

2016 OCEAN SELECTIVE FISHERY SAMPLING REPORT

SUBMITTED BY:

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1. INTRODUCTION

The Pacific Fishery Management Council (PFMC) adopted 2016 recreational and commercial troll fisheries for all salmon species in the area between Cape Falcon, Oregon and the U.S./Canada border. 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.

Concern over extremely low Coastal and Puget Sound coho returns in 2015 and low coho run size forecasts for 2016 drove the process of planning 2016 ocean fisheries. All ocean fisheries were structured to minimize impacts on Coastal and Puget Sound coho.

The PFMC Salmon Advisory Subpanel (SAS) did not recommend, nor did the PFMC adopt, an ocean recreational Chinook mark-selective fishery (MSF) in 2016. This fishery has occurred in Catch Record Card (CRC) Areas 1 through 4 for the past six years, but was eliminated in 2016 to minimize coho encounters.

A recreational MSF for coho was adopted only in the area between Leadbetter Point, WA and Cape Falcon, OR (CRC Area 1) in 2016. All other recreational fisheries were structured as Chinook-directed non-selective fisheries limited to retention of all species except coho. The non-Treaty commercial troll fishery also prohibited retention of coho in all areas north of Cape Falcon.

The Washington Department of Fish and Wildlife's (WDFW's) Ocean Sampling Program (OSP) continued its intensive monitoring program in all ocean ports during the ocean fisheries to collect data to estimate key parameters characterizing the fisheries and their impacts on unmarked and other non-retained salmon. Sampling activities included on-water observation, a Voluntary Trip Report (VTR) system, and dockside creel sampling. Among other parameters, sampling activities emphasized data collection needs for the estimation of: *i*) the mark rate in mark-selective fisheries, *ii*) the total number of Chinook and coho harvested by mark-status, including an estimate of angler compliance rate with coho MSF regulations, *iii*) the total number of Chinook and coho released (by size/mark-status), *iv*) the coded-wire tag (CWT) stock composition of landed Chinook and coho, and *v*) the total mortality of marked and unmarked coho.

This report focuses mainly on the limited 2016 coho mark-selective ocean fishery. Catch and bycatch statistics for the 2016 non-selective fisheries (Chinook-directed) are available in the Pacific Fishery Management Council's Review of 2016 Ocean Salmon Fisheries (<http://www.pcouncil.org/salmon/stock-assessment-and-fishery-evaluation-safe-documents/>).

2. SEASON DESCRIPTION

2.1 Ocean Recreational All-Species Fisheries (Coho Mark-Selective or Coho Non-Retention)

The recreational fisheries north of Cape Falcon operated under coastwide preseason quotas of 35,000 landed Chinook and 18,900 landed marked coho. **Figure 1** shows the Washington ocean CRC areas.

CRC Area 1: The ocean recreational fishery in CRC Area 1 was scheduled open for all salmon species seven days per week from July 1 through August 31 with a quota of 18,900 marked coho and a guideline of 10,200 Chinook. A daily bag limit of two salmon, one of which could be a Chinook, was in effect July 1 – August 15; the bag limit was modified in-season to two salmon from August 16 – August 27. All retained coho were required to have a healed adipose fin clip. The Columbia Control Zone was closed. The fishery closed on August 27 upon attainment of the coho quota. A total of 58 fishing days were available in the area.

CRC Area 2: The ocean recreational fishery in CRC Area 2 was open for all salmon species except coho seven days per week from July 1 through August 21 with a guideline of 16,600 Chinook. A daily bag limit of one salmon, no coho retention, was in effect July 1 – July 22; the bag limit was modified in-season to two salmon, no coho retention, from July 23 – August 21. The Grays Harbor Control Zone was closed beginning August 8. A total of 52 fishing days were available in the area.

CRC Area 3: The ocean recreational fishery in CRC Area 3 was open for all salmon species except coho seven days per week from July 1 through August 21 with a guideline of 2,000 Chinook. A daily bag limit of two salmon, no coho retention, was in effect. A total of 52 fishing days were available in the area.

CRC Area 4: The ocean recreational fishery in CRC Area 4 was open for all salmon species except coho seven days per week from July 1 through August 21 with a guideline of 6,200 Chinook. A daily bag limit of two salmon, no coho retention, was in effect. A total of 52 fishing days were available in the area.

