery- and natural-origin fish in Merced River & San Joaquin Basin tributaries, 2015.

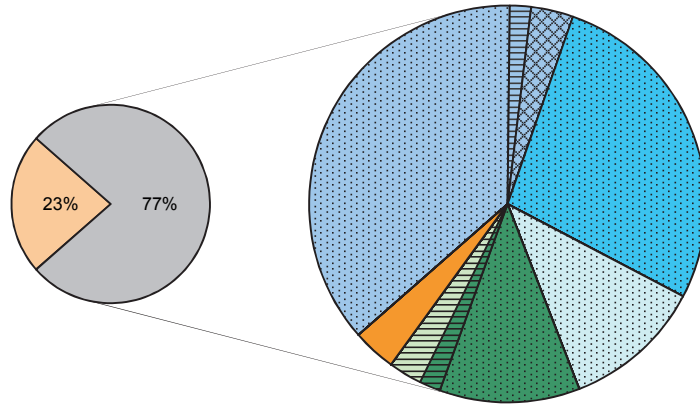
**Upper Sacramento River fall creel**  
n = 8,088



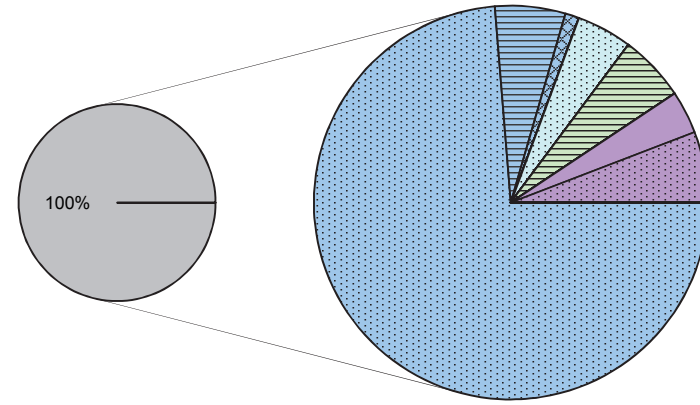
**Upper Sacramento River late-fall creel 2016**  
n = 252



**Lower Sacramento River fall creel**  
n = 6,205



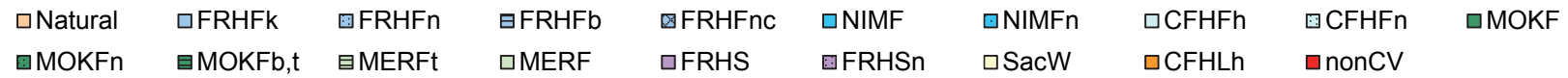
**Feather River fall creel**  
n = 1,906



Natural FRHFk FRHFfn FRHFb FRHFnc NIMF NIMFn CFHFh CFHFfn MOKF  
 MOKFn MOKFb,t MERFt MERF FRHS FRHSn SacW CFHLh nonCV

Figure 12. Proportion of hatchery- and natural-origin fish in sport harvest on Sacramento & Feather rivers, 2015.





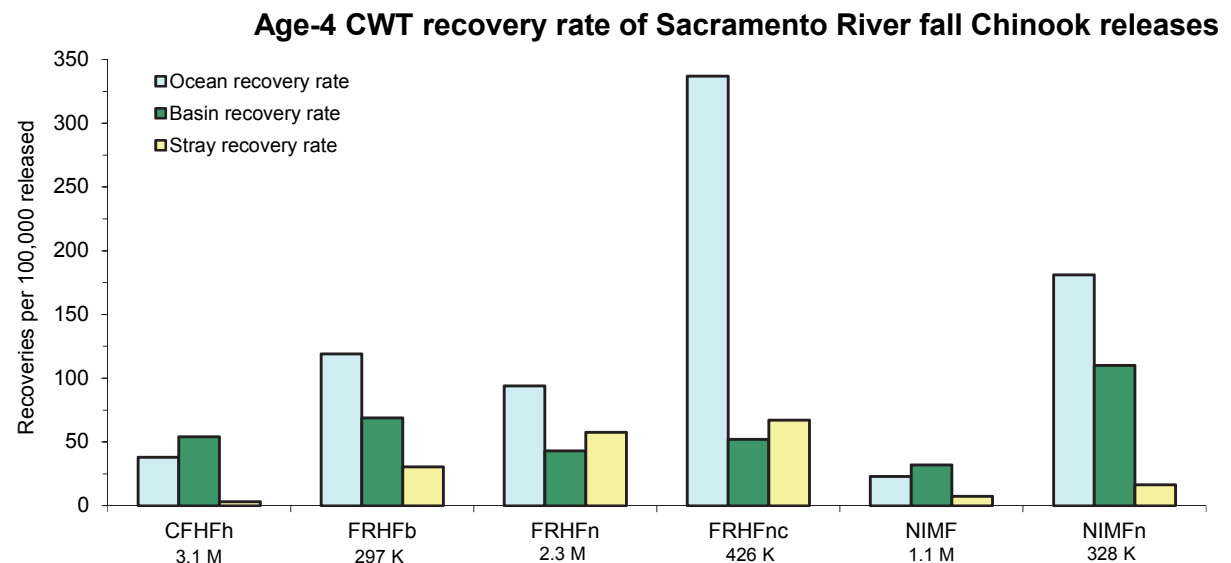
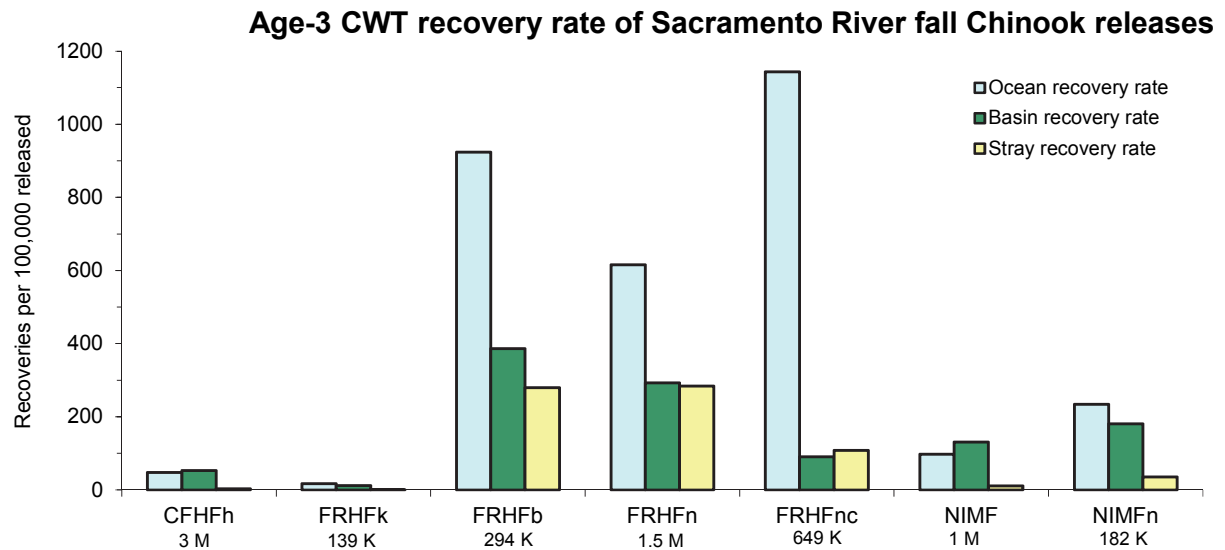
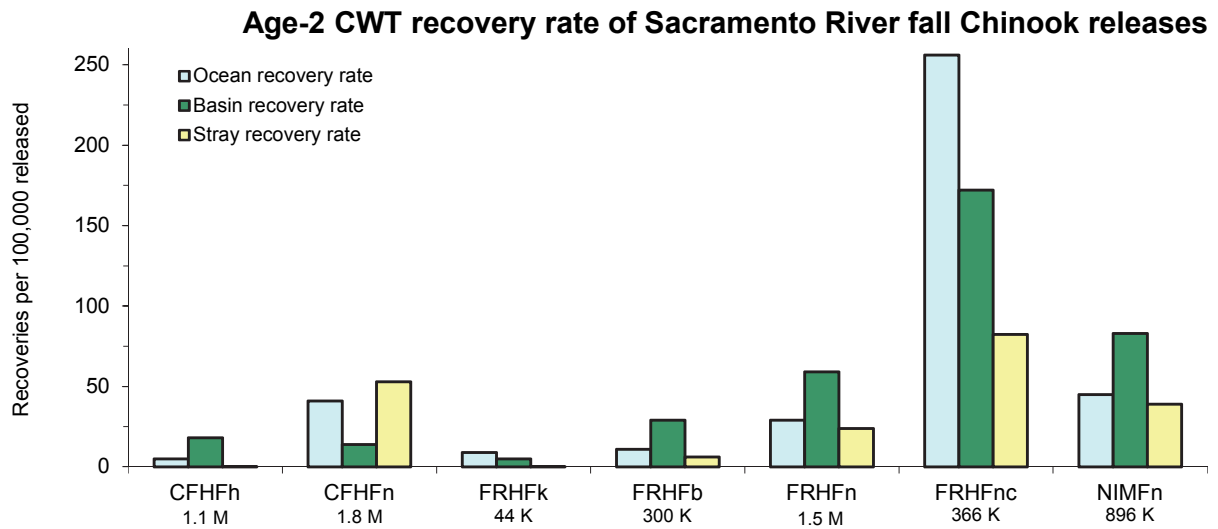
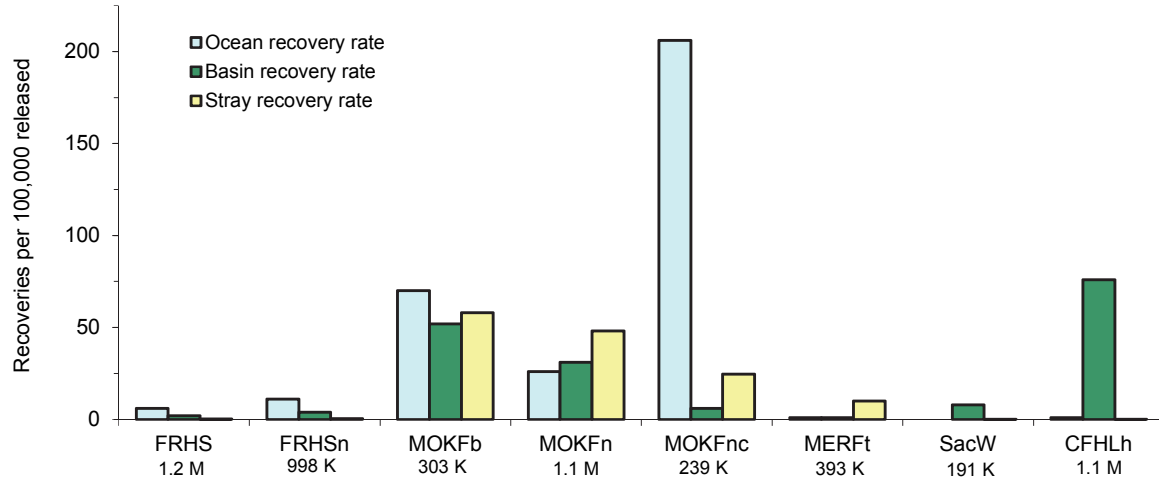
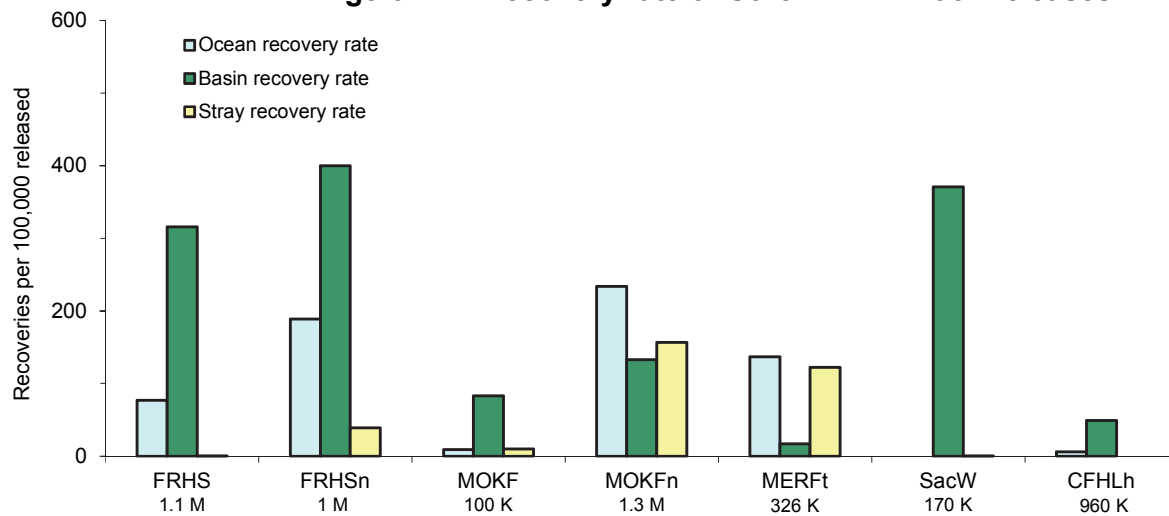


