2010 OCEAN SELECTIVE FISHERY SAMPLING REPORT

SUBMITTED BY:

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1. INTRODUCTION

The Pacific Fishery Management Council (PFMC) adopted 2010 recreational and commercial troll fisheries for all salmon species in the area between Cape Falcon, Oregon and the U.S./Canada border. Mark-selective recreational fisheries for Chinook and coho and mark-selective coho commercial fisheries were included in all four Catch Record Card (CRC) areas of coastal Washington (Areas 1, 2, 3, and 4). Council-area fisheries were adopted based on assumptions regarding coho and Chinook abundance, distribution of stocks, Chinook age class distributions, coho mark rates, compliance with selective fishery regulations, and incidental mortality.

The PFMC adopted a pilot ocean mark-selective Chinook fishery (MSF) in Marine Areas 1 through 4 for the first time from June 12 through June 30, 2010, following state-tribal agreement during the North of Falcon process to establish the pilot fishery (e.g., WDFW and NWIFC, 2010). Consistent with the Washington Department of Fish and Wildlife's (WDFW) intent of Puget Sound/Strait of Juan de Fuca mark-selective Chinook fisheries, the primary goal for this pilot selective fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Chinook salmon encountered in the mixed-stock ocean fisheries. WDFW's Ocean Sampling Program (OSP) implemented an intensive monitoring program in all ocean ports during the season to collect data to estimate key parameters characterizing the fishery and its impacts on unmarked salmon. Sampling activities included dockside creel sampling, on-water observation, and a Voluntary Trip Report (VTR) system. Among other parameters, sampling activities emphasized data collection needs for the estimation of: *i*) the mark rate of the targeted Chinook population, *ii*) the total number of Chinook salmon harvested (by size [legal or sublegal] and mark-status [marked or unmarked]), *iii*) the total number of Chinook salmon released (by size/mark-status), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook mortalities, and v) the total mortality of marked and unmarked double index tag (DIT) CWT stocks.

Additionally, in 2010 coho mark-selective fisheries were adopted for the twelfth consecutive year, and the OSP continued its intensive monitoring program in all ocean ports. Sampling activities were identical to those employed during the Chinook MSF. Sampling activities during the coho MSF emphasized data collection needs for the estimation of: *i*) the mark rate of the targeted coho population, *ii*) the total number of coho harvested by mark-status, including an estimate of angler compliance rate with coho MSF regulations, *iii*) the total number of coho released (by size/mark-status), *iv*) the coded-wire tag- (CWT) stock composition of landed coho, and *v*) the total mortality of marked and unmarked coho.

2. SEASON DESCRIPTION

2.1 Ocean Recreational Chinook pilot MSF

Catch Record Card (CRC) Areas 1 through 4 (**Figure 1**) were open for all salmon except coho seven days per week from June 12 through June 30. A daily bag limit of two salmon was in effect. All retained Chinook were required to have a healed adipose fin clip, and the minimum size limit was 24 inches total length for Chinook. A total of 19 fishing days were available during this fishery.

2.2 Ocean Recreational All-Species Fisheries (Coho Mark-Selective)

CRC Area 1: The ocean recreational fishery in Area 1 was open for all salmon species seven days per week from July 1 through September 30. A daily bag limit of two salmon, one of which could be a Chinook, was in effect through July 7; the bag limit was modified to two salmon beginning July 8. All retained coho were required to have a healed adipose fin clip. The Columbia Control Zone was closed. A total of 92 fishing days were available in the area.

CRC Area 2: The ocean recreational fishery from Leadbetter Point to the Queets River was open for all salmon species Sunday through Thursday from July 4 to July 22, and seven days per week from July 23 to September 19. A daily bag limit of two salmon, one of which could be a Chinook, was in effect through July 7; the bag limit was modified to two salmon beginning July 8. All retained coho were required to have a healed adipose fin clip. The Grays Harbor Control Zone was closed beginning August 1. A total of 74 fishing days were available in the area.

CRC Area 3: The ocean recreational fishery from the Queets River to Cape Alava was open for all salmon species Tuesday through Saturday from July 1 through July 22, and seven days per week from July 23 to September 19. From September 25 to October 10, salmon fishing was restricted to the part of Area 3 north of 47°50’00” north latitude and south of 48°00’00” north latitude, seven days per week. A daily bag limit of two salmon, one of which could be a Chinook, was in effect through July 7; the bag limit was modified to two salmon beginning July 8. All retained coho were required to have a healed adipose fin clip. A total of 91 fishing days were available in the area.

CRC Area 4: The ocean recreational fishery from Cape Alava to the U.S./Canada border was open for all salmon species Tuesday through Saturday from July 1 through July 22, and seven days per week from July 23 to September 19. A daily bag limit of two salmon, one of which could be a Chinook, was in effect through July 7; the bag limit was modified to two salmon beginning July 8. Beginning August 1, Chinook retention east of the Bonilla-Tatoosh line and chum retention were prohibited. All retained coho were required to have a healed adipose fin clip. A total of 75 fishing days were available in the area.

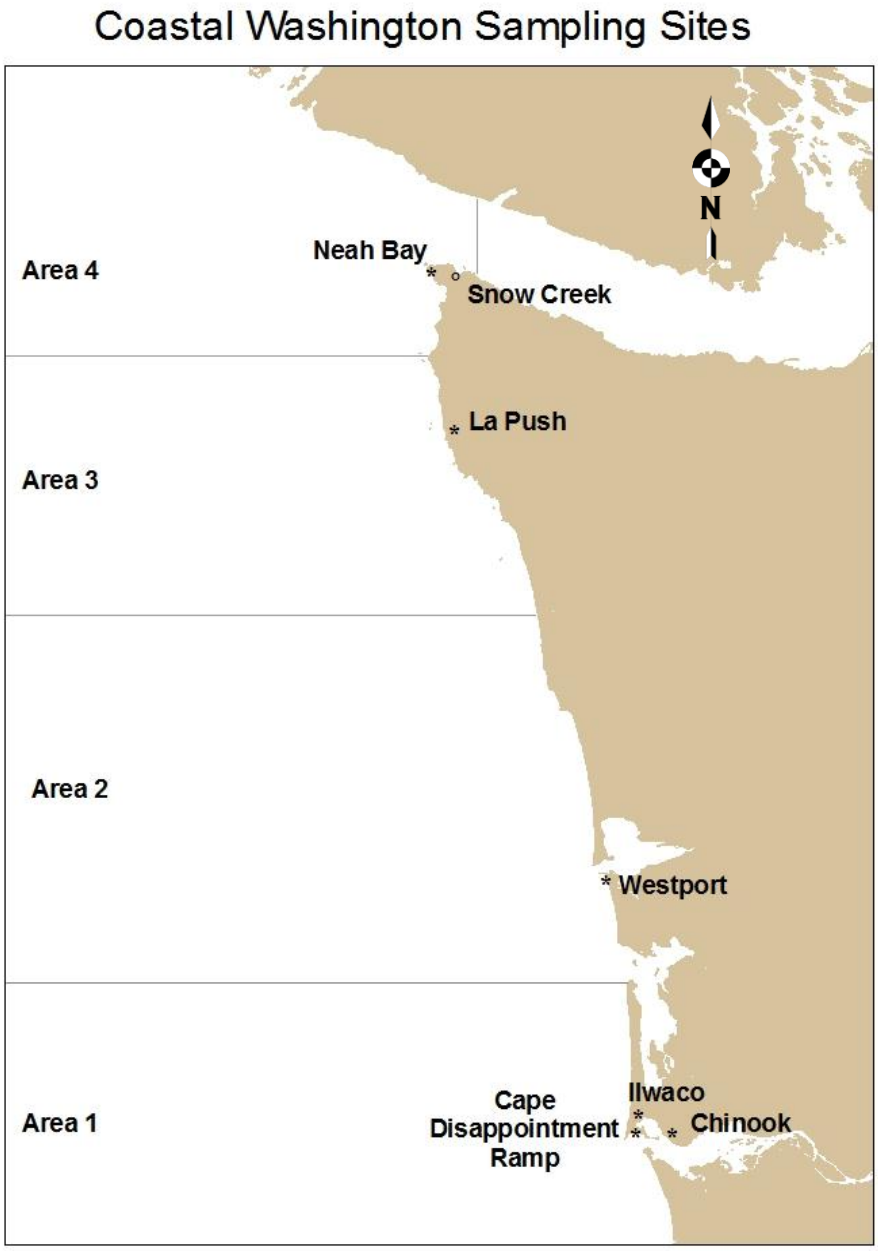


Figure 1. Map of coastal Washington showing the ocean catch record card areas (Areas 1 through 4) and major sampling sites.

2.3 Non-Treaty Commercial Troll Fisheries (Coho Mark-Selective)

The non-Treaty troll fishery was open from Cape Falcon, Oregon to the U.S./Canada border May 1-June 12, June 18-22, and June 25-29, for all salmon except coho (a total of 53 days). The fishery reopened from Cape Falcon to the U.S./Canada border July 1-6, July 9-13, July 16-20, July 23-27, July 30-August 3, August 6-10, August 13-17, August 20-24, August 27-31, and September 3-7 for all salmon species except no chum retention north of Cape Alava, WA in August and September. All retained coho were required to have a healed adipose fin clip. A total of 51 fishing days were available during the summer fishery.

3. METHODS

WDFW's Ocean Sampling Program (OSP) implemented a comprehensive monitoring program in all ocean ports during the Chinook and coho selective fishery seasons in Washington ocean Areas 1-4. OSP collected the data needed to estimate key fishery parameters characterizing the ocean mark-selective fisheries and associated impacts on unmarked salmon. Sampling activities included dockside angler interviews (with catch sampling), total boat counts via exit or entrance counts at each major coastal port, direct on-the-water observations of salmon encounters during charter ride-along trips, and voluntary trip reports of completed trips provided by the angling public.

3.1 On-Board Observation

WDFW samplers conducted direct on-water observation of salmon encounters onboard charter vessels during both the recreational Chinook MSF and the recreational all-species coho MSF. Data collected onboard the charter boats were used to estimate the encounter rates of Chinook by size class and mark group (legal-size and marked [LM], legal-size and unmarked [LU], sublegal-size and marked [SM], and sublegal-size and unmarked [SU]), as well as encounter rates of marked and unmarked coho, and drop-offs. In addition, samplers collected DNA samples from legal sized and sublegal sized Chinook while onboard the charter vessels.

WDFW observers rode along on charter vessels and recorded all hook-ups aboard the vessel; for each hook-up, the following information was recorded: result of the hook-up (fish kept, released, or dropped off), species, mark status (marked or unmarked), and size class (legal or sublegal). A sampling protocol was established for the charter observers so that the most important information relative to this study was collected first. The first priority for the observers was to record the species, mark status, size category, and result of each hook-up aboard the vessel. Collection of these data enabled estimation of encounter rates for Chinook (by size/mark status) and coho (by mark status), and drop-off numbers. The second priority was to collect DNA samples (a small non-lethal clipping from the tip of the dorsal fin), lengths, and scale samples from all Chinook during the June Chinook MSF and from sublegal-sized Chinook during the all-species fishery. DNA from sublegal-sized Chinook was prioritized above that from legal-sized Chinook since legal-sized fish were available on the dock as well as at sea. The third priority was to collect DNA, lengths, and scale samples from legal-sized Chinook.

Direct on-water observation of salmon encounters was the primary method used in CRC Areas 1 and 2 to determine mark rates, encounter rates, and drop-off rates. In CRC Areas 3 and 4, however, the Voluntary Trip Report system (see Section 3.2 below) was the primary method used to collect on-water encounter data, whereas the charter ride-along method was used secondarily due to the limited availability of charter vessels fishing in Areas 3 and 4.

3.2 Voluntary Trip Reports

Selective fishery encounter statistics were also acquired through Voluntary Trip Reports (VTRs) that WDFW samplers distributed and collected from the angling public in Areas 1 through 4. The VTR form is designed to capture information identical to that collected by on-board observers. Anglers complete the information on the form as they fish, minimizing recall error.

Samplers distributed VTRs beginning at 5:00 AM four or five days per week in all ports during the Chinook MSFs. During the all-species fisheries, samplers were also dedicated to distributing VTRs four or five days per week in CRC Areas 3 and 4, and one to two days per week in CRC Areas 1 and 2. These samplers approached anglers as they prepared to depart for fishing, explained the purpose of the VTR and how to complete it, and encouraged anglers to record all encounters and return the form to a dockside sampler at the end of the day. Drop boxes were also provided in some ports, as was the option for postage-paid mail-in.

Collection of VTR data was the primary method used in CRC Areas 3 and 4 to estimate mark rates, encounter rates, and drop-off rates. The VTR method was the secondary method used in CRC Areas 1 and 2.

3.3 Dockside Sampling

Dockside samplers were stationed in the four major landing ports for the ocean fisheries: Neah Bay, La Push, Westport, and Ilwaco (including the port of Chinook). The recreational fisheries in each port were sampled a minimum of 4 to 5 days per week, with weekend (Saturday, Sunday) and weekday days (Monday through Friday) stratified. Typically, both weekend days and a randomly-selected 3 of 5 weekdays were sampled. Total-fishery catch and effort estimates were generated by the OSP using three types of data obtained during dockside sampling: effort counts, interview data, and examination of catch. Each is described below.

Effort Counts

On each sample day, a total recreational boat count was obtained either by counting boats exiting the port or entering the port. A minimum of 20% of the boats returning to the port within each boat type (charter and private) was sampled. An exit count (a count of boats leaving the port) typically began at 4:30AM and continued through the end of the sampling day (exact time was port-specific). An entrance count (a count of boats entering the port) usually began near 8:00AM and continued through dusk. Whether OSP samplers conducted exit or entrance counts varied based on specific considerations for each port. Regardless of the

method used, this effort count, taken on every sampled day, provided the total counts of charter and private boats to which sample data were expanded.

Angler Interviews and Catch Sampling

WDFW samplers stationed in coastal ports collected catch and effort information during dockside angler interviews of boats exiting the fishery in Areas 1-4. Information collected during each sample included number of anglers, target species, area fished, landed catch by species, mark status of landed salmon, identification and recovery of coded wire tags, and angler estimates of released salmon by species and mark status and of released groundfish by species. Additionally, dockside samplers collected DNA samples, lengths, and scale samples from landed Chinook as time allowed.

3.4 Estimating Catch and Effort

3.4.i Estimated Stratum Totals (Primary Stage)

Combined (total) catch estimates are typically stratified by weekend/holiday and weekday. In some strata, every day is sampled. In those strata the combined estimates are simply sums of the daily catches. In other strata, where some days are not sampled, the average catch per day over all sampled days is multiplied by the number of days in the stratum to estimate the total catch.

Let:

a = the marine catch area,

i = trip type,

t = Weekend/holiday or Weekday stratum,

N_t = the number of days in stratum t,

T_t = collection of all days in stratum t,

n_t = the number of days sampled in stratum t, (rather than the number of boats sampled as above),

S_t = collection of sampled days in stratum t (when $S=T$, $n=N$),

Y_{taik} = estimated catch (or effort) on day k for stratum t in area a from trip type i,

C_{tai} = catch for stratum t in area a from trip type i,

Then

$$\hat{C}_{tai} = N_t \frac{\sum_{k \in S_t} \hat{Y}_{taik}}{n_t}$$

with estimated variance (see Thompson 1992, p. 129):

$$\hat{V}\left(\hat{C}_{tai}\right)=\frac{N_t(N_t-n_t)}{n_t}\frac{\sum_{k\in S_t}\left(\hat{Y}_{taik}-\hat{\bar{Y}}_{tai}\right)^2}{n_t-1}+\frac{N_t}{n_t}\sum_{k\in S_t}\hat{V}\left(\hat{Y}_{taik}\right)$$

where

$$\hat{\bar{Y}}_{tai}=\frac{\sum_{k\in S_t}\hat{Y}_{taik}}{n_t}.$$

For strata with all days sampled, $n_t = N_t$, and the catch and variance estimators reduce to:

$$\hat{C}_{tai}=\sum_{k\in T_t}\hat{Y}_{taik}$$

and

$$\hat{V}\left(\hat{C}_{tai}\right)=\sum_{k\in T_t}\hat{V}\left(\hat{Y}_{taik}\right).$$

3.4.ii Daily Catch and Effort Estimation (Secondary Stage)

Both catch and effort are post-stratified by trip-type and area fished. Effort in terms of boat-trips is simply the sample number of boats for each trip-type and area expanded by the appropriate boat-type (charter or private) exit/entrance count. Effort in terms of angler-trips is calculated as the mean number of anglers per boat (indexed by trip-type and area) expanded by the counted total population of boats.

The total catch for a given species on a sampled day is the product of the population of boats and the estimated catch per boat, again post-stratified by trip-type and area fished. Key assumptions in the current estimation procedures are that:

1) All boats exiting/entering a port are included in the exit/entrance count
2) Exit/entrance counts are made without error
3) The approximate systematic sample of boats can be treated as a simple random sample
4) Anglers answer questions accurately and do not conceal fish

In the following discussion, subscripts referring to port and boat-type are suppressed. Let:

M_t = total exit or entrance count for a given port on day *t* (assumed known without error),

m_t = total boats sampled on day *t*,

m_{tai} = number of boats sampled of trip type *i* fishing in area *a* on day *t*,

a_{taij} = number of anglers on the *j*th boat from trip type *i* fishing in area *a* on day *t*,

y_{taij} = number of species specific fish caught on the *j*th boat from trip type *i* in area *a* on day *t*, and

Y_{tai} = total catch of specific species caught from trip type *i* in area *a* on day *t*.