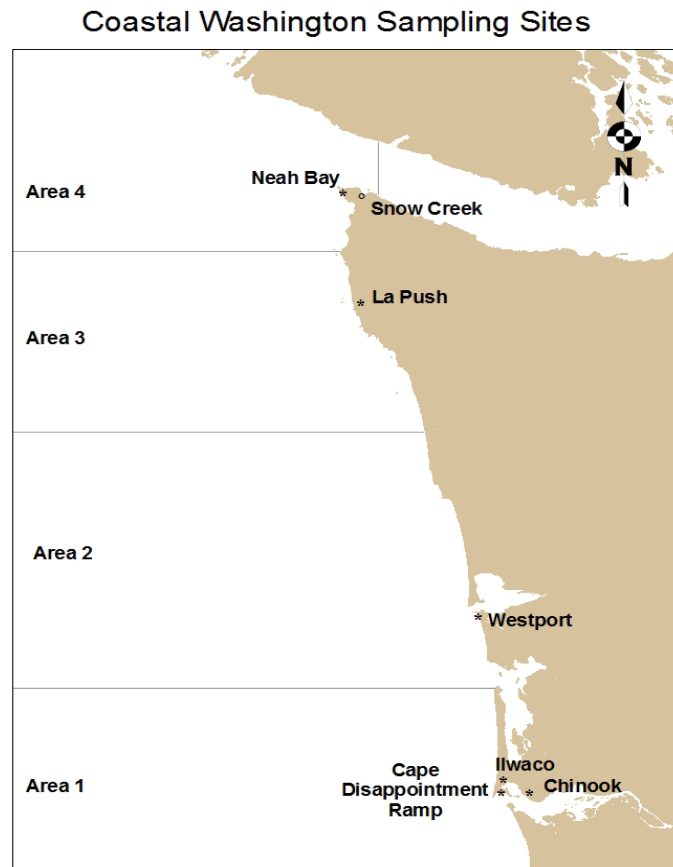


Figure 1. Map of coastal Washington showing the ocean catch record card areas (Areas 1 through 4) and major sampling sites.

2.2 Non-Treaty Commercial Troll Fisheries (Coho Non-Retention)

The non-Treaty troll fishery was open in May and June for all salmon except coho from Cape Falcon, Oregon to the U.S.-Canada border. The sub-areas were open during this time as follows: Area 4: 40 days, Area 3: 26 days, Area 2: 40 days, and Area 1: 40 days. The fishery reopened July 8 for all salmon species except coho with no chum retention north of Cape Alava, WA in August. A total of 30 fishing days were available in all areas between Cape Falcon, Oregon and the U.S.-Canada border. Specific open dates, regulations, and catch and bycatch statistics are available in the PFMC Review of 2016 Ocean Salmon Fisheries (<http://www.pcouncil.org/salmon/stock-assessment-and-fishery-evaluation-safe-documents/>).

3. METHODS

WDFW's OSP implemented a comprehensive monitoring program in all ocean ports during the 2016 fisheries in Washington ocean CRC Areas 1-4. OSP collected data to estimate key fishery parameters characterizing the ocean coho MSF and associated impacts on unmarked salmon as well as to generate estimates of catch used for in-season quota management. 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 VTRs of completed trips provided by charter boat skippers and the angling public.

3.1 On-Board Observation

WDFW samplers conducted direct on-water observation of salmon encounters aboard charter vessels in CRC Areas 1 and 2. Data collected aboard 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 aboard charter vessels.

WDFW observers conducted direct on-water observation of salmon encounters aboard charter vessels, recording 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 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 and coho by size/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 sublegal Chinook. 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 used in CRC Areas 1 and 2 where charter vessel salmon fishing trips are numerous to determine mark rates, encounter rates, and drop-off rates. The VTR system (see Section 3.2 below) was also used to collect encounter data from both charter and private vessels in these two areas.

In CRC Areas 3 and 4, where few charter vessels take salmon fishing trips, and those who do are very small, the VTR system was used exclusively to collect on-water encounter data.

3.2 Voluntary Trip Reports

Fishery encounter statistics were also acquired through analysis of VTRs that WDFW samplers distributed and collected from the angling public in all ocean CRC Areas. 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 to anglers preparing to depart for fishing or after returning from 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 fishing day. Anglers could also mail these forms to the WDFW Region 6 office postage-paid. Additionally, office staff contacted anglers who regularly complete VTRs by phone or mail prior to the season and provided blank VTRs.