Figure 14. CWT recovery rates of Sacramento River fall Chinook releases by age in 2015.

### Age-2 CWT recovery rate of Other CV Chinook releases



### Age-3 CWT recovery rate of Other CV Chinook releases



### Age-4 CWT recovery rate of Other CV Chinook releases

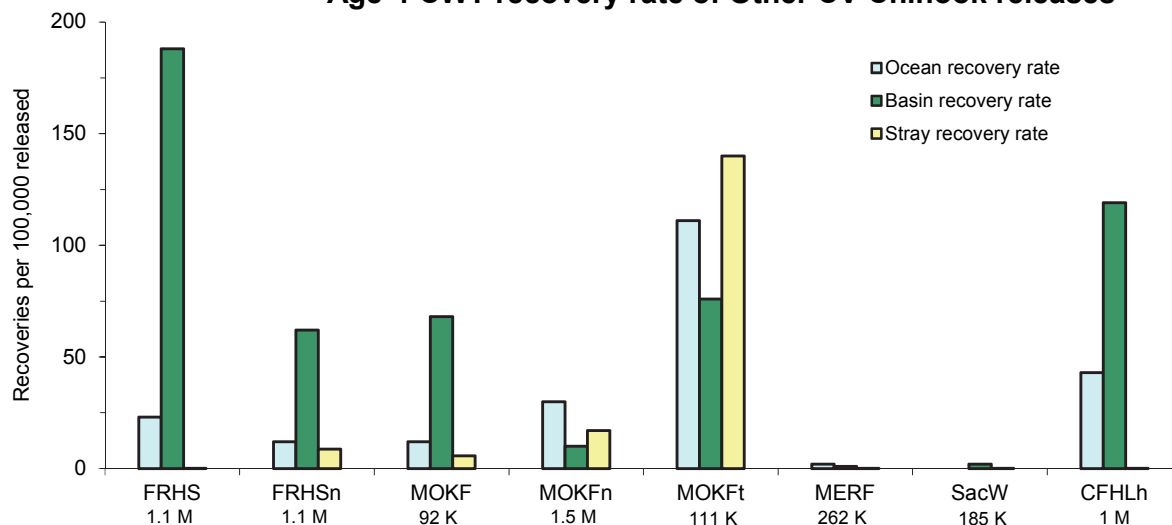
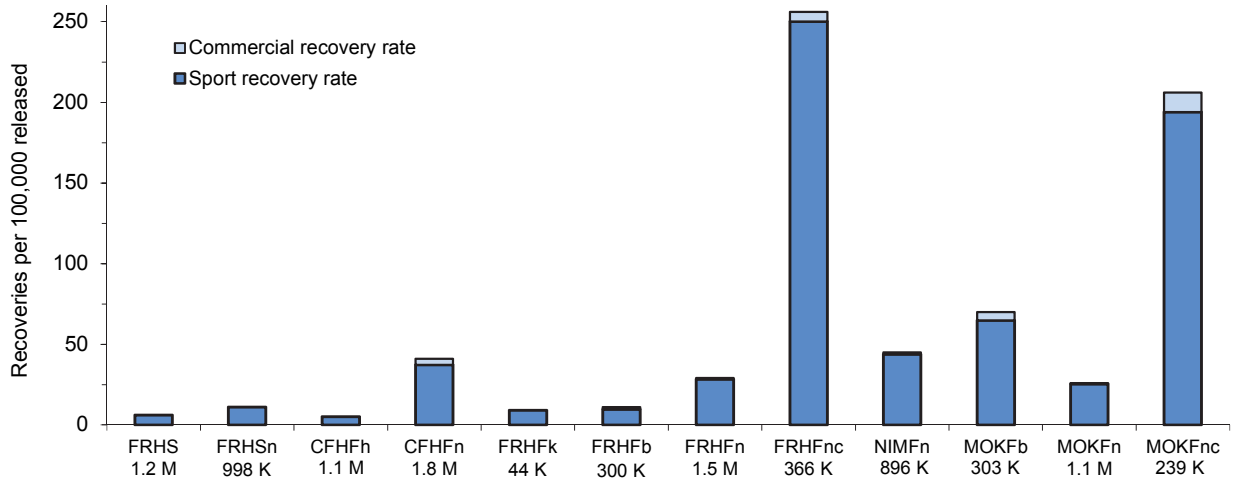
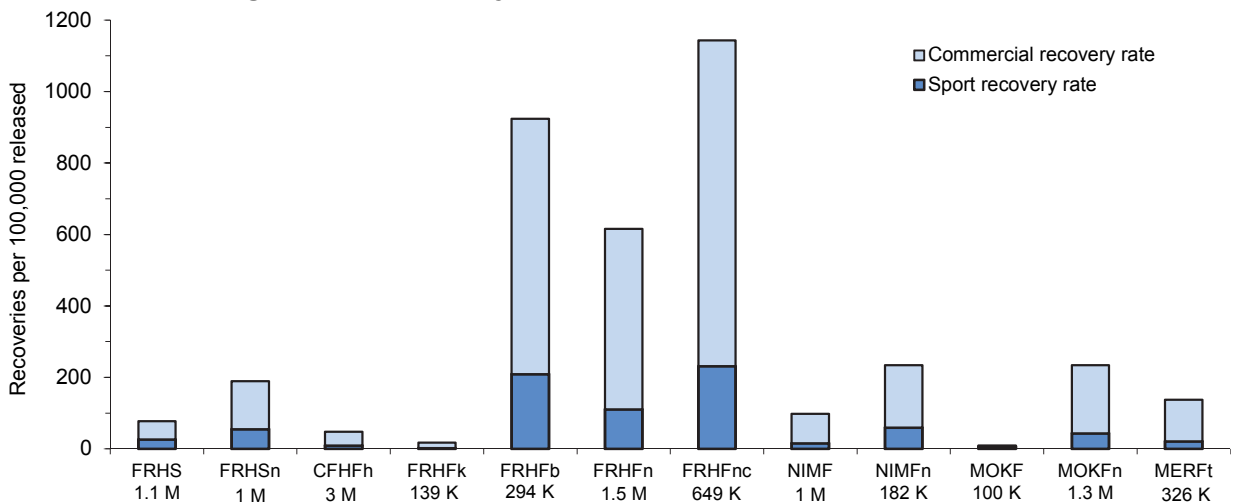


Figure 15. CWT recovery rates of Other CV Chinook releases by age in 2015.