The estimate of the number of boat-trips of trip-type *i* and area *a* follows the procedure outlined in Lai et. al. (1991) where the proportion of boats in each category is estimated by:

$$\hat{p}_{tai} = \frac{m_{tai}}{m_t}$$

with estimated variance (see Cochran 1977, p. 52):

$$V(\hat{p}_{tai}) = \frac{\hat{p}_{tai} \cdot (1 - \hat{p}_{tai})}{(m_t - 1)} \cdot (\frac{M_t - m_t}{M_t})$$

The estimated total boat-trips is then obtained by:

$$\hat{M}_{tai} = M_t \cdot \hat{p}_{tai}$$

with estimated variance:

$$\hat{V}(\hat{M}_{tai}) = M^2{}_t \cdot \hat{V}(\hat{p}_{tai})$$

Effort expressed in terms of angler-trips is the product of the average anglers per boat-trip times the total number of boat-trips. The mean number of anglers per boat-trip (for trip-type *i* and fishing area *a*) is estimated as:

$$\hat{\bar{a}}_{tai} = \frac{\sum_j a_{taij}}{m_t}$$

with variance:

$$\hat{V}(\hat{\bar{a}}_{tai}) = \frac{\sum_j (a_{taij} - \hat{\bar{a}}_{tai})^2}{m_t (m_t - 1)} \cdot (\frac{M_t - m_t}{M_t})$$

Thus the estimated total number of angler-trips is:

$$\hat{a}_{tai} = M_t \cdot \hat{\bar{a}}_{tai}$$

with variance:

$$\hat{V}(\hat{a}_{tai}) = M^2{}_t \cdot \hat{V}(\hat{\bar{a}}_{tai})$$

The catch (or number released) for a specific species on sampled day *t* in area *a* from trip type *i* is similarly estimated by:

$$\hat{Y}_{tai} = \frac{\sum_j y_{taij}}{m_t} M_t$$

with estimated variance:

$$\hat{V}\left(\hat{Y}_{tai}\right) = \frac{\sum_j \left(y_{taij} - \hat{\bar{y}}_{tai}\right)^2}{m_t\left(m_t - 1\right)} M_t\left(M_t - m_t\right)$$

This estimate and it's variance differs somewhat from that described in Lai et al. (1991) since the total count, M_t (assumed to be a known quantity), is used to expand the estimated CPUE (calculated over all sampled boats) rather than the estimated boat-trips by trip-type and area fished.

3.5 Estimating Chinook Encounters and Mortalities

We characterized the overall impacts of the June 2010 recreational mark-selective Chinook fishery in ocean Areas 1-4 in terms of grand-total estimates of Chinook encounters and mortalities and by using estimates specific to each of the four size/mark-status groups (i.e., legal-marked [LM], sublegal-marked [SM], legal-unmarked [LU], and sublegal-unmarked [SU]; **Table 1**). The method described above in section 3.4 was used to generate total estimates of angler effort, retained catch by species, and releases of all fish species except for Chinook salmon released during the June 2010 Chinook MSF in Areas 1-4. However, to estimate Chinook salmon releases (and thus, total encounters) by size/mark group, we applied Conrad and McHugh's (2008) bias-corrected approach, the same method that the Puget Sound Sampling Unit (PSSU) has used since 2008 to estimate Chinook releases in Puget Sound mark-selective Chinook fisheries (e.g., WDFW 2011).

Prior to summer 2008, PSSU had generated two different Chinook encounters estimates based on two separate estimation methods ("Method 1" and "Method 2"; see WDFW 2011 and Conrad and McHugh 2008 for details). Method 1 estimates of total Chinook encounters were derived from the combination of dockside observations of landed catch and angler interview responses about salmon releases; thus, as Conrad and McHugh explain, the accuracy of Method 1 estimates depended heavily on the ability of anglers to correctly recall and report the number of Chinook they actually encountered and released. Method 2 estimates of Chinook encounters were obtained using the creel survey estimates of the total number of legal-size, marked Chinook harvested in combination with the on-water observation or VTR data to estimate both the total number of Chinook encounters and to apportion the encounters to four size/mark status categories (LM, LU, SM, SU). The Method 2 estimator was derived assuming that anglers retain all LM Chinook encountered; therefore, its accuracy depended on the extent

to which angler behavior deviates from this idealized case. Based on their analyses and practical considerations regarding the most feasible bias correction approaches, Conrad and McHugh ultimately recommended using Method 2 with a correction for the release of legal-size marked Chinook as the preferred method for estimating total Chinook encounters in mark-selective Chinook fisheries. After a thorough state-tribal technical review of Conrad and McHugh's method in August 2008, state and tribal technical representatives agreed to use this bias-corrected approach to produce a "best estimate" of Chinook encounters.

Thus, we estimated Chinook releases in the June 2010 Chinook MSF as the difference between retained catch (i.e., from the dockside creel survey) and total Chinook encounters (i.e., releases = encounters – retained catch) generated using Conrad and McHugh (2008) approach. We first divided the creel estimate of legal-marked Chinook harvest by the onboard observer-based estimate of the proportion of the fishable Chinook population that was of legal size and marked (i.e., the former "Method 2" approach; WDFW 2011). Given that this approach yields negatively biased estimates if anglers release any of the legal-marked Chinook they encounter, we then applied Conrad and McHugh's bias correction factor to account for this phenomenon (13%) and incorporated it into the estimator (See **Appendix A** for complete computational details).

Table 1. Sampling/estimation details on target parameters associated with the overall mark-selective Chinook fishery monitoring program in Washington coastal Areas 1 through 4.

Activity	Focal Parameter(s)	Secondary Parameter(s)	Sample Unit(s)	Finest Estimation Time Step	Comments
Dockside Creel Sampling	Fishing effort (boat & angler trips); retained and released fish[1]	Catch rates (CPUE); length, age, and CWT composition of harvest	Boat trip; kept fish; reported fish release	Week	Within weeks, estimates are also produced by strata (weekday/weekend).
Onboard observation and VTRs	Size (legal/sublegal) and mark-status composition (marked, unmarked) of encountered Chinook	Chinook length, age, and DNA-based stock composition; species composition of non-Chinook encounters	Fish encounter	Season	Too few encounters occurred to assess mark rates on a finer time scale.
Overall Fishery Impacts Estimation	Total Chinook encounters and mortalities, by size/mark-status group	Ratios of encounters and mortalities per kept Chinook	N/A	Season	The temporal resolution of impact estimates is constrained by that of the observer encounters data.
Coded-wire tag (CWT) Impacts Estimation	Marked/unmarked double-index tag (DIT) encounters and mortalities	N/A	N/A	Season	The temporal resolution of DIT impacts is constrained by the total number of tags recovered.

[1/] Under the "bias-corrected Method-2" approach, Chinook releases can be estimated only as finely as onboard observer data allow.

We estimated total Chinook mortality resulting from the June 2010 selective Chinook fishery by applying assumed mortality rates to the total harvest and release estimates for the four size/mark-status groups (LM, LU, SM, and SU). For retained Chinook, the mortality estimate was equivalent to the total harvest estimate for the applicable size/mark-status group. We applied a selective fishing mortality (*sfm*) rate of 14% to legal (marked and unmarked) and sublegal (marked and unmarked) release totals, to estimate release mortality in the ocean (the same *sfm* value used in FRAM). See **Appendix A** for a complete description of our impact estimation procedure, including formulae for total and variance estimators.

The final step of our overall impacts assessment involved comparing fishery outcomes to pre-season expectations. To do this, we compared season-total estimates of Chinook encounters and mortalities to pre-season modeled values (FRAM model run no. 1010) for each size and mark status category.

3.6 CWT Impacts

To understand the potential effects of the June 12-30, 2010 recreational mark-selective Chinook fishery in the ocean on the CWT program, we estimated the total number of unmarked-tagged Chinook mortalities that may have occurred during the course of the fishery. To do this, we acquired information for all marked CWT double index tag (DIT) groups present in landed catch from the Pacific States Marine Fisheries Commission's Regional Mark Information System (RMIS) and then applied the methods described by the Pacific Salmon

Commission's Selective Fisheries Evaluation Committee–Analysis Work Group (SFEC-AWG 2002) to estimate the number of unmarked DIT fish encountered[1]. We subsequently estimated the number of these fish that may have died due to hook-and-release impacts using an *sfm* analogous to that used in FRAM modeling. Given our interest in characterizing the impacts of mark-selective regulations on the CWT program and not recreational fishing in general, we used an *sfm* of 10% in all unmarked-DIT mortality calculations. The *sfm* value of 10% did not include unseen drop-off mortality (assumed to be 5% in FRAM) because drop-off mortality occurs in both selective and non-selective recreational Chinook fisheries.

We estimated Chinook encounters and mortalities for each recovered DIT individually and then summed estimates for each hatchery, brood year, and area based on the methods described by SFEC-AWG 2002. Thus, the estimated number of unmarked mortalities was calculated as:

$$\hat{U}_a^{MSF} = \lambda^{REL} \hat{M}_a^{MSF} sfm$$

with associated variance:

$$Var(\hat{U}_a^{MSF}) \approx \left(\lambda^{REL}\right)^2 sfm^2 \hat{M}_a^{MSF} \frac{1-s}{s}.$$

where:

sfm = selective fishing mortality rate (10%, *excludes drop-off mortality*),
$U_{a,i}^{MSF}$ = aged *a* unmarked DIT mortalities from stock *i* in the selective fishery,
$M_{a,i}^{MSF}$ = aged *a* marked DIT mortalities from stock *i* in the selective fishery,
s = sampling rate of the catch,
λ^{REL} = unmarked-to-marked ratio *at release* for fish in a DIT group
$Var(U_{a,i}^{MSF})$ = variance of $U_{a,i}^{MSF}$.

In addition to estimating unmarked-DIT mortalities, we pooled all CWTs (DIT and otherwise) recovered during the fishery and, based on this total, report the proportional contribution (unexpanded recoveries) of different hatcheries to the total Chinook harvest (See CWT Results below).

[1] For all unmarked-DIT encounters and mortalities calculations, we relied on the unmarked-to-marked abundance ratio (λ) estimated for DIT groups at the time of juvenile release.

4. RESULTS IN JUNE CHINOOK MARK SELECTIVE RECREATIONAL FISHERY

4.1 Dockside Sampling Results

WDFW dockside samplers interviewed an estimated 36% of all anglers fishing in Washington coastal Areas 1 through 4 during the June 2010 mark-selective Chinook fishery; a total of 3,619 anglers in 930 boats were enumerated in-sample (**Table 2**). In addition, a total of 32% (1,589) of all marked Chinook harvested in ocean Areas 1 through 4 were sampled, and 229 coded wire tags (CWTs) were collected in Washington's coastal ports (**Table 2**).

Estimates of Fishing Effort and Chinook Catch

An estimated 10,347 angler trips (10,004 from Washington, 343 from Oregon) were completed by private and charter anglers during the coastwide Chinook MSF from June 12 through June 30, 2010. These anglers harvested a total of 5,037 Chinook coastwide (5,000 WA, 37 OR) (**Table 3**). Landed Chinook catch totaled 42% of the overall fishery quota of 12,000.

A total of 11,202 Chinook encounters were estimated in Washington ocean waters during the June 12-30, 2010 mark-selective Chinook fishery, for CRC Areas 1 through 4 combined (**Table 4**). This total consisted of an estimated 5,000 retained (4,981 marked, 19 unmarked) and 6,202 released (2,636 marked, 3,566 unmarked) Chinook salmon.

Table 2. Dockside sampling statistics during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4.

Area	Boats Sampled	Sample Rate	Anglers Sampled	Sample Rate	Landed Chinook Sampled	Sample Rate	Coded wire tags collected
Area 4	227	45%	565	46%	69	48%	5
Area 3	101	67%	271	69%	27	71%	4
Area 2	494	29%	2,399	31%	1,417	30%	203
Area 1	108	68%	384	69%	76	71%	17
Total WA	**930**	**37%**	**3,619**	**36%**	**1,589**	**32%**	**229**

Table 3. Estimates of total fishing effort and number of Chinook retained during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4.

Area	Total Boat Trips	Total Angler Trips	Estimated Chinook Retained		
			Marked	Unmarked	TOTAL
Area 4	501	1,239	144	0	144
Area 3	150	390	38	0	38
Area 2	1,677	7,822	4,694	18	4,711
Area 1	158	553	105	1	106
TOTAL WA	**2,487**	**10,004**	**4,981**	**19**	**5,000**
TOTAL OR	N/A	343	37	0	37
Season Total:	**2,487**	**10,347**	**5,018**	**19**	**5,037**
WA Variance: [1/]	8,341	147,317	170,522	2,574	
WA Standard Error:	91	384	413	51	
WA CV (%):	4%	4%	8%	269%	
WA 95% CI:	2,308-2,666	9,252-10,756	4,172-5,790	-81-118	

[1/] Variance estimates are unavailable for Oregon statistics.

CWT Samples

In total, 229 decoded coded-wire tags were recovered from Chinook salmon sampled dockside during the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1 through 4 combined. Observed (unexpanded) stock composition results for these in-sample tag recoveries are presented by area in **Tables 5-1** through **5-4** for Areas 1 through 4, respectively. In Area 1, samplers recovered a total of 17 CWTs, 7% of the CWTs recovered in all four areas combined. The majority of these recoveries (41.2%) were from Upper Columbia River (above McNary Dam, excluding Snake River), Lower Columbia River (mouth to Bonneville Dam) (17.6%), and Snake River (17.6%) hatcheries, while recoveries from the Central Columbia River (Bonneville to McNary Dam) (5.9%) and Central California coast (5.9%) hatcheries made up the remaining tags in the sample (**Table 5-1**). One of the CWT recoveries in Area 1 was from a double index tag (DIT) release group.

In Area 2, samplers recovered a total of 203 CWTs, 89% of the total tags recovered in all four ocean areas combined. The majority of these recoveries were from Snake River (44.3%), Upper Columbia River (above McNary Dam) (14.8%), and Lower Columbia River (mouth to Bonneville Dam) (12.3%) hatcheries. The remaining Area 2 tag recoveries represented hatcheries from the Central Columbia River (Bonneville to McNary Dam) (7.4%), general Columbia River (3.4%), Puget Sound Washington (1.5%), coastal Oregon (1.5%), California (10.9%), and the Lower Fraser River in British Columbia (3.9%) (**Table 5-2**). In addition, 33 of the CWT recoveries in Area 2 were from double index tag (DIT) release groups.

In Area 3, samplers recovered a total of 4 CWTs, 2% of the total tags recovered in all four ocean areas combined. Two of these CWT recoveries (50%) were from the Lyons Ferry Hatchery on the Snake River; one (25%) was from the Upper Columbia River (above McNary Dam); and one (25%) was from Trinity River Hatchery on the Klamath River, California (**Table 5-3**). None of these CWT recoveries from Area 3 belonged to DIT groups.

In Area 4, samplers recovered a total of 5 CWTs, 2% of the total tags recovered in all four ocean areas combined. Three of these CWT recoveries were from the Columbia River -- one each from the Lower Columbia River (Cowlitz Salmon Hatchery), Central Columbia River (Klickitat Hatchery), and Snake River (NPT Hatchery). Another tag was from mid-Puget Sound (Grovers Creek Hatchery), while one was from a Central California coastal hatchery facility (**Table 5-4**). One of the CWT recoveries in Area 4 was from a double index tag (DIT) release group (Grovers Creek Hatchery in Mid-Puget Sound).

Table 4. Total estimates of fishing effort and the number of Chinook retained and released by mark status and by week, during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4 combined.

Chinook MSF Season	Stat Week	Stratum Start Date	Stratum End Date	Est. Effort		Est. Retained Chinook		Est. Released Chinook [1/]		Est. Total Chinook Encounters
				Boats	Anglers	Marked	Unmarked	Marked	Unmarked	
June 12 - June 30, 2010	24	12-Jun	13-Jun	421	1,617	605	2	320	433	1,360
	25	14-Jun	20-Jun	897	3,649	2,135	12	1,130	1,524	4,801
	26	21-Jun	27-Jun	945	3,738	1,801	1	953	1,295	4,051
	27	28-Jun	30-Jun	223	1,001	440	3	233	314	990
Season Total:				**2,487**	**10,004**	**4,981**	**19**	**2,636**	**3,566**	**11,202**
Variance:				8,341	147,317	170,522	2,574	374,573	177,319	539,213
Standard Error:				91	384	413	51	612	421	734
CV (%):				4%	4%	8%	269%	23.2%	11.8%	6.6%
95% CI:				2,308-2,666	9,252-10,756	4,172-5,790	-81-118	1,437-3,836	2,740-4,391	9,762-12,641

[1/] Released Chinook were estimated as the difference between total Chinook encounters generated using the bias-corrected "Method 2" estimator (see Conrad and McHugh 2008) and creel-based estimates of retained Chinook.

Table 5-1. Summary of coded-wire tags recovered from Chinook salmon harvested in Washington coastal Area 1 during the June 12-30, 2010 mark-selective Chinook fishery. The field "No. DITs" corresponds to the number of tags that belonged to double--index tag groups. Percentages in parentheses indicate the proportional contribution (unexpanded recoveries) of different hatcheries to the total Chinook harvest in Area 1.