In 2013, a new, simpler VTR form was developed to meet the needs of north coast charter boats that do not have sufficient time while fishing to complete the traditional VTR form. The new forms ask anglers simply to tally encountered salmon in the appropriate species/size class/mark status/result of encounter category, ie for Chinook and coho, kept legal marked, kept legal unmarked, released legal marked, released legal unmarked, kept sublegal marked, kept sublegal unmarked, released sublegal marked, or released sublegal unmarked. Anglers are also asked to tally drop offs and kept/released pink. These new forms, which received positive angler feedback since 2013, were distributed exclusively in 2016. We plan to use these forms solely in the future.

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 and the Columbia River North Jetty). The recreational fisheries in each port were sampled a minimum of 4 to 5 days per week, with weekend (Saturday, Sunday, and holidays) and weekday days (non-holiday Monday through Friday) stratified. Typically, all 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 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 from boats returning from fishing. 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, and 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 ,
- 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):

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

where

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

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

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

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):

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

The estimated total boat-trips is then obtained by:

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

with estimated variance:

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

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:

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

with variance:

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

Thus the estimated total number of angler-trips is:

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

with variance:

$$\hat{V}(\hat{a}_{tai}) = M_t^2 \cdot \hat{V}(\hat{a}_{tai})$$

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:

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

This estimate and its 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.

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

4.1 Dockside Sampling Results

An estimated 28,586 angler trips (24,254 from Washington, 4,332 from Oregon) were completed by private and charter anglers during the 2016 CRC Area 1 all-species coho MSF. These anglers harvested a total of 5,997 Chinook (4,957 WA, 1,040 OR) and 18,612 coho (15,958 WA, 2,654 OR). In the non-selective coho non-retention fisheries north of Leadbetter Point, an estimated 27,184 angler trips harvested 11,951 Chinook and 101 illegally-retained coho. **Table 1** shows effort and catch by month and CRC area during the 2016 recreational fisheries.

WDFW dockside samplers interviewed an estimated 35% of all anglers fishing from WA coastwide during the 2016 recreational ocean salmon fisheries. An estimated total of 34% of all Chinook and 37% of all coho harvested in WA were sampled; 943 CWTs were collected from sampled Chinook and 931 were collected from sampled coho in WA ports (**Table 2**).

4.2 On-water Observation and VTR Results

Tables 3 and 4 detail on-water data collected during on-board observation and from VTRs submitted by charter and private fishing vessels. OSP observer staff combined with charter boat VTRs provided on-water catch and encounter data from a total of 64 charter boat trips during the all-species coho MSF documenting a total of 154 legal sized Chinook, 115 sublegal sized Chinook, 986 legal sized coho, and 107 sublegal sized coho. Dockside samplers also collected 77 complete and useable VTRs from private vessels containing 107 legal sized Chinook encounters, 50 sublegal sized Chinook encounters, 325 legal sized coho encounters, and 19 sublegal sized coho encounters. Mark rates calculated from onboard observer and VTR data are shown in **Table 5** and compared to pre-season FRAM coho mark rate projections.

4.3 Overall Fishery Impacts

Estimated Total Coho Encounters and Mortalities

FRAM pre-season projections of coho encounters (Washington and Oregon) in the 2016 ocean recreational all-species coho MSF are compared with field estimated encounters in **Table 6**.

Table 7 compares total coho mortality projected pre-season by FRAM (Washington and Oregon) with field estimated coho mortality.

The overall impacts of the 2016 recreational coho MSF in ocean CRC Area 1 are characterized in terms of grand-total estimates of coho encounters and mortalities and by using estimates specific to mark group (i.e., marked and unmarked). The method described in section 3.4 was used to generate total estimates of retained catch by mark group. To estimate coho salmon encounters and releases by mark group, we applied Conrad's (2012) alternative method for estimating coho encounters and release mortalities in ocean MSFs, which independently calculates charter and private vessel totals based on observer and VTR data. This method differs from that used prior to 2012.

Field estimated 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. Encounters are calculated by boat type and CRC area based on landed catch of legal sized marked coho, the proportion of observed encounters that were legal sized marked coho, and the proportion of observed encounters that were legal sized marked coho retained. Mortality was estimated for each mark group based on calculated encounters and the proportion of the legal sized coho of that mark status that were released multiplied by the PFMC ocean *sfm* rate of 14% (Conrad, 2012).