### 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

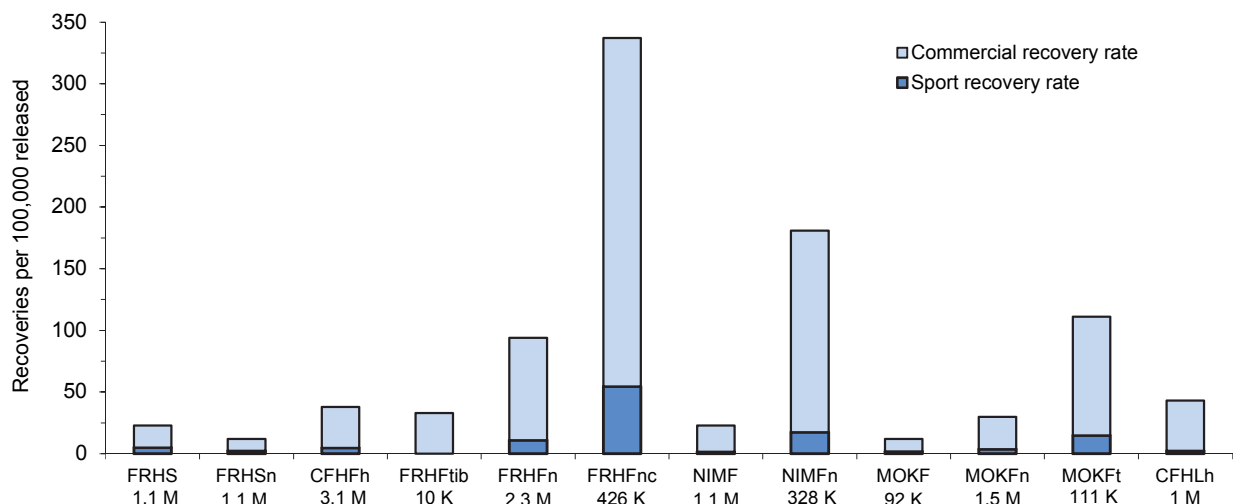
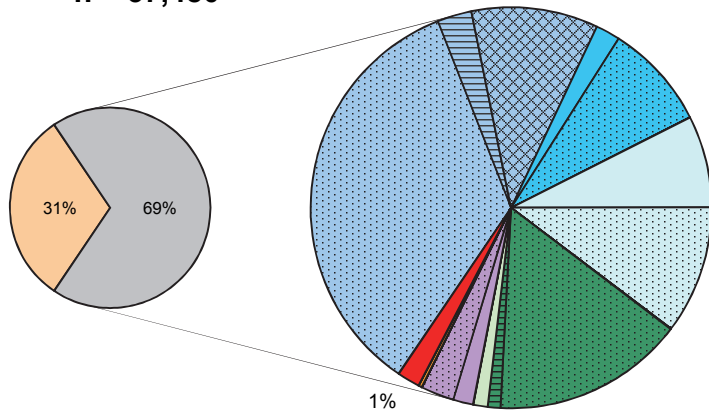
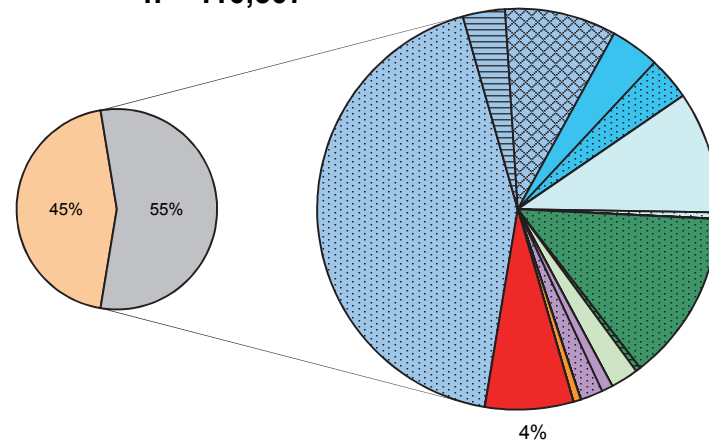


Figure 16. CWT recovery rates by release type in 2015 Ocean Salmon Fisheries.

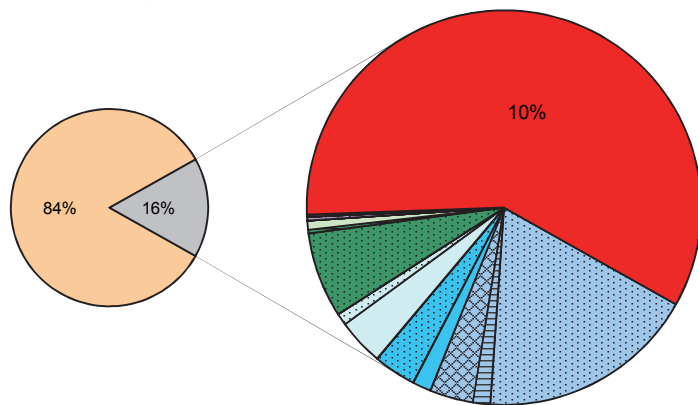
**California Sport Harvest**  
n = 37,480



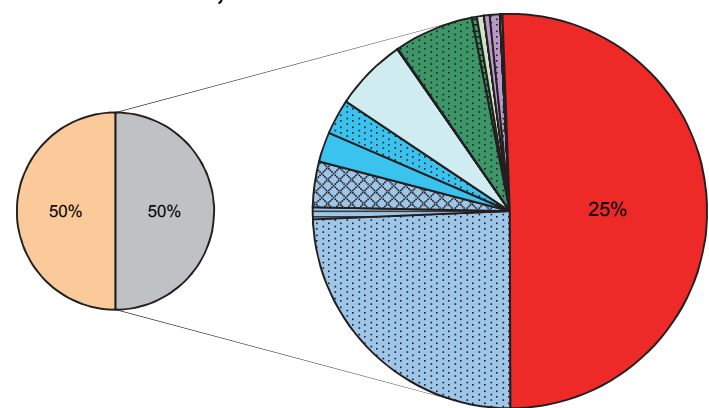
**California Commercial Harvest**  
n = 110,507



**Oregon Sport Harvest**  
n = 6,685



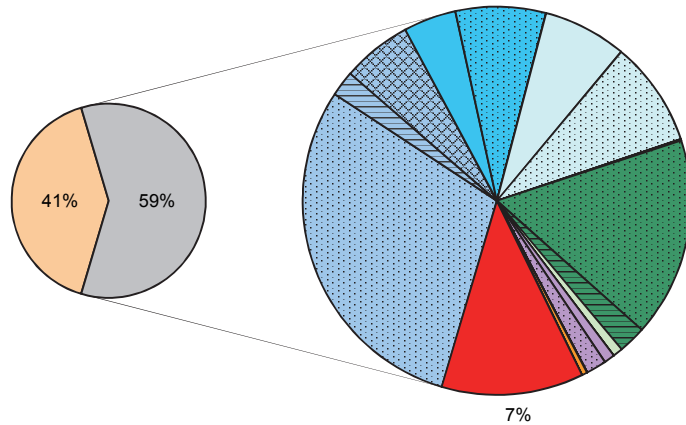
**Oregon Commercial Harvest**  
n = 93,377



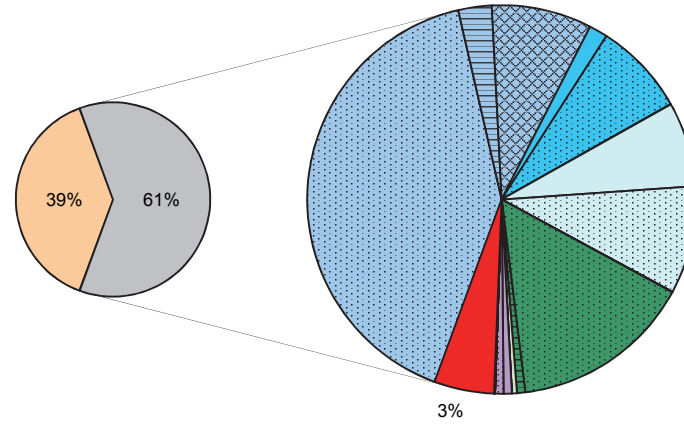
Natural FRHFK FRHFN FRHFB FRHFNC NIMF NIMFN CFHFH CFHFN MOKF  
 MOKFN MOKFB,t MERFt MERF FRHS FRHSn SacW CFHLh nonCV

Figure 17. Proportion of hatchery- and natural-origin salmon in 2015 California and Oregon ocean fisheries.