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
Columbia River	Columbia River General Region (11.8%)	COLUMBIA R - GENERAL	TURTLE ROCK HATCHERY	1 (5.9%)	0
		COLUMBIA R - GENERAL		1 (5.9%)	0
	Upper Columbia R (above McNary Dam; excludes Snake River) (41.2%)	METHOW R 48.0002	CARLTON REARING POND	2 (11.8%)	0
		SIMILKAMEEN R 490325		2 (11.8%)	0
		WENATCHEE R 45.0030		3 (17.6%)	0
	Central Columbia River (Bonneville Dam to McNary Dam) (5.9%)	SPRING CR 29.0159	SPRING CR NFH	1 (5.9%)	1
	Lower Columbia River (mouth to Bonneville Dam) (17.6%)	MOLALLA R	WILLAMETTE HATCHERY	1 (5.9%)	0
		MCKENZIE R 1	MCKENZIE HATCHERY	1 (5.9%)	0
		SANTIAM R & N FK-1	MARION FORKS HATCH	1 (5.9%)	0
	Snake River (17.6%)	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	2 (11.8%)	0
		CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	1 (5.9%)	0
California	Central California Coast (5.9%)	SAN PABLO BAY NET PENS	MOKELUMNE R FISH INS	1 (5.9%)	0
			Total, Area 1:	**17**	**1**

Table 5-2. Summary of coded-wire tags recovered from Chinook salmon harvested in Washington coastal **Area 2** during the June 12-30, 2010 mark-selective Chinook fishery. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups. Percentages in parentheses indicate the proportional contribution (unexpanded recoveries) of different hatcheries to the total Chinook harvest in Area 2.

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
Washington	Northern Washington (0.5%)	FRIDAY CR 03.0017	SAMISH HATCHERY	1 (0.5%)	1
	Mid Puget Sound (0.5%)	GROVERS CR HATCHERY	GROVERS CR HATCHERY	1 (0.5%)	1
	Southern Puget Sound (0.5%)	CLEAR CR 11.0013C	CLEAR CREEK HATCHERY	1 (0.5%)	1
Columbia River	Columbia River General Region (3.4%)	COLUMBIA R - GENERAL	TURTLE ROCK HATCHERY	1 (0.5%)	0
		COLUMBIA R - GENERAL		5 (2.5%)	0
		COLUMBIA R - GENERAL	WELLS HATCHERY	1 (0.5%)	0
	Upper Columbia R (above McNary Dam; excludes Snake River) (14.8%)	LK CHELAN + COLUMBIA R		4 (2%)	0
		METHOW R 48.0002	CARLTON REARING POND	5 (2.5%)	0
		WENATCHEE R 45.0030		8 (3.9%)	0
		SIMILKAMEEN R 490325		8 (3.9%)	0
		SIMILKAMEEN R 490325	SIMILKAMEEN HATCHERY	2 (1%)	0
		WENATCHEE R 45.0030	DRYDEN POND	2 (1%)	0
		CHELAN R 47.0052		1 (0.5%)	0
	Central Columbia River (Bonneville Dam to McNary Dam) (7.4%)	KLICKITAT HATCHERY (YKFP)	KLICKITAT HATCHERY (YKFP)	1 (0.5%)	0
		UMATILLA R	UMATILLA HATCHERY	2 (1%)	0
		SPRING CR 29.0159	SPRING CR NFH	12 (5.9%)	12
	Lower Columbia River (mouth to Bonneville Dam) (12.3%)	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	7 (3.4%)	0
		BIG CR (LWR COL R)	BIG CR HATCHERY	11 (5.4%)	11
		FALLERT CR 27.0017	FALLERT CR HATCHERY	1 (0.5%)	0
		COWLITZ R 26.0002	COWLITZ SALMON HATCH	1 (0.5%)	0
		MCKENZIE R 1	MCKENZIE HATCHERY	1 (0.5%)	0
		ELOCHOMAN R 25.0236	ELOCHOMAN HATCHERY	1 (0.5%)	0

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
		TANNER CR (BNVILLE)	BONNEVILLE HATCHERY	1 (0.5%)	0
		WASHOUGAL R 28.0159	WASHOUGAL HATCHERY	1 (0.5%)	0
		COWLITZ SALMON HATCH	COWLITZ SALMON HATCH	1 (0.5%)	0
	Snake River (44.3%)	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	7 (3.4%)	0
		NPT HATCHERY	NPT HATCHERY	2 (1%)	0
		BIG CANYON ACCL POND	LYONS FERRY HATCHERY	11 (5.4%)	0
		CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	7 (3.4%)	0
		SNAKE R@PITT. LNDG	LYONS FERRY HATCHERY	3 (1.5%)	0
		SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	10 (4.9%)	0
		SNAKE R-UPPR 35.0002	LYONS FERRY HATCHERY	4 (2%)	0
		CLWTR @ LAPWAI CRK	NPT HATCHERY	2 (1%)	0
		SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	39 (19.2%)	0
		SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	5 (2.5%)	0
Oregon	Northern Oregon Coast (0.5%)	THREE RIVERS (NESTUC	CEDAR CR HATCHERY	1 (0.5%)	0
	Southern Oregon Coast (1%)	ELK R	ELK R HATCHERY	1 (0.5%)	0
		ROCK CR (N UMPQUA R)	ROCK CR HATCHERY	1 (0.5%)	0
California	Northern California Coast (0.5%)	SMITH RIVER	ROWDY CREEK HATCHERY	1 (0.5%)	0
	Central California Coast (7.9%)	SAN PABLO BAY	COLEMAN NFH	1 (0.5%)	0
		SAN PABLO BAY NET PENS	FEATHER R HATCHERY	2 (1%)	0
		WICKLAND OIL NET PEN	FEATHER R HATCHERY	2 (1%)	0
		SAN PABLO BAY NET PENS	NIMBUS FISH HATCHERY	1 (0.5%)	0
		SAN PABLO BAY NET PENS	FEATHER R HATCHERY	4 (2%)	0
		MARE ISLAND NET PEN	FEATHER R HATCHERY	4 (2%)	0

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
		SAN PABLO BAY NET PENS	MOKELUMNE R FISH INS	1 (0.5%)	0
		WICKLAND OIL TERMINAL	FEATHER R HATCHERY	1 (0.5%)	0
	Sacramento River (2.5%)	FEATHER BOYDS PUMP RAMP	FEATHER R HATCHERY	1 (0.5%)	0
		SAC R COLUSA TO RBDD	COLEMAN NFH	1 (0.5%)	0
		COLEMAN NFH	COLEMAN NFH	3 (1.5%)	0
British Columbia	Lower Fraser River (3.9%)	R-HARRISON R	H-CHEHALIS R	1 (0.5%)	0
		R-CHILLIWACK R	H-CHILLIWACK R	7 (3.4%)	7
			Total, Area 2:	**203**	**33**

Table 5-3. Summary of coded-wire tags recovered from Chinook salmon harvested in Washington coastal **Area 3** during the June 12-30, 2010 mark-selective Chinook fishery. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups. Percentages in parentheses indicate the proportional contribution (unexpanded recoveries) of different hatcheries to the total Chinook harvest in Area 3.

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
Columbia River	Upper Columbia R (above McNary Dam; excludes Snake River) (25%)	SIMILKAMEEN R 490325		1 (25%)	0
	Snake River (50%)	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	1 (25%)	0
		SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	1 (25%)	0
California	Klamath River – Trinity River (25%)	TRINITY R HATCHERY	TRINITY R HATCHERY	1 (25%)	0
			Total, Area 3:	**4**	**0**

Table 5-4. Summary of coded-wire tags recovered from Chinook salmon harvested in Washington coastal **Area 4** during the June 12-30, 2010 mark-selective Chinook fishery. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups. Percentages in parentheses indicate the proportional contribution (unexpanded recoveries) of different hatcheries to the total Chinook harvest in Area 4.

Release Domain	Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
Washington	Mid Puget Sound (20%)	GROVERS CR 15.0299	GROVERS CR HATCHERY	1 (20%)	1
Columbia River	Central Columbia River (Bonneville Dam to McNary Dam) (20%)	KLICKITAT HATCHERY (YKFP)	KLICKITAT HATCHERY (YKFP)	1 (20%)	0
	Lower Columbia River (mouth to Bonneville Dam) (20%)	COWLITZ R 26.0002	COWLITZ SALMON HATCH	1 (20%)	0
	Snake River (20%)	CLWTR @ LAPWAI CRK	NPT HATCHERY	1 (20%)	0
California	Central California Coast (20%)	SAN PABLO BAY NET PENS	NIMBUS FISH HATCHERY	1 (20%)	0
			Total, Area 4:	**5**	**1**

4.2 On-water Observations of Chinook Encounters

On-Board Observer Data

WDFW's observer staff conducted 22 on-the-water catch surveys onboard charter boats during the 19-day June 2010 selective Chinook fishery. Observers recorded a total of 253 encountered Chinook salmon in all four ocean areas combined; 88% of these encounters were in Area 2. The size/mark status composition of these Chinook encounters is presented in **Table 6**. Chinook encounters of unknown size and/or unknown mark status were excluded in determining the overall size/mark status composition (legal-marked [LM], legal-unmarked [LU], sublegal-marked [SM], and sublegal-unmarked [SU]), yielding a useable sample size of 225 Chinook encounters based on onboard observer data for Areas 1-4 combined. The following size/mark group composition was estimated from the 225 useable encounters: 51.1% LM, 23.6% LU, 16.9% SM, and 8.4% SU. These estimated size/mark group proportions based on onboard observer data were used in subsequent impact estimation steps, as discussed further in the section below titled *Estimated Chinook Encounters and Mortalities* (see **Table 10** and **Appendix A)**.

DNA Results

Chinook DNA samples were collected only by onboard observers who had access to both marked and unmarked Chinook encounters during the June 2010 Chinook MSF. A total of 154 DNA samples were collected from legal sized Chinook and 47 from sublegal sized Chinook during the 19-day season (**Table 7**).

VTR Data

Additional on-the-water encounters data was provided via angler-completed voluntary trip reports (VTRs). Dockside samplers collected 101 completed and useable VTRs containing 444 Chinook encounters (**Table 8**). Chinook encounters of unknown size and/or unknown mark status were excluded in determining the size/mark status composition results based on VTR data, yielding a useable sample size of 407 Chinook encounters for Areas 1-4 combined. The following size/mark group composition was estimated from these 407 useable encounters: 50.6% LM, 22.9% LU, 15.2% SM, and 11.3% SU. Although the VTR data were not used in subsequent fishery-wide impacts estimation steps (i.e., **Appendix A**), the overall size/mark group composition from VTRs was similar to that from onboard observer data (**Table 6**) when pooling the Chinook encounters data across all four ocean areas for each data source.

To compare observed (field-estimated) mark rates in each area with preseason FRAM-predicted values, we combined the onboard observer- and VTR-based encounters data. The combined onboard observer and VTR data indicated mark rates of 69% for legal sized Chinook and 61% for sublegal sized Chinook coast-wide (**Table 9**).

Table 6. Summary of on-water Chinook encounters data by size and mark group, collected by WDFW observers sampling onboard charter boats during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4.

		OBSERVER DATA									
	Total	LEGAL SIZED			SUBLEGAL SIZED			UNKNOWN SIZE[1/]			Total
Area	Observer Trips	Marked	Unmarked	Unknown[1/]	Marked	Unmarked	Unknown[1/]	Marked	Unmarked	Unknown	Chin Enc.
Area 4	5	4	3	0	1	3	0	0	0	2	13
Area 3	2	0	0	0	0	0	0	0	0	0	0
Area 2	10	102	49	11	36	14	8		1	1	222
Area 1	5	9	1	2	1	2	0	0	0	3	18
TOTAL	**22**	**115**	**53**	**13**	**38**	**19**	**8**	**0**	**1**	**6**	**253**
Size/Mark Comp:		**51.1%**	**23.6%**	**--**	**16.9%**	**8.4%**	**--**	**--**	**--**	**--**	**225**

[1/] Chinook encounters of unknown size and/or unknown mark status were excluded in determining the overall size/mark status composition based on onboard observer data, as indicated by the dash (**--**).

Table 7. Number of Chinook DNA samples collected by WDFW observers onboard charter vessels during the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1-4.

	LEGAL SIZED			SUBLEGAL SIZED		
Area	Marked	Unmarked	Total	Marked	Unmarked	Total
Area 4	3	3	6	0	1	1
Area 3	0	0	0	0	0	0
Area 2	96	42	138	33	10	43
Area 1	9	1	10	1	2	3
TOTAL	**108**	**46**	**154**	**34**	**13**	**47**

Table 8. Summary of on-water Chinook encounters by size class and mark status, as reported on angler-completed voluntary trip reports (VTRs) during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4.

		VOLUNTARY TRIP REPORT DATA									
	Total	LEGAL SIZED			SUBLEGAL SIZED			UNKNOWN SIZE[1/]			Total
Area	VTRs Collected	Marked	Unmarked	Unknown[1/]	Marked	Unmarked	Unknown[1/]	Marked	Unmarked	Unknown	Chin Enc.
Area 4	15	13	8	0	4	3	0	0	0	2	30
Area 3	5	1	2	0	0	2	0	0	0	0	5
Area 2	76	185	82	15	57	39	13	1	2	4	398
Area 1	5	7	1	0	1	2	0	0	0	0	11
TOTAL	**101**	**206**	**93**	**15**	**62**	**46**	**13**	**1**	**2**	**6**	**444**
Size/Mark Comp:		**50.6%**	**22.9%**	**--**	**15.2%**	**11.3%**	**--**	**--**	**--**	**--**	**407**

[1/] Chinook encounters of unknown size and/or unknown mark status were excluded in determining the overall size/mark status composition based on VTR data, as indicated by the dash (**--**).

Table 9. Estimated mark rates for legal- and sublegal-sized Chinook during the June 12-30, 2010 recreational Chinook mark-selective fishery in Washington coastal Areas 1 through 4, based on onboard observer and VTR data combined, compared with FRAM preseason predicted values.

	LEGAL SIZED			SUBLEGAL SIZED			FRAM preseason projected mark rate (legal sized)
Area	Marked	Unmarked	Mark Rate	Marked	Unmarked	Mark Rate	
Area 4	17	11	61%	5	6	45%	37%
Area 3	1	2	33%	0	2	0%	53%
Area 2	287	131	69%	93	53	64%	63%
Area 1	16	2	89%	2	4	33%	72%
TOTAL	**321**	**146**	**69%**	**100**	**65**	**61%**	

4.3 Overall Fishery Impacts

Estimated Total Chinook Encounters and Mortalities

We derived size/mark-status group-specific estimates of Chinook encounters from a combination of the dockside sampling results (i.e., retained harvest estimates presented in **Tables 2** and **4**) and the on-water observer based size/mark-status composition data (**Table 6**; see **Appendix A** for computational details). In total, we estimated that private boat anglers fishing in Washington coastal Areas 1 through 4 (combined) encountered 5,725 LM, 2,639 LU, 1,892 SM, and 946 SU Chinook during the 19-day June 2010 selective Chinook fishery (**Table 10**). Given the estimates of harvest and the assumed selective fishing mortality (*sfm*) mortality rate of 0.14 for both legal-sized and sublegal-sized Chinook, these encounters translated into a total of 5,868 estimated Chinook mortalities (5,000 retained and 868 released; 5,085 LM, 386 LU, 265 SM, and 132 SU) in ocean Areas 1 through 4 combined (**Table 10**). Of the total estimated mortalities, 85% were attributed to retention of legal-size marked Chinook.

FRAM versus Creel Comparison

Comparisons of Chinook encounters and mortalities projected in the final preseason FRAM model run (FRAM number 1010) with observed encounters and mortalities are presented in **Tables 11** and **12**. These comparisons are illustrated in **Figure 2**. FRAM projections include encounters and mortalities in Oregon waters; however, observed total encounters and mortalities are not available for Oregon waters. Oregon landed catch comprised 1% of the total landed catch in the ocean Chinook MSF. Both observed encounters and estimated actual mortalities were less than those projected in preseason FRAM model run 1010 for all size/mark group categories. For example, FRAM-predicted total encounters and mortalities were approximately double the field-estimated values of these parameters (**Tables 11** and **12**, **Figure 2**).

Table 13 and **Figure 3** compare preseason modeled impacts on key Columbia River Chinook stocks with modeled impacts using updated catches and run size estimates. In terms of both catch impacts and exploitation rates, the preseason modeled impacts of the Chinook MSF on Bonneville Pool hatchery (BPH), summer Chinook, and upriver bright (URB) Chinook were higher than what was actually observed.

Table 10. Summary of the fishery impact estimates for the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1 through 4.

Size/Mark Group	Total Chinook Encounters	Number Retained	Number Released	Release Mortality Rate	Release Mortality	Total Mortality	Variance	SE	95% CI	CV (%)
Legal Marked	5,725	4,981	744	0.14	104	5,085	6,180	79	4,931-5,239	2%
Legal Unmarked	2,639	19	2,620	0.14	367	386	2,555	51	287-485	13%
Sublegal Marked	1,892	0	1,892	0.14	265	265	1,836	43	181-349	16%
Sublegal Unmarked	946	0	946	0.14	132	132	921	30	73-192	23%
TOTAL ALL GROUPS	11,202	5,000	6,202	0.14	868	5,868	11,492	107	5,658-6,078	2%

Table 11. Comparison of modeled (FRAM model run no. 1010) and estimated total Chinook encounters in the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1 through 4.

Data Source	Group	Total Encounters [1/]	Legal	Sublegal	Landed Only (WA + OR)
FRAM Encounters (WA and OR)	Unmarked	6,643	4,543	2,100	364
	Marked	16,824	13,174	3,650	11,636
	Total	23,467	17,717	5,750	12,000
	% Marked	72%	74%	63%	97%
Estimated (Creel) Encounters (WA only)	Unmarked	3,585	2,639	946	19
	Marked	7,617	5,725	1,892	5,018
	Total	11,202	8,364	2,838	5,037
	% Marked	68%	68%	67%	100%

[1/] Observed (field-estimated) Chinook encounters by size class and mark status are not available for Oregon waters; landed catch includes Oregon.