Field estimates of coho encounters were slightly higher than projected and estimates of total mortality were slightly lower than projected preseason in the CRC Area 1 all-species coho mark-selective fishery.

Compliance

Table 8 reports the rate of compliance observed by dockside samplers in the coho mark-selective recreational fishery in CRC Area 1 by month. Compliance with mark-selective fishery regulations averaged over 99%, similar to that observed in the last twelve seasons.

4.4 DNA Data Collection

A total of 958 DNA samples were collected from Chinook by onboard and dockside samplers during the summer recreational fisheries, including both the coho MSF and coho non-retention fisheries (**Table 9**). A total of 1,197 DNA samples were collected from Chinook by dockside samplers during the 2016 non-Treaty troll fisheries (**Table 10**).

Table 1. Estimates of total fishing effort and number of Chinook and coho retained during the 2016 recreational fishery between Cape Falcon, Oregon and the U.S.-Canada border.

| | TOTAL ANGLER TRIPS | | | CHINOOK RETAINED | | | COHO RETAINED | | |
|-----------------------------------|--------------------|---------------|---------------|------------------|--------------|---------------|---------------|---------------|---------------|
| | July | August | TOTAL | July | August | TOTAL | July | August | TOTAL |
| Area 4 | 7,504 | 751 | 8,255 | 3,011 | 255 | 3,266 | 30 | 23 | 53 |
| Area 3 | 702 | 387 | 1,089 | 221 | 34 | 255 | 3 | 2 | 5 |
| Area 2 | 9,587 | 8,253 | 17,840 | 4,198 | 4,232 | 8,430 | 30 | 13 | 43 |
| Area 1 | 7,666 | 16,587 | 24,254 | 2,088 | 2,868 | 4,957 | 4,692 | 11,266 | 15,958 |
| TOTAL WA | 25,458 | 25,978 | 51,437 | 9,519 | 7,388 | 16,907 | 4,755 | 11,304 | 16,059 |
| OREGON (Area 1) | 1,920 | 2,412 | 4,332 | 653 | 387 | 1,040 | 915 | 1,739 | 2,654 |
| TOTAL NOF | 27,378 | 28,390 | 55,769 | 10,172 | 7,775 | 17,947 | 5,670 | 13,043 | 18,713 |
| WA Variance: ^{1/} | | | 644,820 | | | 267,054 | | | 406,532 |
| WA Standard Error: | | | 803 | | | 517 | | | 638 |
| WA CV (%): | | | 2% | | | 3% | | | 4% |
| WA 95% CI: | | | 49,863-53,011 | | | 15,895-17,920 | | | 14,809-17,308 |

^{1/} Variance estimates are unavailable for Oregon statistics.

Table 2: WA dockside sampling statistics during the 2016 recreational fishery between Cape Falcon, Oregon and the U.S.-Canada border.

| | Anglers | | Landed Chinook | | Landed Coho | | Chinook CWTs | Coho CWTs |
|-----------------|---------------|-------------|----------------|-------------|--------------|-------------|--------------|------------|
| | Sampled | Sample Rate | Sampled | Sample Rate | Sampled | Sample Rate | collected | collected |
| Area 4 | 2,452 | 30% | 950 | 29% | 18 | 34% | 143 | 2 |
| Area 3 | 803 | 74% | 123 | 48% | 3 | 62% | 14 | 0 |
| Area 2 | 6,561 | 37% | 2,708 | 32% | 15 | 35% | 489 | 2 |
| Area 1 | 8,146 | 34% | 1,899 | 38% | 5,847 | 37% | 297 | 927 |
| TOTAL WA | 17,962 | 35% | 5,680 | 34% | 5,883 | 37% | 943 | 931 |

Table 3: On-board Chinook encounters by boat type, size class and mark status in the 2016 coho mark-selective fishery between Cape Falcon, Oregon and Leadbetter Point, Washington.

| | | Charter Boats (On-board observation/VTRs) | | | | | | | Private boats (VTRs) | | | | | | |
|---------------|--------------|---|-------------|-----------|----------|----------------|-----------|----------|-------------------------|-------------|-----------|----------|----------------|-----------|----------|
| | | Total Observer Trips/VTRs | LEGAL-SIZED | | | SUBLEGAL-SIZED | | | Total VTRs Collected | LEGAL-SIZED | | | SUBLEGAL-SIZED | | |
| | | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown |
| Area 1 | July | 25 | 49 | 39 | 0 | 17 | 31 | 1 | 43 | 28 | 38 | 1 | 24 | 9 | 0 |
| | August | 39 | 36 | 30 | 0 | 38 | 27 | 1 | 34 | 24 | 16 | 0 | 9 | 7 | 1 |
| | TOTAL | 64 | 85 | 69 | 0 | 55 | 58 | 2 | 77 | 52 | 54 | 1 | 33 | 16 | 1 |