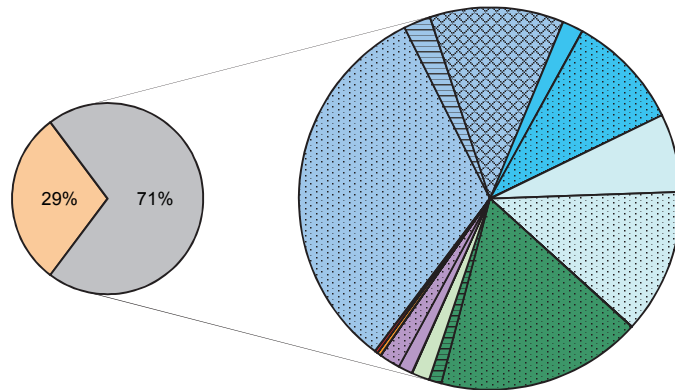
**Eureka / Crescent City Sport**  
n = 3,690



**Fort Bragg Sport**  
n = 5,493



**San Francisco Sport**  
n = 25,227



**Monterey Sport**  
n = 3,070

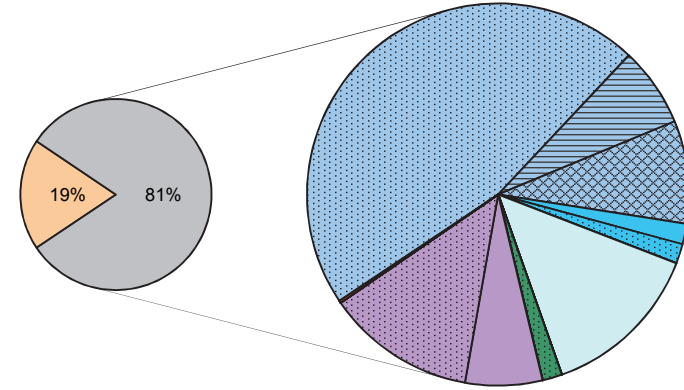
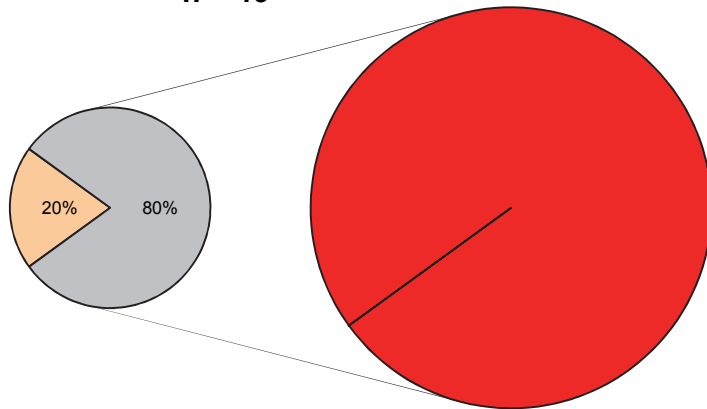
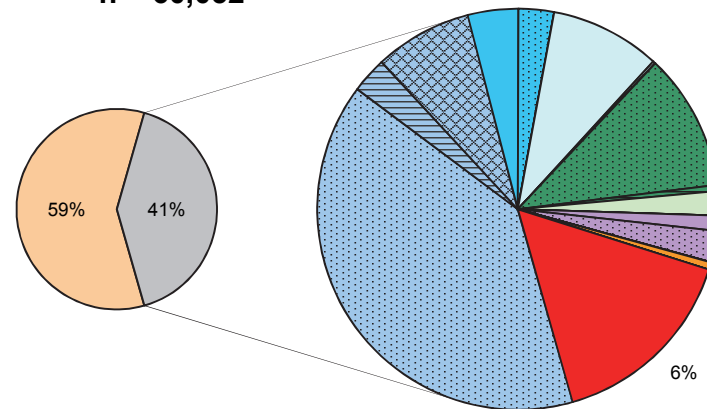


Figure 18. Proportion of hatchery- and natural-origin salmon in the 2015 California ocean sport fishery.

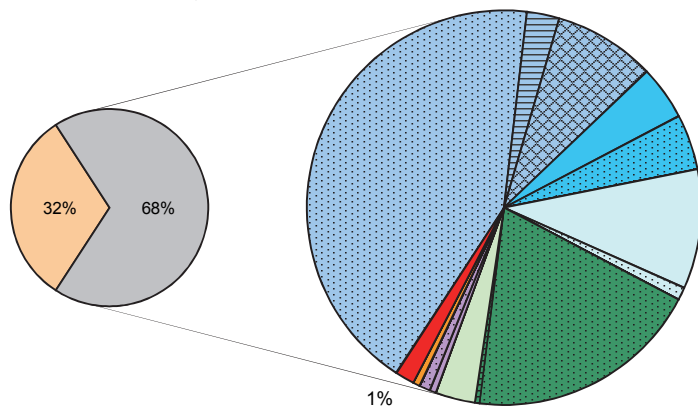
**Eureka / Crescent City Commercial**  
n = 46



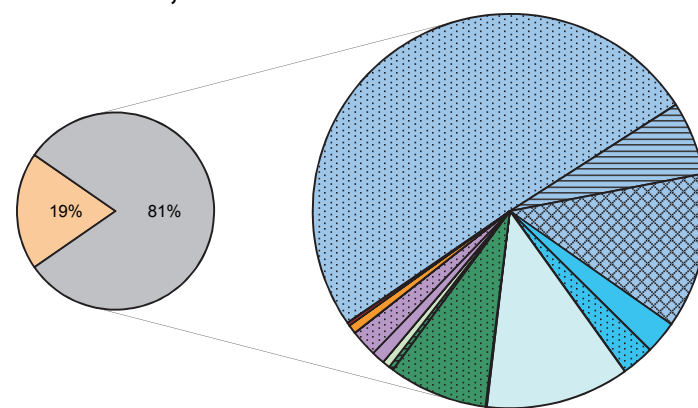
**Fort Bragg Commercial**  
n = 60,052



**San Francisco Commercial**  
n = 35,696



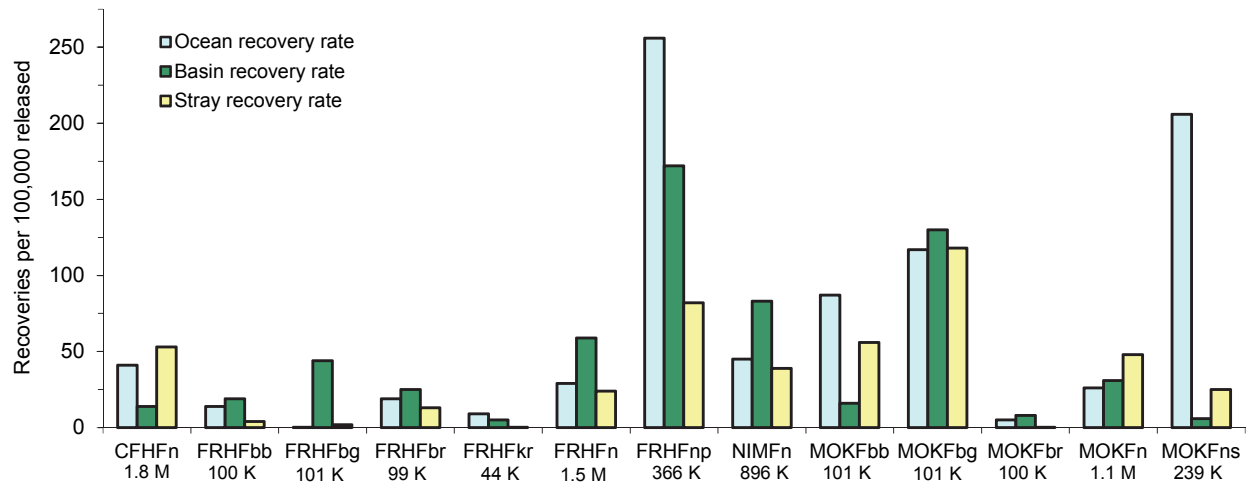
**Monterey Commercial**  
n = 14,713



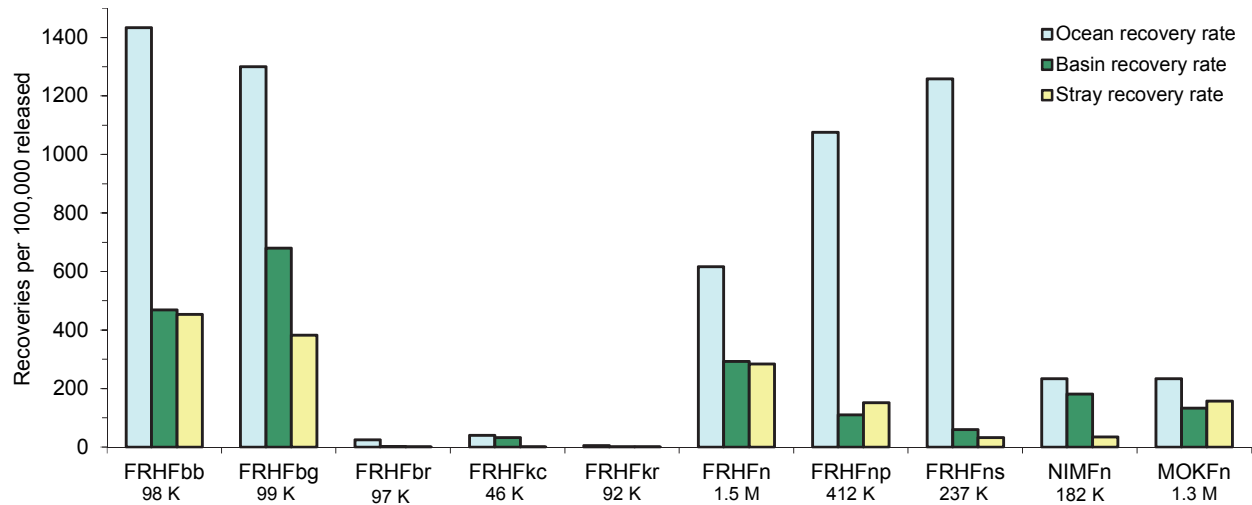
Natural   FRHFk   FRHFh   FRHFb   FRHFnc   NIMF   NIMFn   CFHFh   CFHFh   MOKF  
 MOKFn   MOKFb,t   MERFt   MERF   FRHS   FRHSn   SacW   CFHLh   nonCV

Figure 19. Proportion of hatchery- and natural-origin salmon in the 2015 California ocean commercial fishery.