Table 12. Comparison of modeled (FRAM model run no. 1010) and estimated total Chinook mortalities in the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1 through 4.

	FRAM Chinook Mortalities (WA + OR)			**Estimated Chinook Mortalities [1/] (WA only)**		
Mortality Category	Unmarked	Marked	Total	Unmarked	Marked	Total
Total (Landed + Released)	1,470	13,059	14,529	518	5,350	5,868
Released Legal	812	912	1,724	367	104	471
Released Sublegal	294	511	805	132	265	397
Landed Only (WA + OR)	364	11,636	12,000	19	5,018	5,037

[1/] Observed (field-estimated) Chinook mortalities by size class and mark status are not available for Oregon waters; landed catch includes Oregon.

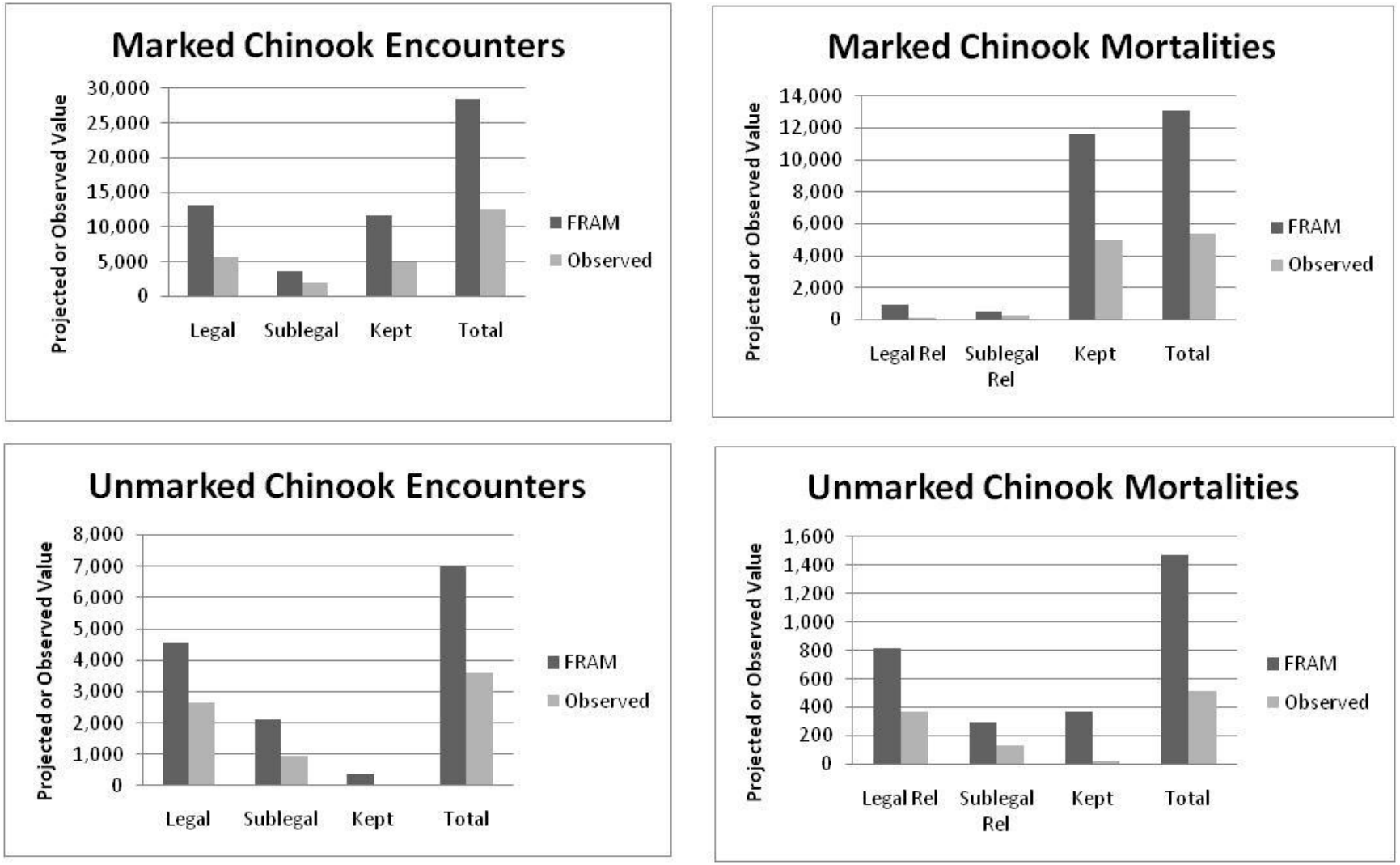


Figure 2. Comparison of modeled (i.e., using FRAM, model run 1010) and estimated total Chinook encounters (*left panel*) and mortalities (*right panel*) for the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1-4.

Table 13. Comparison of 2010 overall fishery impacts on key Columbia River Chinook stocks modeled pre-season and post-season in an updated ocean model run.

River Run Sizes

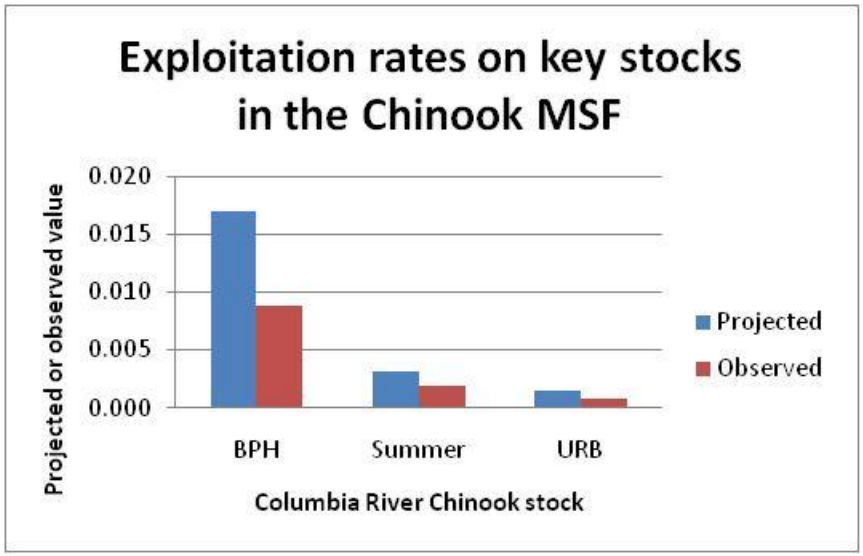
Stock	Updated	Pre-Season
BPH	124,541	162,918
URB	327,102	393,719
Seak Troll	177,613	146,976
Seak Net	9,060	19,129
Seak Sport	31,656	35,107
NCBC Troll	90,200	100,797
NBC Outside Sport	55,000	43,055
WCVI Troll	79,200	71,568
WCVI Sport	52,700	68,900

Ocean Catches

	Updated		Pre-Season	
Updated	May-June	Jul-Sep	May-June	Jul-Sep
Area 3/4				
NT Troll	7,188	2,854	15,512	8,577
T Troll	14,178	15,208	25,138	25,975
Sport	182	4,249	1,404	7,900
Area 2				
NT Troll	23,363	10,808	16,996	3,609
T Troll	802	1,717	2,362	1,525
Sport	4,711	22,278	9,065	28,000
Area 1				
NT Troll	7,672	4,335	9,492	1,814
Sport	143	7,077	1,531	13,100

Summary of impacts

		Exploitation Rates						Catches					
		Updated Model Run			Pre-Season Model			Updated Model Run			Pre-Season Model		
		Bonn. Pool Hat.	Col R Summer All	Col URB All	Bonn. Pool Hat.	Col R Summer All	Col URB All	Bonn. Pool Hat.	Col R Summer All	Col URB All	Bonn. Pool Hat.	Col R Summer All	Col URB All
SEAK		0.000	0.113	0.124	0.000	0.100	0.109	0	11,681	52,536	0	15,096	55,030
CANADA		0.057	0.192	0.084	0.058	0.173	0.090	10,871	19,801	35,553	14,838	26,165	45,789
PFMC TREATY		0.060	0.001	0.003	0.088	0.001	0.004	11,353	109	1,075	22,366	161	1,869
PFMC NON-TREATY	**MSF**	**0.009**	**0.002**	**0.001**	**0.017**	**0.003**	**0.001**	**1,670**	**189**	**356**	**4,291**	**469**	**717**
	NON-SEL NoF	0.190	0.000	0.0113	0.164	0.000	0.0132	36,215	10	4,782	41,698	17	6,676
	NON-SEL SoF	0.018	0.003	0.0022	0.018	0.003	0.0022	3,406	348	947	4,495	522	1,134
PUGET SOUND		0.011	0.001	0.002	0.010	0.001	0.002	2,027	134	907	2,611	201	1,041
COASTAL NET		0.003	0.000	0.000	0.003	0.000	0.000	640	0	10	838	0	12
RIVER TREATY		0.307	0.008	0.178	0.301	0.008	0.179	58,534	833	75,233	76,571	1,278	90,555
RIVER NON-TREATY		0.0718	0.0018	0.090	0.0705	0.0019	0.090	13,700	185	37,917	17,921	284	45,639
TOTAL		0.726	0.323	0.495	0.731	0.293	0.491	138,416	33,291	209,316	185,629	44,193	248,462
ESCAPEMENT								52,307	69,669	213,952	68,426	106,806	257,525



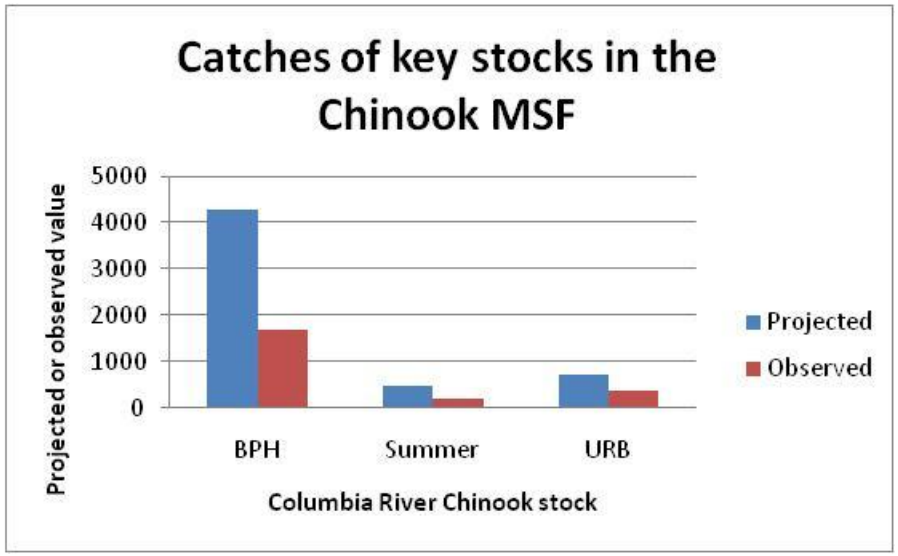


Figure 3. Comparison of exploitation rates and catches of key Columbia River Chinook stocks in the June 2010 Chinook MSF modeled pre-season (run 1010) and post-season in an updated ocean model run.

Estimated CWT-DIT Impacts

Of the 229 coded-wire tags recovered during the June 12-30, 2010 ocean mark-selective Chinook fishery in Areas 1-4 combined, a total of 35 belonged to double-index tag (DIT) release groups (**Table 14**). Based on the release details associated with these tags and their unmarked sister groups, we obtained an estimate of the unmarked-to-marked ratio (λ) at juvenile release for each applicable hatchery of origin and brood year, and we used this value to estimate total unmarked DIT encounters for the entirety of the June 2010 selective Chinook fishery the four areas. In total, we estimated that 114 unmarked-DIT Chinook were encountered during the fishery. Given an assumed *sfm* rate of 0.10 for the estimated unmarked DIT fish that were encountered and released, we estimate that 11 unmarked DIT fish may have died as a result of the June 2010 ocean selective Chinook fishery (**Table 14**).

Table 14. Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the June 12-30, 2010 mark-selective Chinook fishery in Washington coastal Areas 1 through 4.

Marine Area [1/]	Hatchery	Brood Year	DITs Obs.	AD DIT Harvest		UM DIT Enc	UM DIT Mortality		
				Est. AD	var (Est. AD)		Est. UM	var (Est. UM)	SE (Est. UM)
1	SPRING CR NFH	2007	1	1.4	0.5	1.4	0.1	0.005	0.1
	Total, Area 1		**1**	**1.4**	**0.5**	**1.4**	**0.1**	**0.005**	**0.1**
2	BIG CR HATCHERY	2007	11	36.4	84.3	36.6	3.7	0.800	3.1
	CLEAR CREEK HATCHERY	2007	1	3.3	7.7	3.3	0.3	0.100	0.3
	GROVERS CR HATCHERY	2007	1	3.3	7.7	3.3	0.3	0.100	0.3
	H-CHILLIWACK R	2007	7	23.2	53.6	23.2	2.3	0.500	1.9
	SAMISH HATCHERY	2007	1	3.3	7.7	3.4	0.3	0.100	0.3
	SPRING CR NFH	2007	11	36.4	84.3	36.4	3.6	0.800	3.0
	SPRING CR NFH	2008	1	3.3	7.7	4.8	0.5	0.200	0.4
	Total, Area 2		**33**	**109.3**	**252.8**	**111.0**	**11.1**	**2.600**	**9.3**
4	GROVERS CR HATCHERY	2006	1	2.1	2.3	2.1	0.2	0.023	0.2
	Total, Area 4		**1**	**2.1**	**2.3**	**2.1**	**0.2**	**0.023**	**0.2**
Grand Total (all WA Ocean Areas)			**35**	**112.8**	**255.6**	**114.5**	**11.4**	**2.628**	**9.6**

[1/] In Area 3, dockside samplers did not recover any DIT Chinook in their samples.

5. RESULTS IN THE ALL-SPECIES COHO MARK SELECTIVE RECREATIONAL FISHERY

An estimated 80,895 angler trips (70,947 from Washington, 9,948 from Oregon) were completed by private and charter anglers during the coastwide all-species coho MSF operating July 1 through September 30, 2010. These anglers harvested a total of 33,649 Chinook coastwide (31,874 WA, 1,775 OR) and 42,339 coho (36,231 WA, 6,108 OR). Landed Chinook catch totaled 74% of the overall adjusted fishery quota of 45,500[2]; landed coho catch totaled 57% of the adjusted fishery quota of 74,200[3]. **Table 15** shows effort and catch by month and area.

WDFW dockside samplers interviewed an estimated 37% of all anglers fishing from WA coastwide. A total of 32% of all Chinook and 40% of all coho harvested in WA were sampled; 1,460 coded wire tags (CWTs) were collected from sampled Chinook and 1,456 were collected from sampled coho in WA ports (**Table 16**).

OSP observer staff conducted a total of 51 on-the-water catch surveys during the all-species fishery and encountered a total of 329 legal sized Chinook, 222 sublegal sized Chinook, 908 legal sized coho, and 19 sublegal sized coho. Dockside samplers also collected 200 completed and useable VTRs containing 342 legal sized Chinook encounters, 326 sublegal sized Chinook encounters, 773 legal sized coho encounters, and 53 sublegal sized coho encounters (**Tables 17 and 18**). Mark rates calculated from onboard observer and VTR data are shown in **Table 19** and compared to preseason FRAM coho mark rate projections.

FRAM pre-season projections of total coho mortality in the 2010 ocean recreational all-species fisheries are shown in **Table 20**. **Table 21** details observed coho mortality in those fisheries. Both tables include catch from Oregon. An explanation of the calculations and assumptions used in table 21 follows:

Observed marked and unmarked coho retention is calculated from dockside sampling data as described in Section 3.4; note that since catch estimates are stratified by week, monthly total proportions of marked and unmarked retained estimated catch may vary slightly from monthly total proportions of marked and unmarked sampled coho. Marked release mortality is calculated as 6% of the marked retained coho multiplied by the hooking mortality rate of 14% adopted by the PFMC for recreational fisheries north of Cape Falcon. Unmarked release mortality is calculated by dividing total retention by the observed mark rate (to get total encounters), subtracting the total retention (to get unmarked released coho), and multiplying by the ocean recreational hooking mortality rate of 14%. Observed mark rates from on-water sampling or VTRs is used in this calculation. Where there is no observed estimate of mark rate (in 2010, this occurred in Area 4 in September), we estimate mark rate from dockside sampling data ([total

[2] In-season adjustments included rollover of remainder from June MSF, transfers to non-Treaty commercial troll fishery. All rollovers and transfers were executed at an impact-neutral rate. Preseason recreational quota was 49,000.

[3] In-season adjustments included a transfer from the non-Treaty commercial troll fishery (impact-neutral). Preseason recreational quota was 67,200.

marked retained + marked reported released]/[total retained + total reported released]). Total coho handled is estimated by dividing the total release mortality by the 14% hooking mortality rate (to get total released coho) and adding that to the total retained. Drop off mortality is calculated as 5% of the total estimated handled coho, the rate adopted for ocean recreational fisheries by the PFMC. Total incidental mortality is the sum of release mortality and drop off mortality. Total estimated mortality is the sum of total retention and total incidental mortality.

Tables 22 and **23** and **Figure 4** summarize the projected and observed coho encounters and mortality in the all-species fishery. Both observed coho encounters and total mortality were lower than projected preseason in all ocean catch areas.