Table 4: On-board coho encounters by boat type, size class and mark status in the 2016 coho mark-selective fishery between Cape Falcon, Oregon and Leadbetter Point, Washington.

| | | Charter Boats (On-board observation/VTRs) | | | | | | | Private boats (VTRs) | | | | | | |
|---------------|--------------|---|-------------|------------|----------|----------------|-----------|----------|-------------------------|-------------|------------|----------|----------------|----------|----------|
| | | Total Observer Trips/VTRs | LEGAL-SIZED | | | SUBLEGAL-SIZED | | | Total VTRs Collected | LEGAL-SIZED | | | SUBLEGAL-SIZED | | |
| | | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown |
| Area 1 | July | 25 | 123 | 75 | 0 | 4 | 0 | 0 | 43 | 117 | 55 | 0 | 7 | 2 | 0 |
| | August | 39 | 478 | 310 | 0 | 47 | 54 | 2 | 34 | 104 | 49 | 0 | 7 | 3 | 0 |
| | TOTAL | 64 | 601 | 385 | 0 | 51 | 54 | 2 | 77 | 221 | 104 | 0 | 14 | 5 | 0 |

Table 5: Estimated Chinook and coho mark rates during the 2016 coho mark-selective fishery between Cape Falcon, Oregon and Leadbetter Point, Washington by size class using onboard observer and VTR encounters.

| | | LEGAL SIZED CHINOOK | | | SUBLEGAL SIZED CHINOOK | | | LEGAL SIZED COHO | | | FRAM Projected Coho Mark Rate |
|---------------|--------------|---------------------|------------|------------|------------------------|------------|------------|------------------|------------|------------|----------------------------------|
| | | Charter | Private | Combined | Charter | Private | Combined | Charter | Private | Combined | |
| Area 1 | July | 56% | 42% | 50% | 35% | 73% | 51% | 62% | 68% | 65% | 76% |
| | August | 55% | 60% | 57% | 58% | 56% | 58% | 61% | 68% | 62% | 69% |
| | TOTAL | 55% | 49% | 53% | 49% | 67% | 54% | 61% | 68% | 63% | 69% |

Table 6: Comparison of modeled (FRAM model run #1637) and estimated total coho encounters in the 2016 ocean coho mark-selective fishery.

| Data Source | Area | Marked | Unmarked | Total Encounters | Landed Catch |
|-----------------------------|--------|---------------|--------------|------------------|---------------|
| FRAM | Area 1 | 19,876 | 8,828 | 28,704 | 18,900 |
| Estimated Actual Encounters | Area 1 | 19,572 | 10,304 | 29,876 | 18,612 |
| Variance: | | 775,756 | 194,774 | 1,742,015 | 406,532 |
| Standard Error: | | 881 | 441 | 1,320 | 638 |
| CV (%): | | 5% | 4% | 4% | 3% |
| 95% CI: | | 17,845-21,298 | 9,439-11,169 | 27,289-32,463 | 17,362-19,861 |

Table 7: Comparison of modeled (FRAM model run #1637) and estimated total coho mortalities in the 2016 ocean coho mark-selective fishery.

| Data Source | Area | Release Mortality | | Drop Off Mortality ^{1/} | | Landed Catch | | Total Mortality |
|----------------------------|--------|-------------------|-------------|----------------------------------|----------|---------------|----------|-----------------|
| | | Marked | Unmarked | Marked | Unmarked | Marked | Unmarked | |
| FRAM | Area 1 | 167 | 1,244 | 996 | 453 | 18,718 | 182 | 21,760 |
| Estimated Actual Mortality | Area 1 | 139 | 1,391 | 979 | 515 | 18,580 | 32 | 21,636 |
| Variance: | | 899 | 8,757 | 1,939 | 487 | 404,435 | 2,097 | - |
| Standard Error: | | 30 | 94 | 44 | 22 | 636 | 46 | - |
| CV (%): | | 22% | 7% | 5% | 4% | 3% | 143% | - |
| 95% CI: | | 80-198 | 1,208-1,575 | 892-1,065 | 472-558 | 17,334-19,826 | -58-122 | - |

^{1/} Estimated drop off mortality calculated as 5% of estimated encounters.