### Age-2 CWT recovery rate of Experimental & Net Pen releases



### Age-3 CWT recovery rate of Experimental & Net Pen releases



### Age-4 CWT recovery rate of Experimental & Net Pen releases

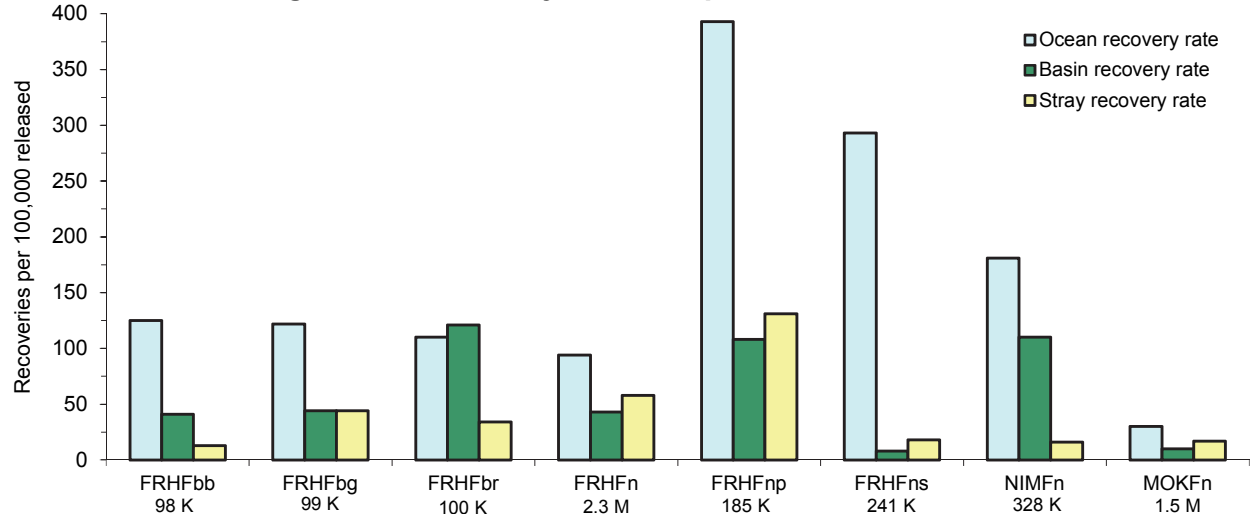


Figure 20. CWT recovery rates of Experimental and Net Pen releases by age in 2015.



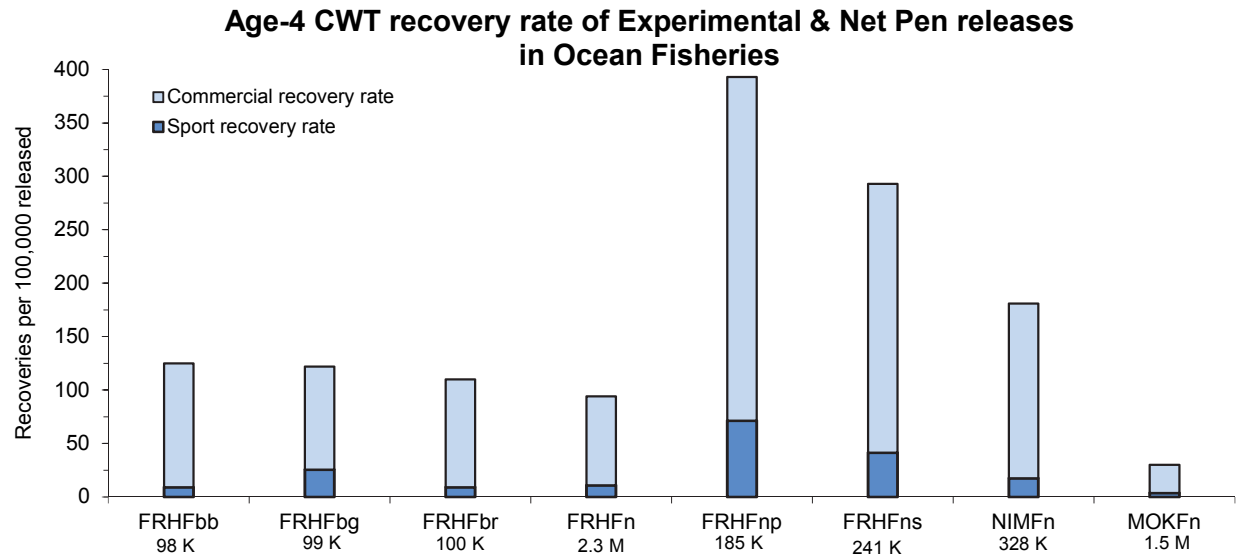
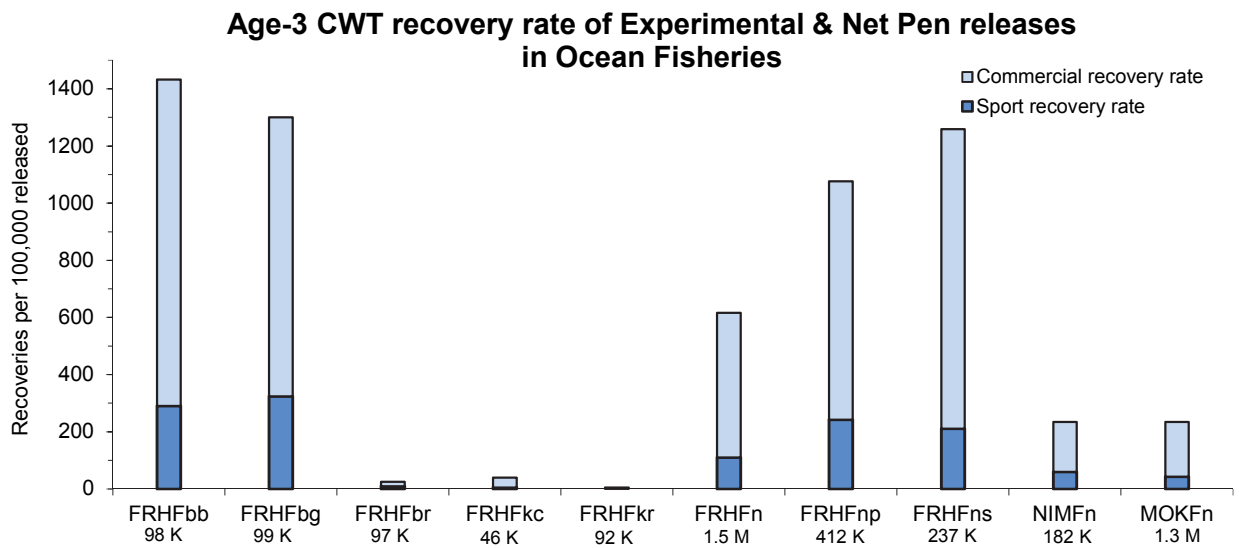
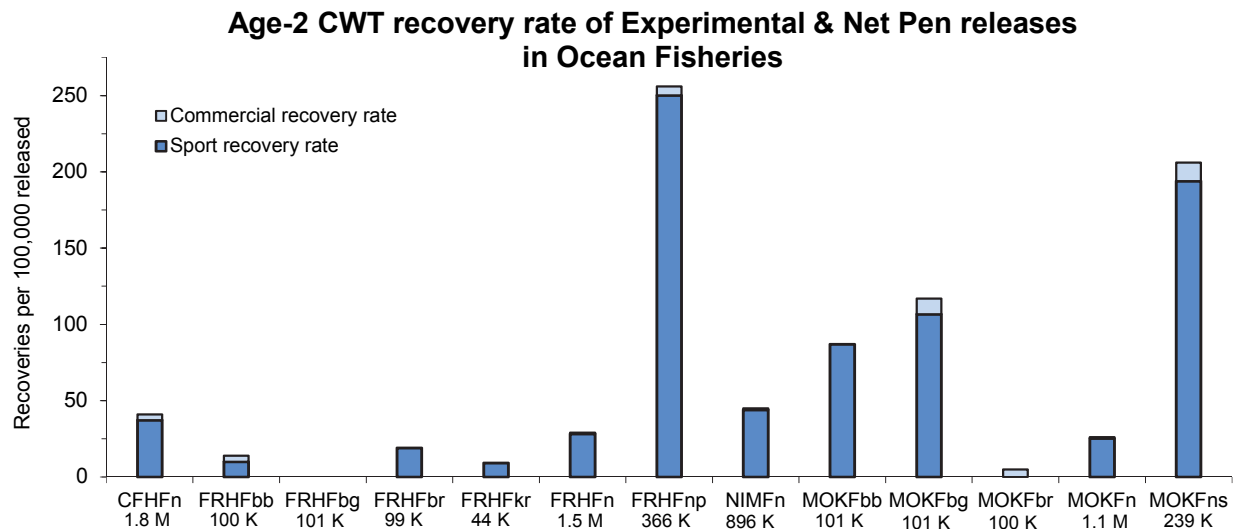