Table 24 reports compliance rates observed by dockside samplers for the recreational fisheries by area and month. Coastwide, compliance with selective fishery regulations averaged 99%, similar to that observed in the last seven seasons.

On-water observers and volunteer anglers were asked to record information on fish that were hooked but lost before being brought to the boat, commonly referred to as drop offs. For this study, the definition of drop off was that the fish was actually hooked but became free before it could be landed. Current PFMC methodology for estimating mortality due to drop off uses a rate of 5% of the total number of fish handled (retention plus release).

Estimates of drop off mortality rates from on-water observation and VTR data collected during the recreational fisheries are compared with FRAM projections in **Table 25**.

A total of 1,920 DNA samples were collected from Chinook by onboard and dockside samplers during the summer all-species recreational fishery. **Table 26** describes the numbers of samples by size class, mark status, and method of collection.

Table 15. Estimates of total fishing effort and number of Chinook and coho retained during the 2010 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

	TOTAL ANGLER TRIPS					CHINOOK RETAINED					COHO RETAINED				
AREA	July	Aug.	Sept.	Oct.	**TOTAL**	July	Aug.	Sept.	Oct.	**TOTAL**	July	Aug.	Sept.	Oct.	**TOTAL**
Area 4	5,701	3,803	807	-	**10,310**	1,573	1,453	129	-	**3,154**	1,926	1,609	150	-	**3,685**
Area 3	838	1,940	513	154	**3,445**	294	715	86	45	**1,140**	211	709	223	37	**1,180**
Area 2	11,841	13,804	4,961	-	**30,607**	9,948	10,586	1,744	-	**22,278**	3,680	3,957	4,925	-	**12,562**
Area 1	7,165	17,349	2,070	-	**26,584**	1,485	3,588	229	-	**5,302**	6,430	11,725	650	-	**18,804**
TOTAL WA	**25,546**	**36,896**	**8,351**	**154**	**70,947**	**13,299**	**16,341**	**2,189**	**45**	**31,874**	**12,247**	**17,999**	**5,947**	**37**	**36,231**
OREGON (Area 1)	2,211	6,996	741	-	**9,948**	388	1,321	66	-	**1,775**	1,491	4,404	213	-	**6,108**
TOTAL NOF	**27,757**	**43,892**	**9,092**	**154**	**80,895**	**13,687**	**17,662**	**2,255**	**45**	**33,649**	**13,738**	**22,403**	**6,160**	**37**	**42,339**
WA Variance: [1/]					691,925					551,302					481,778
WA Standard Error:					832					742					694
WA CV (%):					1%					2%					2%
WA 95% CI:					69,316-72,577					30,419-33,330					34,870-37,591

[1/] Variance estimates are unavailable for Oregon statistics.

Table 16. WA dockside sampling statistics during the 2010 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

AREA	Anglers Sampled	Sample Rate	Landed Chinook Sampled	Sample Rate	Landed Coho Sampled	Sample Rate	Chinook CWTs collected	Coho CWTs collected
Area 4	4,188	41%	1,325	42%	1,406	38%	159	114
Area 3	2,157	63%	692	61%	746	63%	48	53
Area 2	9,503	31%	6,269	28%	4,309	34%	867	407
Area 1	10,191	38%	2,039	38%	8,099	43%	386	882
TOTAL WA	**26,039**	**37%**	**10,325**	**32%**	**14,560**	**40%**	**1,460**	**1,456**

Table 17. On-board Chinook encounters by size class and mark status in the 2010 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

		On-board observation							VTRs						
			LEGAL-SIZED			SUBLEGAL-SIZED				LEGAL-SIZED			SUBLEGAL-SIZED		
Area	**Month**	Total Observer Trips	Marked	Unmarked	Unknown	Marked	Unmarked	Unknown	Total VTRs Collected	Marked	Unmarked	Unknown	Marked	Unmarked	Unknown
Area 4	July	3	5	3	0	6	3	1	36	19	23	3	19	38	13
	August	0	-	-	-	-	-	-	13	7	10	0	2	8	0
	September	0	-	-	-	-	-	-	1	-	-	-	-	-	-
	TOTAL	**3**	**5**	**3**	**0**	**6**	**3**	**1**	**50**	**26**	**33**	**3**	**21**	**46**	**13**
Area 3	July	0	-	-	-	-	-	-	4	1	0	0	0	2	0
	August	0	-	-	-	-	-	-	5	5	0	0	0	0	0
	September	0	-	-	-	-	-	-	2	2	1	0	0		0
	TOTAL	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**11**	**8**	**1**	**0**	**0**	**2**	**0**
Area 2	July	14	97	53	11	26	10	8	40	81	38	3	73	26	4
	August	10	47	64	6	57	23	17	22	34	21	5	29	11	1
	September	3	6	11	3	11	2	3	1	2	2	0		1	0
	TOTAL	**27**	**150**	**128**	**0**	**94**	**35**	**0**	**63**	**117**	**61**	**0**	**102**	**38**	**0**
Area 1	July	10	13	6	2	15	22	4	24	21	9	1	15	15	1
	August	10	10	9	3	27	9	3	50	29	29	4	21	15	36
	September	1	0	0	0	2	1	0	2	0	0	0	1	0	0
	TOTAL	**21**	**23**	**15**	**5**	**44**	**32**	**7**	**76**	**50**	**38**	**5**	**37**	**30**	**37**

Table 18. On-board coho encounters by size class and mark status in the 2010 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

		On-board observation							VTRs						
		Total Observer Trips	LEGAL-SIZED			SUBLEGAL-SIZED			Total VTRs Collected	LEGAL-SIZED			SUBLEGAL-SIZED		
Area	**Month**		Marked	Unmarked	Unknown	Marked	Unmarked	Unknown		Marked	Unmarked	Unknown	Marked	Unmarked	Unknown
Area 4	July	3	18	34	0	0	1	0	36	39	65	3	1	8	3
	August	0	-	-	-	-	-	-	13	17	42	3	2	3	1
	September	0	-	-	-	-	-	-	1	0	2	0	0	0	0
	TOTAL	**3**	**18**	**34**	**0**	**0**	**1**	**0**	**50**	**56**	**109**	**6**	**3**	**11**	**4**
Area 3	July	0	-	-	-	-	-	-	4	5	3	0	0	0	0
	August	0	-	-	-	-	-	-	5	7	12	2	0	3	0
	September	0	-	-	-	-	-	-	2	2	3	0	0	0	0
	TOTAL	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**11**	**14**	**18**	**2**	**0**	**3**	**0**
Area 2	July	14	69	80	8		2	1	40	16	35	1	2	0	0
	August	10	54	43	1	1			22	16	9	6	3	4	0
	September	3	60	55	5		1		1	4	6	0	0	0	0
	TOTAL	**27**	**183**	**178**	**0**	**1**	**3**	**0**	**63**	**36**	**50**	**0**	**5**	**4**	**0**
Area 1	July	10	114	114	6	3			24	68	54	5	1	1	0
	August	10	122	122	6	6	4	1	50	137	169	46	9	9	3
	September	1	6	5					2	2	1	0	0	0	0
	TOTAL	**21**	**242**	**241**	**12**	**9**	**4**	**1**	**76**	**207**	**224**	**51**	**10**	**10**	**3**

Table 19. 2010 estimated Chinook and coho mark rates during the 2010 all-species recreational fishery (coho mark-selective) by size class using onboard observer and VTR encounters.

		LEGAL SIZED CHINOOK			SUBLEGAL SIZED CHINOOK			LEGAL SIZED COHO			FRAM Projected Coho Mark Rate
Area	**Month**	Observer	VTR	Combined	Observer	VTR	Combined	Observer	VTR	Combined	
Area 4	July	63%	45%	48%	67%	33%	38%	35%	38%	37%	51%
	August	-	41%	41%	-	20%	N/A	-	29%	29%	50%
	September	-	N/A	N/A	-	N/A	N/A	-	N/A	N/A	54%
	TOTAL	**63%**	**44%**	**46%**	**67%**	**31%**	**36%**	**35%**	**34%**	**34%**	**51%**
Area 3	July	-	100%	100%	-	N/A	N/A	-	63%	63%	54%
	August	-	100%	100%	-	N/A	N/A	-	37%	37%	57%
	September	-	67%	67%	-	N/A	N/A	-	40%	40%	41%
	TOTAL	**-**	**89%**	**89%**	**-**	**N/A**	**N/A**	**-**	**44%**	**44%**	**54%**
Area 2	July	65%	68%	66%	72%	74%	73%	46%	31%	43%	62%
	August	42%	62%	49%	71%	73%	72%	56%	64%	57%	60%
	September	35%	50%	38%	85%	0%	79%	52%	40%	51%	52%
	TOTAL	**54%**	**66%**	**59%**	**73%**	**73%**	**73%**	**51%**	**42%**	**49%**	**59%**
Area 1	July	68%	70%	69%	41%	50%	45%	50%	56%	52%	70%
	August	53%	50%	51%	75%	58%	67%	50%	45%	47%	66%
	September	N/A	N/A	N/A	67%	100%	75%	55%	67%	57%	64%
	TOTAL	**61%**	**57%**	**58%**	**58%**	**55%**	**57%**	**50%**	**48%**	**49%**	**67%**

Table 20. Preseason FRAM (model run 1016) projected coho mortality in the 2010 all-species recreational fishery (coho mark-selective).

Area	Month	Total Retention	Marked Retention	Marked Release Mortality	Unmarked Retention	Unmarked Release Mortality	Total Handled a/	Predicted Mark Rate	Drop Off Mortality b/	Release Mortality c/	Incidental Mortality d/	Total Mortality e/
Area 4	July	3,137	3,075	27	62	428	6,392	51%	320	455	775	3,912
	August	3,447	3,375	30	72	497	7,214	50%	361	527	888	4,335
	Sept.	406	399	4	7	50	785	54%	39	54	93	499
	Total	**6,990**	**6,849**	**61**	**141**	**975**	**14,391**	51%	**720**	**1,036**	**1,756**	**8,746**
Area 3	July	546	536	5	10	67	1,061	54%	53	72	125	671
	August	1,089	1,072	10	17	120	2,014	57%	101	130	231	1,320
	Sept./Oct.	114	111	1	3	23	285	41%	14	24	38	152
	Total	**1,749**	**1,719**	**16**	**30**	**210**	**3,360**	54%	**168**	**226**	**394**	**2,143**
Area 2	July	6,672	6,587	59	85	582	11,251	62%	563	641	1,204	7,876
	August	13,029	12,843	115	186	1274	22,947	60%	1,147	1,389	2,536	15,565
	Sept.	5,158	5060	45	98	670	10,263	52%	513	715	1,228	6,386
	Total	**24,859**	**24,490**	**219**	**369**	**2,526**	**44,461**	59%	**2,223**	**2,745**	**4,968**	**29,827**
Area 1	July	7,934	7,862	70	72	494	11,964	70%	598	564	1,162	9,096
	August	22,202	21,959	196	243	1,669	35,527	66%	1,776	1,865	3,641	25,843
	Sept.	3,464	3,423	31	41	280	5,683	64%	284	311	595	4,059
	Total	**33,600**	**33,244**	**297**	**356**	**2,443**	**53,174**	67%	**2,659**	**2,740**	**5,399**	**38,999**

a/ Marked handled + Unmarked handled.
b/ 5% of total handled.
c/ Marked release mortality + unmarked release mortality.
d/ Drop off + Release mortality.
e/ Total retention + Incidental mortality.

Table 21. Estimated actual coho mortality in the 2010 all-species recreational fishery (coho mark-selective).

Area	Month	Total Retention	Marked Retention	Marked Released Mortality a/	Unmarked Retention	Unmarked Released Mortality b/	Total Handled c/	Observed Mark Rate d/	Drop Off Mortality e/	Release Mortality f/	Incidental Mortality g/	Total Mortality h/
Area 4	July	1,926	1,903	16	23	468	5,385	37%	269	484	754	2,679
	August	1,609	1,545	13	64	557	5,678	29%	284	570	853	2,463
	Sept.	150	141	1	9	79	724	21%	36	80	116	267
	Total	**3,685**	**3,589**	**30**	**96**	**1,104**	**11,786**	34%	**589**	**1,134**	**1,723**	**5,409**
Area 3	July	211	207	2	4	18	350	63%	18	19	37	248
	August	709	703	6	6	170	1,966	37%	98	176	274	983
	Sept./Oct.	259	258	2	1	54	664	40%	33	57	90	349
	Total	**1,180**	**1,168**	**10**	**12**	**242**	**2,981**	44%	**149**	**252**	**401**	**1,581**
Area 2	July	3,680	3,676	31	4	697	8,880	43%	444	728	1,172	4,852
	August	3,957	3,942	33	15	412	7,133	57%	357	445	801	4,758
	Sept./Oct.	4,925	4,892	41	33	657	9,912	51%	496	698	1,194	6,118
	Total	**12,562**	**12,510**	**105**	**52**	**1,766**	**25,925**	49%	**1,296**	**1,871**	**3,167**	**15,729**
Area 1	July	7,921	7,914	66	7	1,024	15,708	52%	785	1,090	1,875	9,796
	August	16,129	16,079	135	50	2,537	35,214	47%	1,761	2,672	4,433	20,561
	Sept.	863	848	7	15	91	1,561	57%	78	98	176	1,039
	Total	**24,912**	**24,841**	**209**	**72**	**3,651**	**52,483**	49%	**2,624**	**3,860**	**6,484**	**31,396**

a/ 6% of marked retention multiplied by 0.14 hooking mortality
b/ Total retention divided by observed mark rate less total retention multiplied by 0.14 hooking mortality
c/ Total retention + (Total released mortality divided by 0.14 mooking mortality).
d/ Observed mark rates assumed from dockside sampling data where observer data and VTR data are unavailable (Area 4 September).
e/ 5% of total handled.
f/ Unmarked released mortality + marked released mortality.
g/ Drop off + release mortality.
h/ Total retention + incidental mortality.

Table 22. Comparison of modeled (FRAM model run #1016) and estimated total coho encountersa/ in the 2010 all-species recreational fishery (coho mark-selective).

Area	Projected	Observed
Area 4	14,390	11,786
Area 3	3,363	2,981
Area 2	44,466	25,925
Area 1	53,171	52,483
Coastwide Total	**115,391**	**93,174**

[a/] Total retention + (Total released mortality divided by 0.14 hooking mortality).

Table 23. Comparison of modeled (FRAM model run #1016) and estimated total coho mortalities in the 2010 all-species recreational fishery (coho mark-selective).

	Projected	Observed
Area 4	8,746	5,409
Area 3	2,143	1,581
Area 2	29,827	15,729
Area 1	38,999	31,396
Coastwide Total	**79,714**	**54,115**

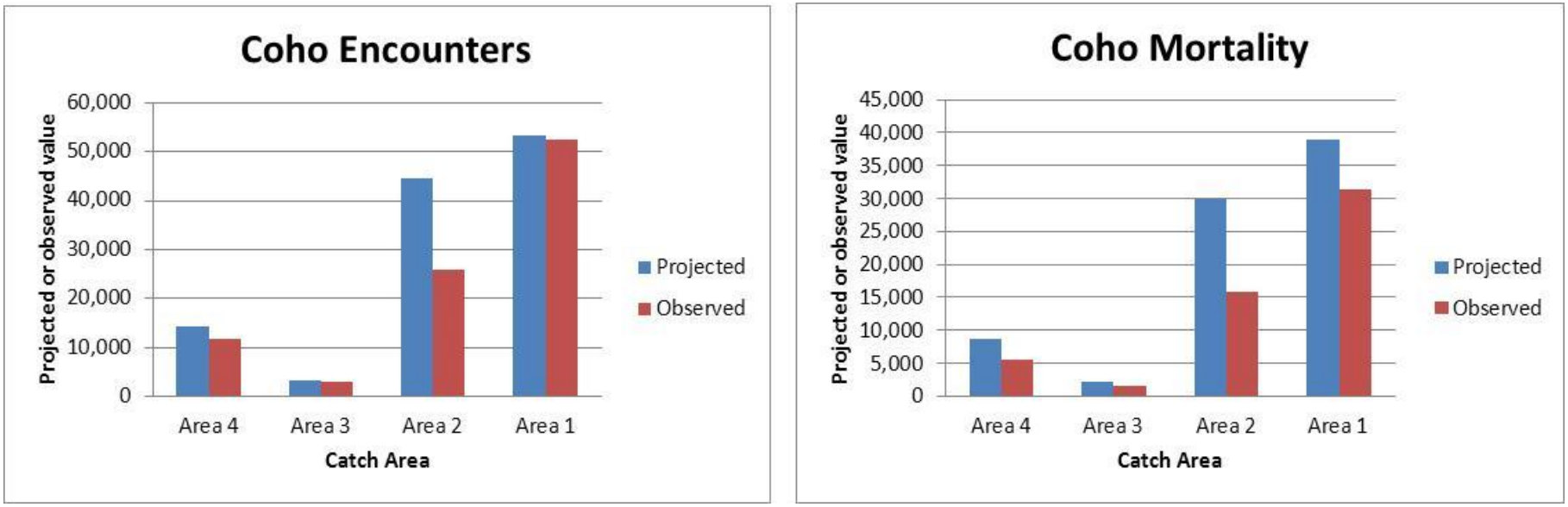


Figure 4. Comparison of modeled (FRAM model run #1016) and estimated total coho encounters and mortality in the 2010 all-species recreational fishery (coho mark-selective).