Table 8: Compliance with coho mark-selective fishery regulations observed during dockside sampling interviews in the 2016 all-species recreational fishery (coho mark-selective) between Cape Falcon, Oregon and Leadbetter Point, Washington.

| | | Total Coho Sampled | Marked Coho Sampled | Unmarked Coho Sampled | % Sampled Coho Marked |
|---------------|--------------|-----------------------|------------------------|--------------------------|--------------------------|
| Area 1 | July | 2,605 | 2,602 | 3 | 99.9% |
| | August | 3,008 | 3,002 | 6 | 99.8% |
| | Total | 5,613 | 5,604 | 9 | 99.8% |

Table 9: Number of Chinook DNA samples collected from the ocean recreational fishery by size class, mark status, and sample type (including both mark-selective and non-selective coho fisheries).

| | | On-Board Sampling | | | | | | Dockside Sampling | | | Total Number of DNA Samples |
|--------|--------------|-------------------|-----------|----------|----------------|-----------|----------|-------------------|------------|----------|--------------------------------|
| | | Legal Sized | | | Sublegal Sized | | | Legal-Sized | | | |
| | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown | |
| Area 4 | July | - | - | - | - | - | - | 122 | 83 | | 205 |
| | August | - | - | - | - | - | - | 41 | 15 | | 56 |
| | Total | 0 | 0 | 0 | 0 | 0 | 0 | 163 | 98 | 0 | 261 |
| Area 3 | July | - | - | - | - | - | - | 13 | 31 | | 44 |
| | August | - | - | - | - | - | - | 4 | 6 | | 10 |
| | Total | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 37 | 0 | 54 |
| Area 2 | July | 14 | 12 | | 33 | 18 | | 80 | 71 | 1 | 229 |
| | August | 1 | 1 | | | 1 | | 24 | 29 | | 56 |
| | Total | 15 | 13 | 0 | 33 | 19 | 0 | 104 | 100 | 1 | 285 |
| Area 1 | July | 18 | 12 | | 5 | 14 | | 59 | 61 | | 169 |
| | August | 17 | 7 | | 7 | 4 | | 74 | 79 | 1 | 189 |
| | Total | 35 | 19 | 0 | 12 | 18 | 0 | 133 | 140 | 1 | 358 |

Table 10: Number of chinook DNA samples collected from the non-treaty troll fishery by size class, mark status.

| | | Dockside Sampling | | | Number of DNA Samples |
|--------|--------------|-------------------|-------------|----------|-----------------------------|
| | | Marked | Legal-Sized | | |
| | | | Unmarked | Unknown | |
| Area 4 | May | 25 | 23 | 0 | 48 |
| | June | 27 | 40 | 1 | 68 |
| | July | 0 | 0 | 0 | 0 |
| | August | 0 | 0 | 0 | 0 |
| | Total | 52 | 63 | 1 | 116 |
| Area 3 | May | 64 | 44 | 0 | 108 |
| | June | 13 | 32 | 0 | 45 |
| | July | 29 | 93 | 0 | 122 |
| | August | 4 | 13 | 0 | 17 |
| | Total | 110 | 182 | 0 | 292 |
| Area 2 | May | 59 | 39 | 0 | 98 |
| | June | 56 | 53 | 0 | 109 |
| | July | 40 | 59 | 0 | 99 |
| | August | 40 | 44 | 0 | 84 |
| | Total | 195 | 195 | 0 | 390 |
| Area 1 | May | 50 | 50 | 0 | 100 |
| | June | 34 | 66 | 0 | 100 |
| | July | 42 | 57 | 0 | 99 |
| | August | 38 | 62 | 0 | 100 |
| | Total | 164 | 235 | 0 | 399 |

5. RESULTS IN THE COHO NON-RETENTION RECREATIONAL FISHERIES

The 2016 recreational fisheries in the areas between Leadbetter Point and the U.S.-Canada border allowed no retention of coho. The fishery in all CRC areas began on July 1 and closed as scheduled on August 21. Catch for each area is shown in **Table 1** and dockside sampling is summarized in **Table 2**.