Figure 21. CWT recovery rates of Experimental and Net Pen releases in 2015 ocean sport and commercial fisheries

## Appendix 1. Sample expansion factors for Central Valley salmon carcass surveys collecting fish condition in 2015. (page 1 of 2)

### Upper Sacramento River fall-run Chinook salmon carcass survey

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$   | $p_{cwt adc}$ | $F_{samp}$   | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|---------------|--------------|-------------------|------------------------------|---------------|
| fresh 22%    |                 | 708                    | 2.5%           | 154                  | 154                   | 151               | 151           | <b>0.22</b> | <b>0.98</b>   | 40.49        | 3.17              | 19,374                       | 67.6%         |
| nonfresh 78% |                 | 2,467                  | 8.6%           | 251                  | 250                   | 240               | 230           | 0.10        | 0.96          |              |                   |                              |               |
| total        | <b>28,668</b>   | 3,175                  | 11.1%          | 405                  | 404                   | 391               | <b>381</b>    |             |               | <b>16.05</b> | <b>3.17</b>       | 19,374                       | <b>67.6%</b>  |

### Clear Creek fall-run Chinook salmon carcass survey

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$   | $p_{cwt adc}$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|---------------|-------------|-------------------|------------------------------|---------------|
| fresh 30%    |                 | 539                    | 6.1%           | 130                  | 129                   | 124               | 114           | <b>0.24</b> | <b>0.96</b>   | 17.91       | 3.18              | 6,488                        | 73.7%         |
| nonfresh 70% |                 | 1,239                  | 14.1%          | 141                  | 141                   | 136               | 132           | 0.11        | 0.96          |             |                   |                              |               |
| total        | <b>8,809</b>    | 1,778                  | 20.2%          | 271                  | 270                   | 260               | <b>246</b>    |             |               | <b>8.30</b> | <b>3.18</b>       | 6,488                        | <b>73.7%</b>  |

### Mill Creek fall-run Chinook salmon carcass survey

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$   | $p_{cwt adc}$ | $F_{samp}$   | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|---------------|--------------|-------------------|------------------------------|---------------|
| fresh 53%    |                 | 33                     | 3.2%           | 5                    | 5                     | 4                 | 4             | <b>0.15</b> | <b>0.80</b>   | 31.30        | 3.64              | 455                          | 44.0%         |
| nonfresh 47% |                 | 29                     | 2.8%           | 4                    | 4                     | 4                 | 4             | 0.14        | 1.00          |              |                   |                              |               |
| total        | <b>1,033</b>    | 62                     | 6.0%           | 9                    | 9                     | 8                 | <b>8</b>      |             |               | <b>15.65</b> | <b>3.64</b>       | 455                          | <b>44.0%</b>  |

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

| Condition  | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$   | $p_{cwt adc}$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|---------------|-------------|-------------------|------------------------------|---------------|
| fresh 100% |                 | 3,578                  | 17.4%          | 1,323                | 1,323                 | 1,279             | 1,238         | <b>0.37</b> | <b>0.97</b>   | 5.94        | 2.31              | 16,978                       | 82.6%         |
| nonfresh   |                 |                        |                |                      |                       |                   |               |             |               |             |                   |                              |               |
| total      | <b>20,566</b>   | 3,578                  | 17.4%          | 1,323                | 1,323                 | 1,279             | <b>1,238</b>  |             |               | <b>5.94</b> | <b>2.31</b>       | <b>16,978</b>                | <b>82.6%</b>  |

### Lower Yuba River (below DPD) fall-run Chinook salmon carcass survey

| Condition  | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$   | $p_{cwt adc}$ | $F_{samp}$   | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|---------------|--------------|-------------------|------------------------------|---------------|
| fresh 100% |                 | 237                    | 9.2%           | 35                   | 35                    | 31                | 31            | <b>0.15</b> | <b>0.89</b>   | 10.84        | 3.48              | 1,168                        | 45.5%         |
| random 0%  |                 | 1                      |                | 1                    | 1                     | 1                 | 1             |             |               |              |                   |                              |               |
| total      | <b>2,569</b>    | 237                    | 9.2%           | 36                   | 36                    | 32                | <b>32</b>     |             |               | <b>10.50</b> | <b>3.48</b>       | <b>1,168</b>                 | <b>45.5%</b>  |

## Appendix 1. Sample expansion factors for Central Valley salmon carcass surveys collecting fish condition in 2015. (page 2 of 2)

### Lower American River fall-run Chinook salmon carcass survey

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p\_adc$    | $p\_cwt adc$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|--------------|-------------|-------------------|------------------------------|---------------|
| fresh 9%     |                 | 714                    | 5.2%           | 134                  | 134                   | 127               | 122           | <b>0.19</b> | <b>0.95</b>  | 20.11       | 3.66              | 8,972                        | 65.0%         |
| nonfresh 91% |                 | 6,802                  | 49.3%          | 1,240                | 1,108                 | 1,010             | 978           | 0.18        | 0.91         |             |                   |                              |               |
| total        | <b>13,793</b>   | 7,516                  | 54.5%          | 1,374                | 1,242                 | 1,137             | <b>1,100</b>  |             |              | <b>2.23</b> | <b>3.66</b>       | <b>8,972</b>                 | <b>65.0%</b>  |

### Merced River fall-run Chinook salmon carcass survey

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p\_adc$    | $p\_cwt adc$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|--------------|-------------|-------------------|------------------------------|---------------|
| fresh 63%    |                 | 277                    | 22.2%          | 60                   | 60                    | 58                | 55            | <b>0.22</b> | <b>0.97</b>  | 4.75        | 3.89              | 1,014                        | 81.3%         |
| nonfresh 37% |                 | 166                    | 13.3%          | 15                   | 15                    | 15                | 14            | 0.09        | 1.00         |             |                   |                              |               |
| total        | <b>1,247</b>    | 443                    | 35.5%          | 75                   | 75                    | 73                | <b>69</b>     |             |              | <b>3.78</b> | <b>3.89</b>       | <b>1,014</b>                 | <b>81.3%</b>  |

### Stanislaus River fall-run Chinook salmon carcass survey

| Condition  | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p\_adc$    | $p\_cwt adc$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|--------------|-------------|-------------------|------------------------------|---------------|
| fresh 100% |                 | 794                    | 12.9%          | 163                  | 163                   | 161               | 153           | <b>0.21</b> | <b>0.99</b>  | 8.13        | 3.85              | 4,797                        | 78.2%         |
| weir CWTs  |                 |                        |                | 37                   | 37                    | 37                | 37            |             |              |             |                   |                              |               |
| total      | <b>6,136</b>    | 794                    | 12.9%          | 200                  | 200                   | 198               | <b>190</b>    |             |              | <b>6.55</b> | <b>3.85</b>       | <b>4,797</b>                 | <b>78.2%</b>  |

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p\_adc$    | $p\_cwt adc$ | $F_{samp}$  | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|--------------|-------------|-------------------|------------------------------|---------------|
| fresh 47%    |                 | 502                    | 15.8%          | 100                  | 100                   | 82                | 82            | <b>0.20</b> | <b>0.82</b>  | 6.34        | 1.07              | 558                          | 17.5%         |
| nonfresh 53% |                 | 574                    | 18.0%          | 95                   | 94                    | 79                | 79            | 0.17        | 0.84         |             |                   |                              |               |
| total        | <b>3,182</b>    | 1,076                  | 33.8%          | 195                  | 194                   | 161               | <b>161</b>    |             |              | <b>3.23</b> | <b>1.07</b>       | <b>558</b>                   | <b>17.5%</b>  |

### Upper Sacramento River late-fall-run Chinook salmon carcass survey 2016

| Condition    | Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p\_adc$    | $p\_cwt adc$ | $F_{samp}$   | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|--------------|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|-------------|--------------|--------------|-------------------|------------------------------|---------------|
| fresh 23%    |                 | 145                    | 4.7%           | 9                    | 9                     | 9                 | 8             | <b>0.06</b> | <b>1.00</b>  | 23.94        | 1.31              | 251                          | 8.1%          |
| nonfresh 77% |                 | 492                    | 15.9%          | 7                    | 7                     | 6                 | 5             | 0.01        | 0.86         |              |                   |                              |               |
| total        | <b>3,085</b>    | 637                    | 20.6%          | 16                   | 16                    | 15                | <b>13</b>     |             |              | <b>14.73</b> | <b>1.31</b>       | <b>251</b>                   | <b>8.1%</b>   |

$p\_adc$  = proportion of sampled fish that were ad-clipped;  $p\_cwt|adc$  = proportion of ad-clipped fish containing CWTs

**Appendix 2. Alternative 2015 CWT recovery and stray rates (recoveries per 100,000 CWTs released) of CFH and FRH releases.<sup>a/</sup>**