Table 24. Compliance with coho selective fishery regulations observed during dockside sampling interviews in the 2010 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

Area	Month	Total Coho Sampled	Marked Coho Sampled	Unmarked Coho Sampled	% Sampled Coho Marked
Area 4	July	689	679	10	98.5%
	August	661	640	21	96.8%
	September	48	45	3	93.8%
	Total	**1,398**	**1,364**	**34**	**97.6%**
Area 3	July	124	123	1	99.2%
	August	491	487	4	99.2%
	September	148	147	1	99.3%
	Total	**763**	**757**	**6**	**99.2%**
Area 2	July	1,125	1,110	15	98.7%
	August	1,310	1,305	5	99.6%
	September	1,918	1,909	9	99.5%
	Total	**4,353**	**4,324**	**29**	**99.3%**
Area 1	July	3,335	3,332	3	99.9%
	August	4,523	4,509	14	99.7%
	September	238	234	4	98.3%
	Total	**8,096**	**8,075**	**21**	**99.7%**

Table 25. Estimated drop off mortality rate in the 2010 all-species recreational fishery (coho mark-selective) using on-water observation data and voluntary trip reports.

		On-Board Observation					VTRs				
Area	Month	Total Salmon Handled	Observed Drop Offs	Estimated Observed Drop Off Mortality a/	FRAM Total Drop Off Mortality b/	Observed Drop Off Mortality Rate c/	Total Salmon Handled	Observed Drop Offs	Estimated Observed Drop Off Mortality a/	FRAM Total Drop Off Mortality b/	Observed Drop Off Mortality Rate c/
Area 4	July	72	1	0	4	0.2%	241	20	3	12	1.2%
	August	-	-	-	-	-	96	7	1	5	1.0%
	Sept	-	-	-	-	-	3	1	0	0	4.7%
	Total	**72**	**1**	**0**	**4**	**0.2%**	**340**	**28**	**4**	**17**	**1.2%**
Area 3	July	-	-	-	-	-	11	4	1	1	5.1%
	August	-	-	-	-	-	31	5	1	2	2.3%
	Sept	-	-	-	-	-	8	0	0	0	0.0%
	Total	**-**	**-**	**-**	**-**	**-**	**50**	**9**	**1**	**3**	**2.5%**
Area 2	July	368	37	5	18	1.4%	283	55	8	14	2.7%
	August	313	29	4	16	1.3%	147	27	4	7	2.6%
	Sept	157	16	2	8	1.4%	15	0	0	1	0.0%
	Total	**838**	**82**	**11**	**42**	**1.4%**	**445**	**82**	**11**	**22**	**2.6%**
Area 1	July	301	198	28	15	9.2%	197	28	4	10	2.0%
	August	328	133	19	16	5.7%	567	161	23	28	4.0%
	Sept	14	3	0	1	3.0%	4	1	0	0	3.5%
	Total	**643**	**334**	**47**	**32**	**7.3%**	**768**	**190**	**27**	**38**	**3.5%**

a/ Assume 14% hooking mortality rate on observed drop offs.
b/ Total drop off mortality calculated using FRAM methodology (5% of handled fish).
c/ Estimated drop off mortality/Total salmon handled; 5% used by FRAM pre-season.

Table 26. Number of Chinook DNA samples collected by onboard and dockside samplers from the ocean recreational all-species fishery, by size class, mark status, and sample type.

		On-Board Sampling						Dockside Sampling			Total Number of DNA Samples
		Legal Sized			Sublegal Sized			Legal-Sized			
Area	Month	Marked	Unmarked	Unknown	Marked	Unmarked	Unknown	Marked	Unmarked	Unknown	
Area 4	July	2	2	0	6	3	0	66	106	35	220
	August	0	0	0	0	0	0	50	51	3	104
	September	0	0	0	0	0	0	5	3	1	9
	Total	**2**	**2**	**0**	**6**	**3**	**0**	**121**	**160**	**39**	**333**
Area 3	July	-	-	-	-	-	-	21	21	0	42
	August	-	-	-	-	-	-	50	43	0	93
	September	-	-	-	-	-	-	7	20	0	27
	Total	**-**	**-**	**-**	**-**	**-**	**-**	**78**	**84**	**0**	**162**
Area 2	July	101	59	0	29	14	0	236	106	0	545
	August	31	54	0	46	17	0	63	49	0	260
	September	4	10	0	12	2	0	9	12	0	49
	Total	**136**	**123**	**0**	**87**	**33**	**0**	**308**	**167**	**0**	**854**
Area 1	July	9	6	0	12	16	1	127	80	8	259
	August	10	8	0	25	8	0	120	119	1	291
	September	0	0	0	2	1	0	6	12	0	21
	Total	**19**	**14**	**0**	**39**	**25**	**1**	**253**	**211**	**9**	**571**

6. RESULTS IN THE ALL-SPECIES COHO MARK SELECTIVE NON-TREATY COMMERCIAL TROLL FISHERY

The non-Treaty commercial troll fishery harvested a total of 17,997 Chinook (14,108 WA, 3,889 OR) and 3,142 coho (2,104 WA, 1,038 OR) during the coastwide all-species coho MSF operating July 1 through September 7, 2010. Landed Chinook catch totaled 98% of the overall adjusted fishery quota of 18,350[4]; landed coho catch totaled 52% of the adjusted fishery quota of 6,100[5]. **Table 27** shows catch by month and area.

WDFW dockside samplers sampled a total of 44% of all Chinook and 44% of all coho harvested in WA. Coded wire tag collections totaled 637 from Chinook and 88 from coho in WA ports (**Table 28**).

Table 29 details numbers of Chinook DNA samples collected in WA by month and area. A total of 2,295 DNA samples were collected from Chinook by dockside samplers throughout the May – September non-Treaty troll fishery (1,313 in May-June, 982 in July-September).

Table 27. Total Chinook and coho retained during the 2010 all-species non-Treaty commercial troll fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

	Chinook				Coho			
AREA	July	August	September	TOTAL	July	August	September	TOTAL
Area 4	368	332	0	700	69	18	0	87
Area 3	984	1,147	23	2,154	121	87	1	209
Area 2	4,761	5,788	259	10,808	895	639	123	1,657
Area 1	168	237	41	446	99	38	14	151
TOTAL WA	**6,281**	**7,504**	**323**	**14,108**	**1,184**	**782**	**138**	**2,104**
OREGON (Area 1)	2,121	1,657	111	3,889	636	367	35	1,038
TOTAL NOF	**8,402**	**9,161**	**434**	**17,997**	**1,820**	**1,149**	**173**	**3,142**

Table 28. Chinook and coho sampled in WA during the 2010 all-species non-Treaty commercial troll fishery (coho mark-selective) between Cape Falcon, Oregon and the U.S.-Canada border.

AREA	Chinook			Coho		
	Total Sampled	Sample Rate	CWTs Collected	Total Sampled	Sample Rate	CWTs Collected
Area 4	507	72%	43	70	80%	8
Area 3	1,237	57%	90	160	77%	7
Area 2	4,249	39%	460	596	36%	59
Area 1	281	63%	44	90	60%	14
TOTAL WA	**6,274**	**44%**	**637**	**916**	**44%**	**88**

[4] In-season adjustments included rollover of remainder from May-June fishery and transfers from the recreational fishery. All rollovers and transfers were executed at an impact-neutral rate. Preseason summer Chinook quota was 14,000.

[5] In-season adjustments included a transfer to the recreational fishery (impact-neutral). Preseason troll coho quota was 11,800.

Table 29. Number of chinook DNA samples collected from the non-treaty troll fishery by size class, mark status.

		Dockside Sampling			Total Number of DNA Samples
		Legal-Sized			
Area	**Month**	Marked	Unmarked	Unknown	
Area 4	May	94	164	0	258
	June	28	62	0	90
	July	34	86	0	120
	August	0	0	0	0
	September	0	0	0	0
	Total	**156**	**312**	**0**	**468**
Area 3	May	68	113	0	181
	June	112	149	0	261
	July	22	93	0	115
	August	50	190	0	240
	September	0	0		0
	Total	**252**	**545**	**0**	**797**
Area 2	May	183	59	1	243
	June	162	64	0	226
	July	71	35	1	107
	August	98	63	0	161
	September	11	5	0	16
	Total	**525**	**226**	**2**	**753**
					0
Area 1	May	20	14	0	34
	June	6	14	0	20
	July	34	40	0	74
	August	83	66	0	149
	September	0	0	0	0
	Total	**143**	**134**	**0**	**277**

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APPENDICES

Appendix A. Mark-selective fishery impact estimation details for the pilot recreational selective Chinook fishery in Washington coastal Areas 1 through 4.

Below are definitions and equations for all quantities used in estimating mark-selective fishery impacts from the combination of dockside creel survey information, on-water observer data, and/or voluntary trip report (VTR) results as applicable. The estimation sequence builds from monthly[6] estimators of encounters-by-class (i.e., the four size [legal, sublegal] × mark-status [marked, unmarked] groups) to season-wide impact estimates.

A. Total and Class-specific Encounters Estimation

The first step towards quantifying mark-selective fishery impacts by size/mark-status class is to estimate total Chinook encounters ($\hat{E}_i$, includes retained + released Chinook; See *Monthly Encounters* below) for each month of the fishery. Secondarily, encounters are apportioned to the appropriate size/mark-status group using encounters-composition data collected from onboard sampling on charter boats (See *Estimating Chinook Encounter Composition* on following page).

Monthly Encounters

$\hat{E}_i$ = Total Chinook encounters for month *i*, which is estimated by combining creel estimates of legal-marked Chinook harvest ($\hat{K}_{LM\,i}$, defined on subsequent page) with an estimate of the proportion of the fishable Chinook population that is of legal size and marked ($\hat{p}_{LM\,i}$, defined on subsequent page). Given the potential for negative bias in $\hat{E}_i$ if anglers release any of the legal-marked Chinook that they encounter, the $\hat{E}_i$ estimator also includes a "correction" to account for this phenomenon (i.e., 1-$p_{\text{LM-R}}$, where $p_{\text{LM-R}}$ is the estimated legal-marked Chinook release rate)[7]. $\hat{E}_i$ and its variance are estimated as:

$$(1) \qquad \hat{E}_i = \frac{\hat{K}_{LM}}{[\hat{p}_{LM}(1-p_{LM-R})]}$$

$$(2) \qquad \text{var}(\hat{E}_i) = \frac{1}{[(1-p_{LM-R})^2]} * \left[\frac{\hat{K}_{LM\,i}{}^2}{\hat{p}_{LM\,i}{}^2} * \left(\frac{\text{var}(\hat{K}_{LM\,i})}{\hat{K}_{LM\,i}{}^2} + \frac{\text{var}(\hat{p}_{LM\,i})}{\hat{p}_{LM\,i}{}^2} \right) \right]$$

[6] **Note:** For fisheries characterized by short-duration seasons (i.e., ~ 1 month), the "monthly" estimators described in this appendix are synonymous season-total estimators.

[7] Equations 1 and 2 were modified based on a 2008 state–tribal evaluation of sources of bias in estimates of total Chinook encounters in mark-selective fisheries. Based on a review of relevant data, the current operational $p_{\text{LM-R}}$ (combined intentional and unintentional LM Chinook release rate) applied in the bias-corrected $\hat{E}_i$ estimator is 0.13. See Conrad and McHugh (2008) for further detail.

Estimating Chinook Encounter Composition

$\hat{p}_{LM\,i}$ = the onboard observer (charter ride-along)-based estimate of the proportion of Chinook encounters that are legal-sized (*L*) and marked (*M*) during month *i*

$\hat{p}_{LU\,i}$ = the estimated proportion of encounters that are legal-sized (*L*) and unmarked (*U*)

$\hat{p}_{SM\,i}$ = the estimated proportion of encounters that are sublegal-sized (*S*) and unmarked (*M*)

$\hat{p}_{LU\,i}$ = the estimated proportion of encounters that are sublegal-sized (*S*) and unmarked (*U*)

For each *XY* combination (where *X* = *L* or *S* and *Y* = *M* or *U*), $\hat{p}_{XY\,i}$ and its variance is estimated as:

(3) $\hat{p}_{XY\,i} = n_{XY\,i} / n_i$, and

(4) $\text{var}(\hat{p}_{XY\,i}) = [\hat{p}_{XY\,i}(1 - \hat{p}_{XY\,i})]/(n_i - 1)$,

Where, n_i = the total number of fish encountered by the onboard observers during month *i*.

Encounters by Size/Mark-status Class

$\hat{E}_{LM\,i}$ = estimated legal (*L*), marked (*M*) encounters during month *i*

$\hat{E}_{LU\,i}$ = estimated legal (*L*), unmarked (*U*) encounters during month *i*

$\hat{E}_{SM\,i}$ = estimated sublegal (*S*), marked (*M*) encounters during month *i*

$\hat{E}_{SU\,i}$ = estimated sublegal (*S*), marked (*U*) encounters during month *i*

For each *XY* combination (where *X* = *L* or *S* and *Y* = *M* or *U*) $\hat{E}_{XY\,i}$ and an estimate of its variance are obtained from:

(5) $\hat{E}_{XY\,i} = \hat{E}_i * \hat{p}_{XY\,i}$

(6) $\text{var}(\hat{E}_{XY\,i}) = \text{var}(\hat{E}_i) * \hat{p}_{XY\,i}^{\,2} + \hat{E}_i^{\,2} * \text{var}(\hat{p}_{XY\,i}) - \text{var}(\hat{E}_i) * \text{var}(\hat{p}_{XY\,i})$

B. Estimating Retained and Released Numbers by Size/Mark-status Class

Before total mortality can be estimated for each class (LM, SM, LU, SU), class-specific encounters must be separated into retention and release categories. First, given that harvest is estimated only to mark-status class for creel survey purposes, estimates of marked and unmarked Chinook retention must be assigned to size classes (See *Apportioned Estimates of Retention to Size Classes* on subsequent page); this is done using mark-status-specific size composition data from dockside sampling (See *Dockside Observations for Apportioning Retained Catch to Class* on subsequent page). Subsequently, size/mark-status group-specific releases are estimated as the difference between class-specific encounters and retention (See *Estimating Release Numbers by Class* on subsequent page).

Dockside Observations for Apportioning Retained Catch to Class

$\hat{d}_{LMK}$ = the estimated proportion of retained (kept, *K*), marked (*M*) Chinook salmon that were legal (*L*); based on *season-wide*[8] dockside observations of marked Chinook (as is $\hat{d}_{SMK}$)

$\hat{d}_{SMK}$ = the estimated proportion of retained (kept, *K*), marked (*M*) Chinook that were sublegal (*S*)

The proportion of retained, marked fish in size class *X* (*X* = *L* or *S*) and its variance are estimated as:

$$(7) \qquad \hat{d}_{XMK} = n_{XMK} / n_{MK}$$

$$(8) \qquad \text{var}(\hat{d}_{XMK}) = [\hat{d}_{XMK} * (1 - \hat{d}_{XMK})] / (n_{MK} - 1),$$

where n_{MK} and n_{XMK} are *season-wide* total dockside counts of marked fish and the subset of marked fish in size-class *X*, respectively.

$\hat{d}_{LUK}$ = the estimated proportion of retained (kept, *K*), unmarked (*U*) Chinook salmon that are legal (*L*); estimated from *season-wide* dockside observations of unmarked Chinook (as is $\hat{d}_{SUK}$)

$\hat{d}_{SUK}$ = the estimated proportion of retained (kept, *K*), unmarked (*U*) Chinook that are sublegal (*S*)

The proportions of retained, unmarked fish belonging to legal and sublegal size classes and their respective variances are estimated as above (Eqns. 7 and 8) but using *season-wide* dockside observations on unmarked (*U*), not marked Chinook salmon.

Apportioned Estimates of Retention to Size Classes

$\hat{K}_{LM\,i}$ = the estimated number of legal (*L*), marked (*M*) Chinook kept in month *i*

$\hat{K}_{LU\,i}$ = the estimated number of legal (*L*), unmarked (*U*) Chinook kept in month *i*

The number of kept, marked encounters, marked fish in size class *X* (*L* or *S*) and its variance is estimated as:

$$(9) \qquad \hat{K}_{XM\,i} = \hat{d}_{XMK} * \hat{N}_{MK\,i}$$

$$(10) \qquad \text{var}(\hat{K}_{XM\,i}) = \text{var}(\hat{N}_{MK\,i}) * \hat{d}_{XMK}^{\,2} + \hat{N}_{MK\,i}^{\,2} * \text{var}(\hat{d}_{XMK}) - \text{var}(\hat{N}_{MK\,i}) * \text{var}(\hat{d}_{XMK})$$

where $\hat{d}_{XMK}$ and its variance are from 6 and 7 above and $\hat{N}_{MK\,i}$ is the survey estimate of retained marked fish for month *i* defined in Eqn. 1.

$\hat{K}_{SM\,i}$ = estimated number of sublegal (*S*), marked (*M*) Chinook kept in month *i*

$\hat{K}_{SU\,i}$ = estimated number of sublegal (*S*), unmarked (*U*) Chinook kept in month *i*

The number of retained, unmarked fish belonging to legal and sublegal size classes is estimated according to Eqns. 9 and 10 above but using unmarked fish proportions and monthly retention estimates.

[8] Due to small sample sizes for observed, harvested Chinook—particularly for sublegal and/or unmarked classes—dockside length data are pooled across the season to estimate $\hat{d}_{XYK}$.