**Age 2 CWT recoveries**

| Release type | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |     |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|--------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-----|-----|-----|-----|-----|----|-------------------------------|-------|----------|------------|---------------------------|---------------------------------|-------|----------|-------|
|              |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |            |                           | In-basin                        | Stray | CV total | Ocean |
| CFHFh        | 2013       | Fall     | 1,125,706    | 201                                                             |        |                        |     |     |     |     |     |    | 201                           | 0     | 201      | 0%         | 61                        | 18                              | 0     | 18       | 5     |
| CFHFh        | 2013       | Fall     | 1,810,972    | 147                                                             | 112    | 138                    | 228 | 309 | 134 | 91  | 14  | 46 | 147                           | 1,073 | 1,220    | 88%        | 736                       | 8                               | 59    | 67       | 41    |
| CFHLh        | 2014       | Late     | 1,056,322    | 789                                                             | 15     |                        |     |     |     | 1   |     |    | 789                           | 16    | 805      | 2%         | 7                         | 75                              | 1     | 76       | 1     |
| FRHFk        | 2013       | Fall     | 44,127       |                                                                 |        |                        | 2   |     |     |     |     |    | 2                             | 0     | 2        | 0%         | 4                         | 5                               | 0     | 5        | 9     |
| FRHFtib      | 2013       | Fall     | 11,791       | 5                                                               |        |                        | 9   |     |     | 1   |     |    | 9                             | 6     | 15       | 40%        | 30                        | 76                              | 6     | 82       | 255   |
| FRHfb        | 2013       | Fall     | 300,145      | 6                                                               |        | 8                      | 88  |     | 2   | 2   |     |    | 88                            | 19    | 106      | 18%        | 33                        | 29                              | 6     | 35       | 11    |
| FRHFn        | 2013       | Fall     | 1,459,468    | 52                                                              | 144    | 77                     | 801 | 67  | 27  | 36  | 6   | 7  | 801                           | 417   | 1,217    | 34%        | 422                       | 55                              | 29    | 83       | 29    |
| FRHFnc       | 2013       | Fall     | 366,033      | 44                                                              | 80     | 84                     | 607 | 21  | 34  | 35  | 4   | 20 | 607                           | 322   | 930      | 35%        | 938                       | 166                             | 88    | 254      | 256   |
| FRHS         | 2013       | Spr      | 1,217,640    |                                                                 |        |                        | 26  |     | 2   |     |     |    | 26                            | 2     | 28       | 7%         | 68                        | 2                               | 0     | 2        | 6     |
| FRHSn        | 2013       | Spr      | 997,962      |                                                                 |        |                        | 36  |     | 4   |     |     |    | 36                            | 4     | 40       | 10%        | 105                       | 4                               | 0     | 4        | 11    |

**Age 3 CWT recoveries**

| Release type | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |       |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|--------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-------|-----|-----|-----|-----|----|-------------------------------|-------|----------|------------|---------------------------|---------------------------------|-------|----------|-------|
|              |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea   | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |            |                           | In-basin                        | Stray | CV total | Ocean |
| CFHFh        | 2012       | Fall     | 2,956,348    | 1,473                                                           | 80     | 90                     | 1     |     |     |     |     |    | 1,473                         | 172   | 1,645    | 10%        | 1,418                     | 50                              | 6     | 56       | 48    |
| CFHFn        | 2013       | Fall     | 1,810,972    | 147                                                             | 112    | 138                    | 228   | 309 | 134 | 91  | 14  | 46 | 147                           | 1,073 | 1,220    | 88%        | 736                       | 8                               | 59    | 67       | 41    |
| CFHLh        | 2013       | Late     | 960,075      | 467                                                             |        |                        |       |     | 3   |     |     |    | 467                           | 3     | 470      | 1%         | 58                        | 49                              | 0     | 49       | 6     |
| FRHFk        | 2012       | Fall     | 138,888      |                                                                 |        |                        | 16    |     |     |     |     |    | 16                            | 0     | 16       | 0%         | 23                        | 12                              | 0     | 12       | 17    |
| FRHFtib      | 2012       | Fall     | 9,918        |                                                                 |        | 17                     | 14    |     |     |     |     |    | 14                            | 17    | 31       | 54%        | 81                        | 141                             | 17    | 157      | 817   |
| FRHfb        | 2012       | Fall     | 293,784      | 92                                                              | 546    | 174                    | 1,057 | 78  | 8   | 1   |     |    | 1,057                         | 899   | 1,956    | 46%        | 2,714                     | 360                             | 306   | 666      | 924   |
| FRHFn        | 2012       | Fall     | 1,453,105    | 360                                                             | 2,520  | 1,080                  | 4,101 | 162 | 75  | 51  | 18  | 20 | 4,101                         | 4,286 | 8,386    | 51%        | 8,957                     | 282                             | 295   | 577      | 616   |
| FRHFnc       | 2012       | Fall     | 649,160      | 57                                                              | 465    | 168                    | 482   | 111 | 6   | 2   | 6   |    | 482                           | 816   | 1,298    | 63%        | 7,418                     | 74                              | 126   | 200      | 1,143 |
| FRHS         | 2012       | Spr      | 1,106,679    |                                                                 |        |                        | 3,495 |     | 1   |     |     |    | 3,495                         | 1     | 3,496    | 0%         | 848                       | 316                             | 0     | 316      | 77    |
| FRHSn        | 2012       | Spr      | 1,015,285    | 2                                                               | 305    | 66                     | 4,026 | 34  | 20  | 2   |     |    | 4,026                         | 429   | 4,455    | 10%        | 1,916                     | 397                             | 42    | 439      | 189   |

**Age 4 CWT recoveries**

| Release type | Brood year | Run type | # CWT tagged | Central Valley total recoveries (CWT <sub>samp</sub> ) by basin |        |                        |       |     |     |     |     |    | CV CWT <sub>samp</sub> totals |       |          | % CV Stray | Ocean CWT <sub>samp</sub> | Recovery rate per 100K released |       |          |       |
|--------------|------------|----------|--------------|-----------------------------------------------------------------|--------|------------------------|-------|-----|-----|-----|-----|----|-------------------------------|-------|----------|------------|---------------------------|---------------------------------|-------|----------|-------|
|              |            |          |              | Bat Cr                                                          | Up Sac | Nat crks <sup>a/</sup> | Fea   | Yub | Ame | Mok | Mer | SJ | In-basin                      | Stray | CV total |            |                           | In-basin                        | Stray | CV total | Ocean |
| CFHFh        | 2011       | Fall     | 3,117,042    | 1,208                                                           | 465    | 91                     | 10    |     |     |     |     |    | 1,208                         | 567   | 1,775    | 32%        | 1,172                     | 39                              | 18    | 57       | 38    |
| CFHLh        | 2012       | Late     | 1,031,419    | 1,061                                                           | 166    |                        |       |     |     |     |     |    | 1,061                         | 166   | 1,227    | 14%        | 440                       | 103                             | 16    | 119      | 43    |
| FRHFtib      | 2011       | Fall     | 9,933        | 1                                                               |        |                        |       |     |     |     |     |    | 0                             | 1     | 1        | 100%       | 3                         | 0                               | 12    | 12       | 33    |
| FRHfb        | 2011       | Fall     | 297,089      | 2                                                               | 48     | 33                     | 206   |     | 5   | 1   |     |    | 206                           | 90    | 296      | 30%        | 354                       | 69                              | 30    | 100      | 119   |
| FRHFn        | 2011       | Fall     | 2,293,211    | 41                                                              | 1,011  | 250                    | 984   |     | 16  | 2   |     |    | 984                           | 1,321 | 2,304    | 57%        | 2,163                     | 43                              | 58    | 100      | 94    |
| FRHFnc       | 2011       | Fall     | 426,190      | 27                                                              | 209    | 50                     | 220   |     |     |     |     |    | 0                             | 506   | 506      | 100%       | 1,435                     | 0                               | 119   | 119      | 337   |
| FRHS         | 2011       | Spr      | 1,088,286    |                                                                 |        |                        | 2,051 |     | 1   |     |     |    | 2,051                         | 1     | 2,052    | 0%         | 254                       | 188                             | 0     | 189      | 23    |
| FRHSn        | 2011       | Spr      | 1,125,189    |                                                                 | 80     | 17                     | 698   |     | 1   |     |     |    | 698                           | 98    | 796      | 12%        | 132                       | 62                              | 9     | 71       | 12    |

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

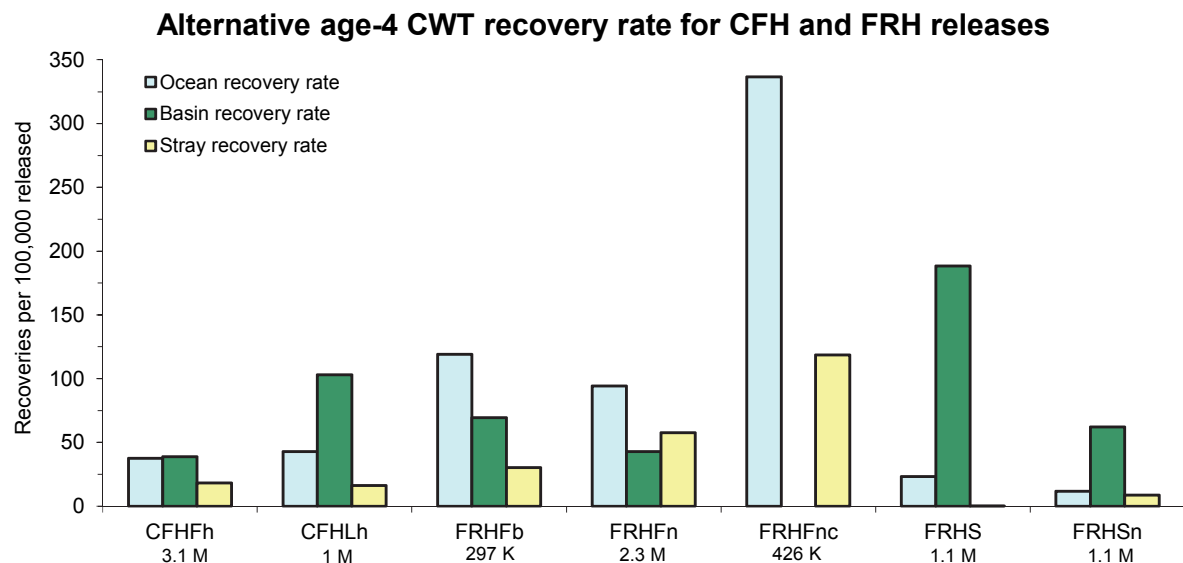
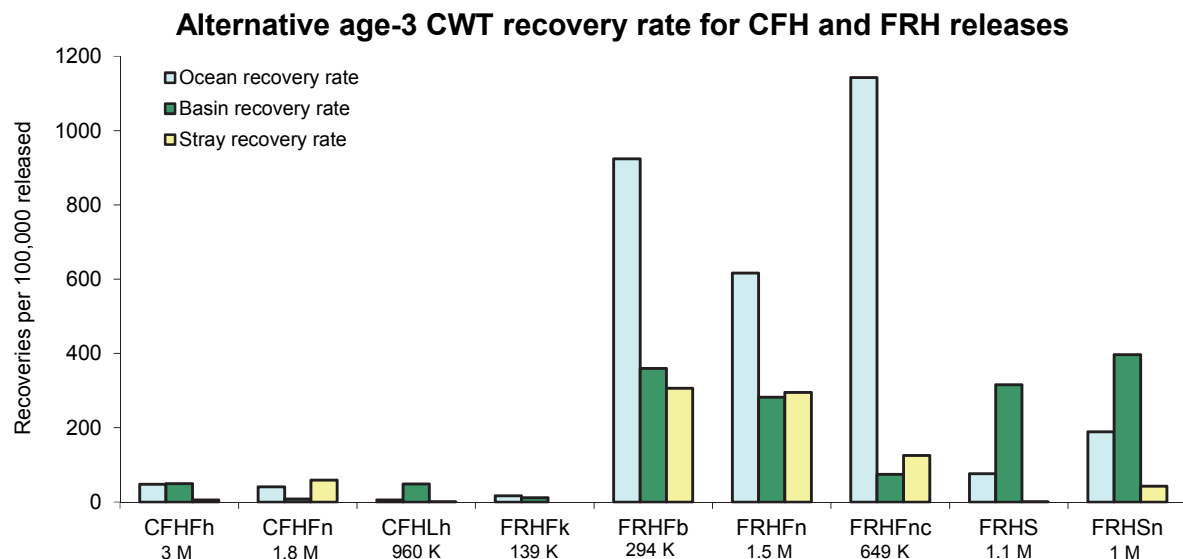
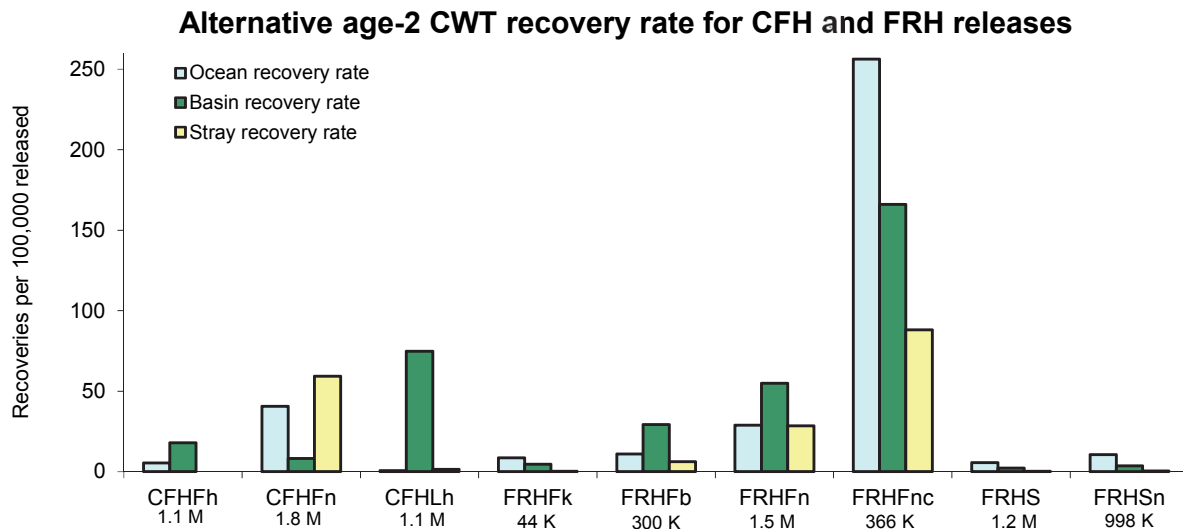
b/ Natural creeks can include Clear Creek, Cow Creek, Cottonwood Creek, Paynes Creek, Mill Creek, Deer Creek and Butte Creek, depending on survey year.

**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            |
| FRHFk   | Feather River Hatchery fall Knaggs Ranch experimental releases      |
| FRHFtib | Feather River Hatchery fall Tiburon net pen releases                |
| FRHfb   | Feather River Hatchery fall barge study releases                    |
| FRHFn   | Feather River Hatchery fall bay net pen releases                    |
| FRHFnc  | Feather River Hatchery fall coastal net pen releases (Pillar Point) |
| NIMF    | Nimbus Hatchery fall in-basin releases                              |
| NIMFn   | Nimbus Hatchery fall bay net pens releases                          |
| FRHFk   | Feather River Hatchery fall Knaggs Ranch experimental 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                     |
| MOKFb  | Mokelumne River Hatchery fall barge study releases                  |
| MOKFn  | Mokelumne River Hatchery fall bay net pen releases                  |
| MOKFnc | Mokelumne River Hatchery fall coastal net pen releases (Santa Cruz) |
| 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          |



Appendix 3. Alternative CWT recovery rates for CFH and FRH releases by age in 2015.

Appendix 4. Sample expansion for CWTs recovered in Yuba River above Daguerre Point Dam (DPD) based on carcass survey vs video data, 2015.

**Yuba River natural escapement above DPD: carcass survey (fresh fish only)**

| Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$    | $p_{cwt adc}^*$ | $F_{smp}$    | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|--------------|-----------------|--------------|-------------------|------------------------------|---------------|
| <b>4,981</b>    | <b>148</b>             | <b>3%</b>      | <b>28</b>            | <b>28</b>             | <b>28</b>         | <b>28</b>     | <b>0.189</b> | <b>1.000</b>    | <b>33.66</b> | <b>3.16</b>       | <b>2,978</b>                 | <b>59.8%</b>  |
| video count     |                        |                |                      |                       |                   |               |              |                 |              |                   |                              |               |

| DPD Vaki video | Total        | % adclip |
|----------------|--------------|----------|
| no clip        | 3,877        |          |
| adclip         | 999          | 20.5%    |
| unknown clip   | 105          | 20.5%    |
| <b>total</b>   | <b>4,981</b> |          |

| Estimated<br>total adclips | average<br>$p_{cwt adc}^*$ | Estimated<br>total CWTs | CWTs<br>collected | Estimated CWT<br>expansion factor |
|----------------------------|----------------------------|-------------------------|-------------------|-----------------------------------|
| 999                        |                            |                         |                   |                                   |
| 22                         |                            |                         |                   |                                   |
| 1,021                      | 0.924                      | 943                     | <b>28</b>         | <b>33.68</b>                      |

\*average  $p_{cwt|adc}$  observed for fresh ad-clipped salmon recovered in Feather River and lower Yuba carcass surveys (n=1,358)

Appendix 5. Sample expansion for CWTs recovered in Mokelumne River above Woodbridge Dam (WD) based on video data, 2015.

|                                           | Known ad     |              |          |
|-------------------------------------------|--------------|--------------|----------|
|                                           | Total        | status       | % adclip |
| <b>Woodbridge Dam video</b>               | 12,879       | 3,456        | 26.8%    |
| <b>MRFI return</b>                        | 8,298        | 2,227        | 26.8%    |
| <b>Natural Escapement Mokelumne River</b> | <b>4,581</b> | <b>1,229</b> | 26.8%    |

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

| Escapement<br>N | Chinook<br>sampled (n) | Sample<br>rate | Observed<br>ad-clips | Ad-clips<br>processed | CWTs<br>recovered | Valid<br>CWTs | $p_{adc}$    | $p_{cwt adc}$ | $F_{smp}$   | Avg<br>$F_{prod}$ | $\sum_{i=1}^m CWT_{total,i}$ | %<br>hatchery |
|-----------------|------------------------|----------------|----------------------|-----------------------|-------------------|---------------|--------------|---------------|-------------|-------------------|------------------------------|---------------|
| <b>4,581</b>    | 4,581                  | 100%           | <b>1,229</b>         | <b>194</b>            | <b>179</b>        | <b>178</b>    | <b>0.268</b> | <b>0.923</b>  | <b>6.37</b> | <b>3.82</b>       | <b>4,329</b>                 | <b>94.5%</b>  |
| video count     |                        |                | video count          |                       | carcass survey    |               |              |               |             |                   |                              |               |