Estimating Release Numbers by Class

$\hat{R}_{LM\,i}$ = the estimated number of legal (*L*), marked (*M*) Chinook released in month *i*

$\hat{R}_{LU\,i}$ = the estimated number of legal (*L*), unmarked (*U*) Chinook released in month *i*

$\hat{R}_{SM\,i}$ = the estimated number of sublegal (*S*), marked (*M*) Chinook released in month *i*

$\hat{R}_{SU\,i}$ = the estimated number of sublegal (*S*), unmarked (*U*) Chinook released in month *i*

For each size/mark-status class (i.e., *XY* combination [*X* = *L* or *S* and *Y* = *M* or *U*]), the number of fish encountered and released is estimated as the difference between total size/mark-status class encounters ($\hat{E}_{XY\,i}$) and retention ($\hat{K}_{XY\,i}$) during month *i*. The estimator and its variance are:

$$\hat{R}_{XY\,i} = \hat{E}_{XY\,i} - \hat{K}_{XY\,i} \quad (11)$$

$$\mathrm{var}(\hat{R}_{XY\,i}) = \mathrm{var}(\hat{E}_{XY\,i}) + \mathrm{var}(\hat{K}_{XY\,i}) \quad (12)$$

C. Estimating Total (and Class-specific) Monthly and Season-wide Mortality

The application of assumed mortality rates (See *Assumed Mortality Rates for Retained and Released Chinook* below) to class-specific estimates of total retention and releases constitutes the final step in quantifying mark-selective fishery impacts.

Assumed Mortality Rates for Retained and Released Chinook

m_K = retention mortality rate, 100% for all retained Chinook (reincarnation is rare among fishes)
sfm_L = release mortality rate for legal (*L*) Chinook, assumed to be a constant of 14% in ocean fisheries
sfm_S = release mortality rate for sublegal (*S*) Chinook, assumed to be a constant of 14% in ocean fisheries

Retention-mortality Estimates

$\hat{M}_{LMK_i}$ = estimated mortality due to legal (*L*), marked (*M*) Chinook harvest in month *i* (= $\hat{K}_{LM\,i}$).

$\hat{M}_{LUK_i}$ = estimated mortality due to harvest of legal (*L*), unmarked (*U*) Chinook in month *i* (= $\hat{K}_{LU\,i}$).

$\hat{M}_{SMK_i}$ = estimated mortality due to harvest of sublegal (*S*), marked (*M*) Chinook in month *i* (= $\hat{K}_{SM\,i}$).

$\hat{M}_{SUK_i}$ = estimated mortality due to harvest of sublegal (*S*), marked (*M*) Chinook in month *i* (= $\hat{K}_{SU\,i}$).

Release-mortality Estimates

$\hat{M}_{LMR_i}$ = estimated post-release mortality for legal (*L*), marked (*M*) Chinook in month *i*

$\hat{M}_{LUR_i}$ = estimated post-release mortality for legal (*L*), unmarked (*U*) Chinook in month *i*

$\hat{M}_{SMR_i}$ = estimated post-release mortality for sublegal (*S*), marked (*M*) Chinook in month *i*

$\hat{M}_{SUR_i}$ = estimated post-release mortality for sublegal (*S*), unmarked (*U*) Chinook in month *i*

All class-specific (*XY* [*X* = *L* or *S*, *Y* = *M* or *U*]) release mortality estimates are obtained from:

(13) $\hat{M}_{XYRi} = \hat{R}_{XYi} * sfm_Y$

(14) $\text{var}(\hat{M}_{XYRi}) = \text{var}(\hat{R}_{XYi}) * sfm_Y{}^2$

Season-wide Total and Class-specific Mortality Estimation

$\hat{M}_{total}$ = total season-wide Chinook salmon mortality; this parameter and its variance [$\text{var}(\hat{M}_{total})$] are computed as the sum of all monthly retention and release mortality estimates [i.e., $\hat{M}_{total} = \sum_{i=1}^{\max i} (\hat{M}_{XYK\,i} + \hat{M}_{XYR\,i})$] and variances [$\text{var}(\hat{M}_{total}) = \sum_{i=1}^{\max i} [\text{var}(\hat{M}_{XYK\,i}) + \text{var}(\hat{M}_{XYR\,i})]$], respectively, for all four size/mark-status groups (*X* = *L* or *S*, *Y* = *M* or *U*). Season total estimates for subgroups of interest (e.g., unmarked, sublegal Chinook, $\hat{M}_{SU-total}$) are obtained by summing monthly estimates (and variances) across the season for just that group.

D. Characterizing Precision of Estimates

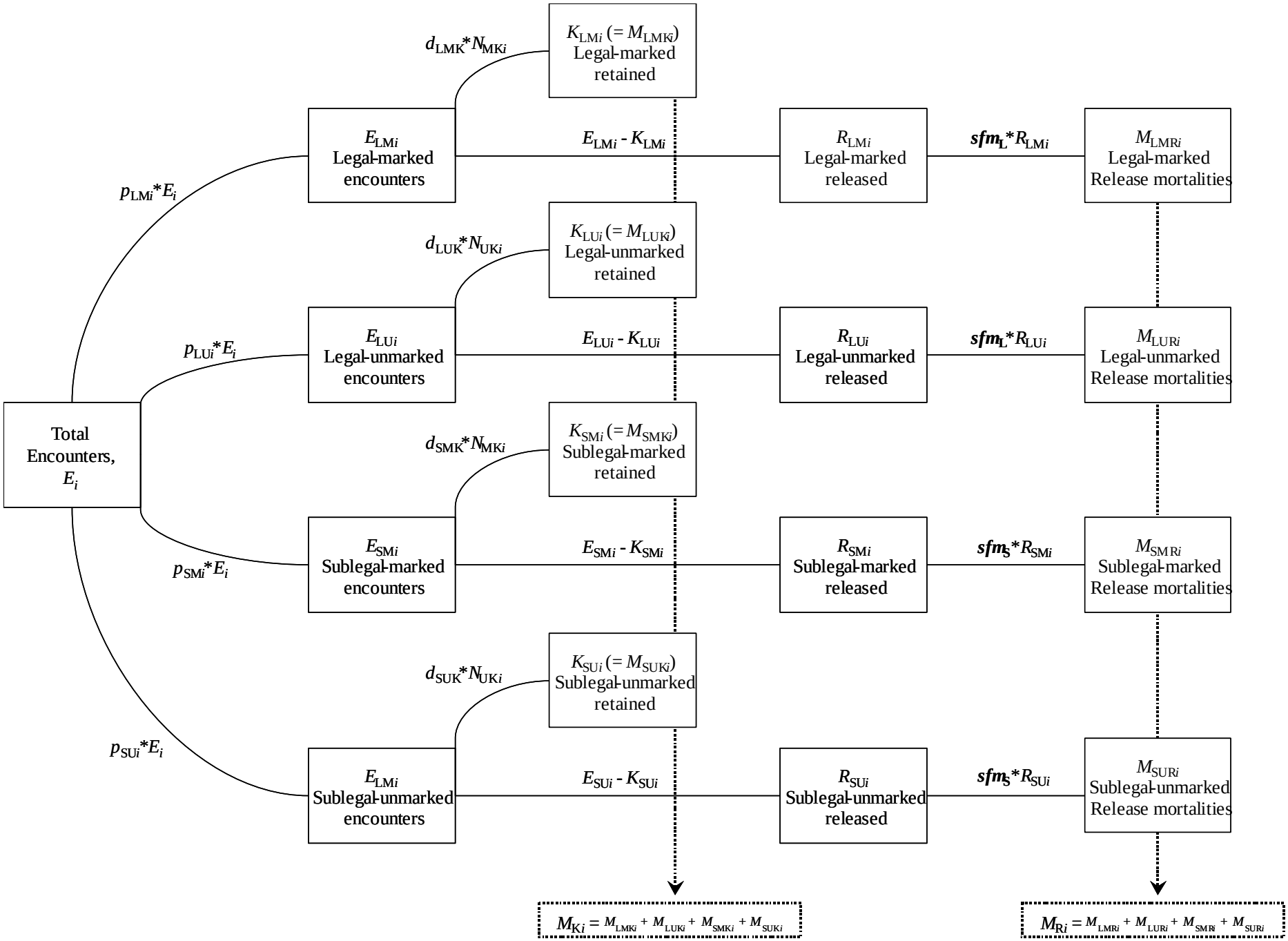
The precision of estimates generated from creel surveys and the preceding fishery impact estimation scheme is characterized using estimates of a parameter's standard error (*SE*), coefficient of variation (*CV* or relative standard error), and approximate 95% confidence interval. For any parameter estimate $\hat{\theta}$ (e.g., $\hat{M}_{total}$, $\hat{K}_{LM\,i}$, $\hat{E}_i$, etc.), these metrics are estimated using:

(15) $SE(\hat{\theta}) = \sqrt{\text{var}(\hat{\theta})}$

(16) $CV(\hat{\theta}) = [SE(\hat{\theta}) / \hat{\theta}] * 100$

(17) $CI = \hat{\theta} \pm 1.96 * SE(\hat{\theta})$

Figure A1. (*On following page*) Graphical representation of the approach used to estimate monthly encounters and mortalities by size/mark-status category in mark-selective Chinook fisheries. Boxes depict abundance estimates (encounters, mortalities) whereas the mathematical operations depicted on intermediate connector lines are estimator formulae yielding quantities found in subsequent boxes (moving from left to right). Parameter definitions, complete formulae, and variances are defined in the preceding pages. For short-duration fisheries (~ 1 month or less), monthly and season-total values are equivalent; for all others, season-total impacts are equivalent to the sum of monthly impact estimates (and variances).


Total Encounters, E_i
$p_{LMi}*E_i$
$p_{LUi}*E_i$
$p_{SMi}*E_i$
$p_{SUi}*E_i$
E_{LMi} Legal-marked encounters
E_{LUi} Legal-unmarked encounters
E_{SMi} Sublegal-marked encounters
E_{LMi} Sublegal-unmarked encounters
$d_{LMK}*N_{MKi}$
$d_{LUK}*N_{UKi}$
$d_{SMK}*N_{MKi}$
$d_{SUK}*N_{UKi}$
K_{LMi} (= M_{LMKi}) Legal-marked retained
K_{LUi} (= M_{LUKi}) Legal-unmarked retained
K_{SMi} (= M_{SMKi}) Sublegal-marked retained
K_{SUi} (= M_{SUKi}) Sublegal-unmarked retained
$E_{LMi} - K_{LMi}$
$E_{LUi} - K_{LUi}$
$E_{SMi} - K_{SMi}$
$E_{SUi} - K_{SUi}$
R_{LMi} Legal-marked released
R_{LUi} Legal-unmarked released
R_{SMi} Sublegal-marked released
R_{SUi} Sublegal-unmarked released
sfm_L*R_{LMi}
sfm_L*R_{LUi}
sfm_S*R_{SMi}
sfm_S*R_{SUi}
M_{LMRi} Legal-marked Release mortalities
M_{LURi} Legal-unmarked Release mortalities
M_{SMRi} Sublegal-marked Release mortalities
M_{SURi} Sublegal-unmarked Release mortalities
$M_{Ki} = M_{LMKi} + M_{LUKi} + M_{SMKi} + M_{SUKi}$
$M_{Ri} = M_{LMRi} + M_{LURi} + M_{SMRi} + M_{SURi}$

Appendix B. Coded-wire tag recovery data collected during dockside sampling activities in the June 12-30, 2010 recreational mark-selective Chinook fishery in Washington coastal Marine Areas 1, 2, 3, and 4.

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
Area 1	18-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		74	69551	AD Fin Clp
Area 1	20-Jun-10	54276	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	54274,54275,54277	69	69552	AD Fin Clp
Area 1	24-Jun-10	94615	2006	MCKENZIE R 1	MCKENZIE HATCHERY	ODFW		66	69553	AD Fin Clp
Area 1	27-Jun-10	633378	2006	COLUMBIA R - GENERAL	TURTLE ROCK HATCHERY	WDFW		75	69554	AD Fin Clp
Area 1	26-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		75	82229	AD Fin Clp
Area 1	12-Jun-10	94602	2006	MOLALLA R	WILLAMETTE HATCHERY	ODFW		85	94851	AD Fin Clp
Area 1	12-Jun-10	94609	2006	SANTIAM R & N FK-1	MARION FORKS HATCH	ODFW		76	94852	AD Fin Clp
Area 1	18-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW			94853	AD Fin Clp
Area 1	18-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		64	94854	AD Fin Clp
Area 1	18-Jun-10	612511	2006	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		82	94855	AD Fin Clp
Area 1	27-Jun-10	634183	2006	METHOW R 48.0002	CARLTON REARING POND	WDFW		79	95101	AD Fin Clp
Area 1	21-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		76	95125	AD Fin Clp
Area 1	19-Jun-10	68607	2007	SAN PABLO BAY NET PENS	MOKELUMNE R FISH INS	CDFG		73	95302	AD Fin Clp
Area 1	19-Jun-10	633799	2006	COLUMBIA R - GENERAL		WDFW		80	95303	AD Fin Clp
Area 1	23-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		69	95304	AD Fin Clp
Area 1	27-Jun-10	634183	2006	METHOW R 48.0002	CARLTON REARING POND	WDFW		84	95305	AD Fin Clp
Area 1	23-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		79	95320	AD Fin Clp
Area 2	12-Jun-10	54274	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	54276,54275,54277	77	53287	AD Fin Clp
Area 2	12-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		72	69698	AD Fin Clp
Area 2	12-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		69	96100	AD Fin Clp
Area 2	12-Jun-10	94332	2005	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		78	53296	AD Fin Clp
Area 2	12-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	84	94501	AD Fin Clp
Area 2	12-Jun-10	103680	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		66	96103	AD Fin Clp
Area 2	12-Jun-10	210790	2007	GROVERS CR HATCHERY	GROVERS CR HATCHERY	Suquamish Tribe	634276	78	96104	AD Fin Clp
Area 2	12-Jun-10	612511	2006	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		66	69699	AD Fin Clp
Area 2	12-Jun-10	612716	2007	NPT HATCHERY	NPT HATCHERY	Nez Perce Tribe (ID)		54	53290	AD Fin Clp
Area 2	12-Jun-10	633592	2005	WENATCHEE R 45.0030	DRYDEN POND	WDFW		78	53295	AD Fin Clp

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
Area 2	12-Jun-10	633594	2005	SIMILKAMEEN R 490325	SIMILKAMEEN HATCHERY	WDFW		82	96101	AD Fin Clp
Area 2	12-Jun-10	633871	2007	COLUMBIA R - GENERAL		WDFW		72	96102	AD Fin Clp
Area 2	12-Jun-10	634183	2006	METHOW R 48.0002	CARLTON REARING POND	WDFW		71	53291	AD Fin Clp
Area 2	12-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		67	53286	AD Fin Clp
Area 2	12-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		70	53292	AD Fin Clp
Area 2	12-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		78	94087	AD Fin Clp
Area 2	12-Jun-10	634280	2007	COWLITZ R 26.0002	COWLITZ SALMON HATCH	WDFW		70	53293	AD Fin Clp
Area 2	12-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		70	53294	AD Fin Clp
Area 2	12-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		68	94502	AD Fin Clp
Area 2	13-Jun-10	52978	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	53782,53783,53768	62	53300	AD Fin Clp
Area 2	13-Jun-10	53767	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	50685,53766,50686	77	53298	AD Fin Clp
Area 2	13-Jun-10	53874	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	53779,53875,53776,53777,53778,53780,53781	79	53301	AD Fin Clp
Area 2	13-Jun-10	94611	2006	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		78	53299	AD Fin Clp
Area 2	13-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		70	94505	AD Fin Clp
Area 2	13-Jun-10	634183	2006	METHOW R 48.0002	CARLTON REARING POND	WDFW		66	94504	AD Fin Clp
Area 2	13-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		77	53297	AD Fin Clp
Area 2	17-Jun-10	68610	2007	MARE ISLAND NET PEN	FEATHER R HATCHERY	CDFG		75	94506	AD Fin Clp
Area 2	17-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		73	96108	AD Fin Clp
Area 2	17-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	78	96106	AD Fin Clp
Area 2	17-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	81	96107	AD Fin Clp
Area 2	17-Jun-10	186242	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186241,186240,186243		96304	AD Fin Clp
Area 2	17-Jun-10	633799	2006	COLUMBIA R - GENERAL		WDFW		63	96301	AD Fin Clp
Area 2	17-Jun-10	633872	2007	COLUMBIA R - GENERAL		WDFW		63	96105	AD Fin Clp
Area 2	17-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		76	94508	AD Fin Clp
Area 2	17-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		65	96110	AD Fin Clp
Area 2	17-Jun-10	634370	2007	ELOCHOMAN R 25.0236	ELOCHOMAN HATCHERY	WDFW		79	96109	AD Fin Clp
Area 2	17-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		67	94507	AD Fin Clp
Area 2	17-Jun-10	634680	2007	SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	WDFW		60	96303	AD Fin Clp
Area 2	18-Jun-10	53767	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	50685,53766,50686	75	87416	AD Fin Clp

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
Area 2	18-Jun-10	54274	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	54276,54275,54277	78	87414	AD Fin Clp
Area 2	18-Jun-10	67005	2006	WICKLAND OIL TERMINAL	FEATHER R HATCHERY	CDFG		83	96493	AD Fin Clp
Area 2	18-Jun-10	68603	2007	SAN PABLO BAY NET PENS	NIMBUS FISH HATCHERY	CDFG		78	96121	AD Fin Clp
Area 2	18-Jun-10	68605	2007	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDFG		70	96306	AD Fin Clp
Area 2	18-Jun-10	68611	2007	WICKLAND OIL NET PEN	FEATHER R HATCHERY	CDFG		72	69530	AD Fin Clp
Area 2	18-Jun-10	68611	2007	WICKLAND OIL NET PEN	FEATHER R HATCHERY	CDFG		79	80347	AD Fin Clp
Area 2	18-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		61	69532	AD Fin Clp
Area 2	18-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		59	83292	AD Fin Clp
Area 2	18-Jun-10	94611	2006	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		76	96118	AD Fin Clp
Area 2	18-Jun-10	94611	2006	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		78	96305	AD Fin Clp
Area 2	18-Jun-10	94615	2006	MCKENZIE R 1	MCKENZIE HATCHERY	ODFW		70	96117	AD Fin Clp
Area 2	18-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	75	69531	AD Fin Clp
Area 2	18-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	74	96113	AD Fin Clp
Area 2	18-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	63	96307	AD Fin Clp
Area 2	18-Jun-10	94647	2007	TANNER CR (BNVILLE)	BONNEVILLE HATCHERY	ODFW		61	69548	AD Fin Clp
Area 2	18-Jun-10	186240	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186242,186241,186243	71	96114	AD Fin Clp
Area 2	18-Jun-10	612511	2006	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		80	96119	AD Fin Clp
Area 2	18-Jun-10	612517	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		67	69700	AD Fin Clp
Area 2	18-Jun-10	612517	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		66	83293	AD Fin Clp
Area 2	18-Jun-10	612520	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		69	87415	Unmarked
Area 2	18-Jun-10	633385	2006	COLUMBIA R - GENERAL	WELLS HATCHERY	WDFW		64	80348	AD Fin Clp
Area 2	18-Jun-10	633593	2005	METHOW R 48.0002	CARLTON REARING POND	WDFW		77	96111	AD Fin Clp
Area 2	18-Jun-10	633895	2006	LK CHELAN + COLUMBIA R		WDFW		71	87413	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		69	69547	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		77	80349	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		73	96115	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		77	96116	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		71	96491	AD Fin Clp
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY	WDFW		75	96492	AD Fin Clp

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
					HATCHERY					
Area 2	18-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		68	96494	AD Fin Clp
Area 2	18-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		71	96112	AD Fin Clp
Area 2	18-Jun-10	634272	2007	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW	634273	68	83294	AD Fin Clp
Area 2	18-Jun-10	634671	2007	SNAKE R-UPPR 35.0002	LYONS FERRY HATCHERY	WDFW		67	96308	AD Fin Clp
Area 2	18-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		61	80350	AD Fin Clp
Area 2	18-Jun-10	634680	2007	SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	WDFW		57	96120	AD Fin Clp
Area 2	19-Jun-10	54274	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	54276,54275,54277	70	53304	AD Fin Clp
Area 2	19-Jun-10	54873	2008	COLEMAN NFH	COLEMAN NFH	USFWS		56	96124	AD Fin Clp
Area 2	19-Jun-10	94321	2006	THREE RIVERS (NESTUC	CEDAR CR HATCHERY	ODFW		79	96123	AD Fin Clp
Area 2	19-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	78	53307	AD Fin Clp
Area 2	19-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	76	93760	AD Fin Clp
Area 2	19-Jun-10	612513	2006	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		65	53311	AD Fin Clp
Area 2	19-Jun-10	612517	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		63	53302	AD Fin Clp
Area 2	19-Jun-10	612517	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		64	93761	AD Fin Clp
Area 2	19-Jun-10	612519	2007	SNAKE R@PITT. LNDG	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		70	96125	AD Fin Clp
Area 2	19-Jun-10	612750	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		53	53303	AD Fin Clp
Area 2	19-Jun-10	633592	2005	WENATCHEE R 45.0030	DRYDEN POND	WDFW		83	53310	AD Fin Clp
Area 2	19-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		68	93762	AD Fin Clp
Area 2	19-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		77	93763	AD Fin Clp
Area 2	19-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		73	53308	AD Fin Clp
Area 2	19-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		67	53309	AD Fin Clp
Area 2	19-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		57	94509	AD Fin Clp
Area 2	19-Jun-10	634680	2007	SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	WDFW		60	53305	AD Fin Clp
Area 2	20-Jun-10	54274	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	54276,54275,54277	67	69533	AD Fin Clp
Area 2	20-Jun-10	54395	2007	COLEMAN NFH	COLEMAN NFH	USFWS		63	69537	AD Fin Clp

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
Area 2	20-Jun-10	54397	2007	SAC R COLUSA TO RBDD	COLEMAN NFH	USFWS		77	96128	AD Fin Clp
Area 2	20-Jun-10	68608	2007	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDFG			69534	AD Fin Clp
Area 2	20-Jun-10	94332	2005	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		84	83295	AD Fin Clp
Area 2	20-Jun-10	94611	2006	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		64	53312	AD Fin Clp
Area 2	20-Jun-10	94611	2006	CEDAR CR #1 (SANDY R	CLACKAMAS HATCHERY	ODFW		70	69538	AD Fin Clp
Area 2	20-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	72	83297	AD Fin Clp
Area 2	20-Jun-10	107502	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		66	69536	AD Fin Clp
Area 2	20-Jun-10	186242	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186241,186240,186243	68	96127	AD Fin Clp
Area 2	20-Jun-10	210788	2007	CLEAR CR 11.0013C	CLEAR CREEK HATCHERY	Nisqually Tribe (WA)	634277		69535	AD Fin Clp
Area 2	20-Jun-10	633881	2006	COLUMBIA R - GENERAL	TURTLE ROCK HATCHERY	WDFW		74	83296	AD Fin Clp
Area 2	20-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		81	94510	AD Fin Clp
Area 2	20-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		71	96126	AD Fin Clp
Area 2	20-Jun-10	634680	2007	SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	WDFW		59	94511	AD Fin Clp
Area 2	22-Jun-10	53874	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	53779,53875,53776,53777,53778,53780,53781	79	69543	AD Fin Clp
Area 2	22-Jun-10	54391	2007	COLEMAN NFH	COLEMAN NFH	USFWS		75	83299	AD Fin Clp
Area 2	22-Jun-10	68601	2007	SAN PABLO BAY NET PENS	MOKELUMNE R FISH INS	CDFG		70	96486	AD Fin Clp
Area 2	22-Jun-10	68604	2007	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDFG		79	96490	AD Fin Clp
Area 2	22-Jun-10	68605	2007	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDFG		75	96489	AD Fin Clp
Area 2	22-Jun-10	90134	2007	UMATILLA R	UMATILLA HATCHERY	ODFW		68	94513	AD Fin Clp
Area 2	22-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		70	85498	AD Fin Clp
Area 2	22-Jun-10	103680	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		61	85497	AD Fin Clp
Area 2	22-Jun-10	107502	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		75	69540	AD Fin Clp
Area 2	22-Jun-10	107502	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		71	96479	AD Fin Clp
Area 2	22-Jun-10	612518	2007	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		69	69549	AD Fin Clp
Area 2	22-Jun-10	612519	2007	SNAKE R@PITT. LNDG	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		62	69546	AD Fin Clp
Area 2	22-Jun-10	633799	2006	COLUMBIA R - GENERAL		WDFW		65	85499	AD Fin Clp
Area 2	22-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		78	69550	AD Fin Clp
Area 2	22-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		72	94512	AD Fin Clp
Area 2	22-Jun-10	634183	2006	METHOW R 48.0002	CARLTON REARING POND	WDFW		67	85496	AD Fin Clp

Area	Recov Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel Agency	DIT codes	FKL cm	Label	Mark
Area 2	22-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		66	69542	AD Fin Clp
Area 2	22-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		56	69544	AD Fin Clp
Area 2	22-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		61	69545	AD Fin Clp
Area 2	22-Jun-10	634680	2007	SNAKE R @ ASOTIN	LYONS FERRY HATCHERY	WDFW		61	83298	AD Fin Clp
Area 2	23-Jun-10	68010	2007	FEATHER BOYDS PUMP RAMP	FEATHER R HATCHERY	CDWR		76	94040	AD Fin Clp
Area 2	23-Jun-10	68022	2008	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDWR		58	96309	AD Fin Clp
Area 2	23-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	75	96314	AD Fin Clp
Area 2	23-Jun-10	186242	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186241,186240,186243	68	94515	AD Fin Clp
Area 2	23-Jun-10	612513	2006	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		63	94516	AD Fin Clp
Area 2	23-Jun-10	634671	2007	SNAKE R-UPPR 35.0002	LYONS FERRY HATCHERY	WDFW		63	96310	AD Fin Clp
Area 2	23-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		70	94041	AD Fin Clp
Area 2	23-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		71	94514	AD Fin Clp
Area 2	23-Jun-10	634693	2007	CHELAN R 47.0052		WDFW		56	94039	AD Fin Clp
Area 2	24-Jun-10	52978	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	53782,53783,53768	78	94291	AD Fin Clp
Area 2	24-Jun-10	68612	2007	MARE ISLAND NET PEN	FEATHER R HATCHERY	CDFG		71	94292	AD Fin Clp
Area 2	24-Jun-10	94646	2007	BIG CR (LWR COL R)	BIG CR HATCHERY	ODFW	94662	83	86929	AD Fin Clp
Area 2	24-Jun-10	186242	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186241,186240,186243	73	86930	AD Fin Clp
Area 2	24-Jun-10	612752	2007	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		53	86931	AD Fin Clp
Area 2	24-Jun-10	633593	2005	METHOW R 48.0002	CARLTON REARING POND	WDFW		90	94295	AD Fin Clp
Area 2	24-Jun-10	633895	2006	LK CHELAN + COLUMBIA R		WDFW		72	94293	AD Fin Clp
Area 2	24-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		72	86927	AD Fin Clp
Area 2	24-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		77	94294	AD Fin Clp
Area 2	24-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		73	86928	AD Fin Clp
Area 2	24-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		71	94296	AD Fin Clp
Area 2	26-Jun-10	54394	2007	SAN PABLO BAY	COLEMAN NFH	USFWS		83	94518	AD Fin Clp
Area 2	26-Jun-10	68610	2007	MARE ISLAND NET PEN	FEATHER R HATCHERY	CDFG		73	94517	AD Fin Clp
Area 2	26-Jun-10	90135	2007	UMATILLA R	UMATILLA HATCHERY	ODFW		67	86934	AD Fin Clp
Area 2	26-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		67	96130	AD Fin Clp

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Area 2	26-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		69	96316	AD Fin Clp
Area 2	26-Jun-10	186242	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186241,186240,186243	70	96312	AD Fin Clp
Area 2	26-Jun-10	612694	2007	CLWTR @ LAPWAI CRK	NPT HATCHERY	Nez Perce Tribe (ID)		71	86935	AD Fin Clp
Area 2	26-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		74	96129	AD Fin Clp
Area 2	26-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		74	96313	AD Fin Clp
Area 2	26-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		77	96132	AD Fin Clp
Area 2	26-Jun-10	634184	2006	WENATCHEE R 45.0030		WDFW		72	96131	AD Fin Clp
Area 2	26-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		65	86933	AD Fin Clp
Area 2	26-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		57	96317	AD Fin Clp
Area 2	27-Jun-10	68612	2007	MARE ISLAND NET PEN	FEATHER R HATCHERY	CDFG		71	70182	AD Fin Clp
Area 2	27-Jun-10	68618	2007	SMITH RIVER	ROWDY CREEK HATCHERY	Rowdy Creek Hatchery (CA)		64	96321	AD Fin Clp
Area 2	27-Jun-10	90156	2006	ROCK CR (N UMPQUA R)	ROCK CR HATCHERY	ODFW		63	94520	AD Fin Clp
Area 2	27-Jun-10	94343	2005	ELK R	ELK R HATCHERY	ODFW		73	86936	AD Fin Clp
Area 2	27-Jun-10	103680	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		68	94522	AD Fin Clp
Area 2	27-Jun-10	107502	2007	SNAKE@ HLLS CNYON DM	OXBOW HATCHERY	IDFG		66	70185	AD Fin Clp
Area 2	27-Jun-10	612513	2006	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		77	70183	AD Fin Clp
Area 2	27-Jun-10	612517	2007	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		65	94521	AD Fin Clp
Area 2	27-Jun-10	612518	2007	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		64	96318	AD Fin Clp
Area 2	27-Jun-10	612716	2007	NPT HATCHERY	NPT HATCHERY	Nez Perce Tribe (ID)		68	70190	AD Fin Clp
Area 2	27-Jun-10	612752	2007	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)			95135	AD Fin Clp
Area 2	27-Jun-10	633972	2006	SIMILKAMEEN R 490325		WDFW		69	96323	AD Fin Clp
Area 2	27-Jun-10	633974	2007	COWLITZ SALMON HATCH	COWLITZ SALMON HATCH	WDFW		59	96320	AD Fin Clp
Area 2	27-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		72	70184	AD Fin Clp
Area 2	27-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		71	70188	AD Fin Clp
Area 2	27-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		67	96322	AD Fin Clp

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Area 2	27-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		76	96324	AD Fin Clp
Area 2	27-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		69	70187	AD Fin Clp
Area 2	27-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		67	94519	AD Fin Clp
Area 2	27-Jun-10	634269	2007	KLICKITAT HATCHERY (YKFP)	KLICKITAT HATCHERY (YKFP)	Yakama Nation		70	70181	AD Fin Clp
Area 2	27-Jun-10	634371	2007	FALLERT CR 27.0017	FALLERT CR HATCHERY	WDFW		68	70189	AD Fin Clp
Area 2	27-Jun-10	634671	2007	SNAKE R-UPPR 35.0002	LYONS FERRY HATCHERY	WDFW		73	70186	AD Fin Clp
Area 2	27-Jun-10	634671	2007	SNAKE R-UPPR 35.0002	LYONS FERRY HATCHERY	WDFW		68	96133	AD Fin Clp
Area 2	27-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		63	96319	AD Fin Clp
Area 2	28-Jun-10	53767	2007	SPRING CR 29.0159	SPRING CR NFH	USFWS	50685,53766,50686	77	96329	AD Fin Clp
Area 2	28-Jun-10	68009	2007	SAN PABLO BAY NET PENS	FEATHER R HATCHERY	CDWR		70	93765	AD Fin Clp
Area 2	28-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		68	93764	AD Fin Clp
Area 2	28-Jun-10	90136	2007	SNAKE R-1 (HELLS CAN	UMATILLA HATCHERY	ODFW		66	96328	AD Fin Clp
Area 2	28-Jun-10	185612	2007	R-HARRISON R	H-CHEHALIS R	CDFO		74	96325	AD Fin Clp
Area 2	28-Jun-10	186240	2007	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	186242,186241,186243	76	93767	AD Fin Clp
Area 2	28-Jun-10	612511	2006	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		72	94525	AD Fin Clp
Area 2	28-Jun-10	633872	2007	COLUMBIA R - GENERAL		WDFW		60	94528	AD Fin Clp
Area 2	28-Jun-10	633895	2006	LK CHELAN + COLUMBIA R		WDFW		72	94529	AD Fin Clp
Area 2	28-Jun-10	633895	2006	LK CHELAN + COLUMBIA R		WDFW		74	96326	AD Fin Clp
Area 2	28-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		74	94527	AD Fin Clp
Area 2	28-Jun-10	634182	2006	SIMILKAMEEN R 490325		WDFW		69	96327	AD Fin Clp
Area 2	28-Jun-10	634369	2007	WASHOUGAL R 28.0159	WASHOUGAL HATCHERY	WDFW		64	94526	AD Fin Clp
Area 2	28-Jun-10	634392	2007	SIMILKAMEEN R 490325	SIMILKAMEEN HATCHERY	WDFW		54	94523	AD Fin Clp
Area 2	28-Jun-10	634672	2007	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		68	94524	AD Fin Clp
Area 2	29-Jun-10	54864	2008	SPRING CR 29.0159	SPRING CR NFH	USFWS	54865	61	96135	AD Fin Clp
Area 2	29-Jun-10	612513	2006	BIG CANYON ACCL POND	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		78	96134	AD Fin Clp
Area 2	29-Jun-10	612519	2007	SNAKE R@PITT. LNDG	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		74	96331	AD Fin Clp
Area 2	29-Jun-10	612694	2007	CLWTR @ LAPWAI CRK	NPT HATCHERY	Nez Perce Tribe (ID)		72	96136	AD Fin Clp

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Area 2	29-Jun-10	633987	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		67	96330	AD Fin Clp
Area 3	2010-06-12	68804	2007	TRINITY R HATCHERY	TRINITY R HATCHERY	Hoopa Valley Tribe (CA)		66	80475	AD Fin Clp
Area 3	2010-06-18	634182	2006	SIMILKAMEEN R 490325		WDFW		69	80476	AD Fin Clp
Area 3	2010-06-26	612518	2007	CAPTAIN JOHNS PD	LYONS FERRY HATCHERY	Nez Perce Tribe (ID)		66	90701	AD Fin Clp
Area 3	2010-06-26	634092	2006	SNAKE R-LOWR 33.0002	LYONS FERRY HATCHERY	WDFW		68	90700	AD Fin Clp
Area 4	30-Jun-10	68602	2007	SAN PABLO BAY NET PENS	NIMBUS FISH HATCHERY	CDFG		65	60084	AD Fin Clp
Area 4	25-Jun-10	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	Suquamish Tribe	210737	75	60755	AD Fin Clp
Area 4	27-Jun-10	612694	2007	CLWTR @ LAPWAI CRK	NPT HATCHERY	Nez Perce Tribe (ID)		69	96503	AD Fin Clp
Area 4	12-Jun-10	634280	2007	COWLITZ R 26.0002	COWLITZ SALMON HATCH	WDFW		61	96508	AD Fin Clp
Area 4	13-Jun-10	634269	2007	KLICKITAT HATCHERY (YKFP)	KLICKITAT HATCHERY (YKFP)	Yakama Nation		60	96906	AD Fin Clp