Coho impacts in the non-retention fisheries were estimated pre-season based on average coho encounters for the past 6 years by area in the ocean fisheries. Effort shifts used to calculate impacts in Puget Sound recreational fishery time-block closures were applied to all areas to account for the early planned season closure.

Onboard observers rode along on charter vessels in CRC Area 2, and VTRs were distributed to both charter and private vessels to collect information on actual coho impacts during 2016 coho non-retention fisheries; summarized in **Table 11**. The dockside sampling program also collected coho catch and release data through angler interviews, in addition to information on retained Chinook salmon: **Table 12**

Dockside sampling data were used to calculate total estimated coho encounters in the recreational fisheries in the areas between Leadbetter Point and the U.S.-Canada border. The total number of encountered coho was estimated at 4,201 in CRC Area 4, 1,262 in CRC Area 3, and 8,166 in CRC Area 2. The estimated total of 13,630 coho encountered is much lower than the anticipated total of 45,126 modeled pre-season in FRAM (**Table 13**). Likewise, estimated actual coho mortality in these fisheries is lower than that anticipated pre-season (2,691 actual estimated mortalities compared to 8,574 mortalities anticipated pre-season; **Table 14**).

No data exist to estimate actual coho encounters or mortalities in the non-Treaty commercial troll coho non-retention fishery. Specific open dates, regulations, and catch and bycatch statistics for both the 2016 recreational and non-Treaty commercial troll coho non-retention fisheries are available in the PFMC Review of 2016 Ocean Salmon Fisheries (<http://www.pcouncil.org/salmon/stock-assessment-and-fishery-evaluation-safe-documents/>).

Table 11: On-board observed coho encounters by boat type, size class and mark status in the the 2016 coho non-retention fishery between Leadbetter Point and U.S.-Canada border.

| | | Charter Boats (On-board observation/VTRs) | | | | | | | Private boats (VTRs) | | | | | | |
|---------------|--------------|---|-------------|-----------|----------|----------------|----------|----------|----------------------|-------------|-----------|----------|----------------|----------|----------|
| | | Total Observer | LEGAL-SIZED | | | SUBLEGAL-SIZED | | | Total VTRs | LEGAL-SIZED | | | SUBLEGAL-SIZED | | |
| | | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown | | Marked | Unmarked | Unknown | Marked | Unmarked | Unknown |
| Area 2 | July | 7 | 51 | 34 | 1 | 3 | 1 | 0 | 65 | 77 | 52 | 6 | 26 | 2 | 0 |
| | August | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 28 | 12 | 16 | 0 | 2 | 1 | 0 |
| | TOTAL | 8 | 51 | 36 | 1 | 3 | 1 | 0 | 93 | 89 | 68 | 6 | 28 | 3 | 0 |
| Area 3 | July | 0 | - | - | - | - | - | - | 8 | 0 | 7 | 0 | 0 | 1 | 0 |
| | August | 0 | - | - | - | - | - | - | 12 | 46 | 32 | 0 | 0 | 0 | 0 |
| | TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 46 | 39 | 0 | 0 | 1 | 0 |
| Area 4 | July | 0 | - | - | - | - | - | - | 70 | 65 | 41 | 2 | 6 | 3 | 0 |
| | August | 0 | - | - | - | - | - | - | 0 | - | - | - | - | - | - |
| | TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 65 | 41 | 2 | 6 | 3 | 0 |

Table 12: Dockside sampled retained Chinook and reported encountered coho (retained + released) by boat type and mark status in the the 2016 coho non-retention fishery between Leadbetter Point and U.S.-Canada border.

| | | Charter Boats | | | | Private boats | | | |
|---------------|--------------|---------------|------------|------------|------------|---------------|------------|------------|------------|
| | | CHINOOK | | COHO | | CHINOOK | | COHO | |
| | | Marked | Unmarked | Marked | Unmarked | Marked | Unmarked | Marked | Unmarked |
| Area 2 | July | 348 | 351 | 629 | 384 | 438 | 429 | 213 | 80 |
| | August | 212 | 131 | 78 | 51 | 457 | 264 | 80 | 34 |
| | TOTAL | 560 | 482 | 707 | 435 | 895 | 693 | 293 | 114 |
| Area 3 | July | 13 | 22 | 40 | 29 | 29 | 39 | 45 | 17 |
| | August | 4 | 1 | 55 | 74 | 10 | 7 | 133 | 162 |
| | TOTAL | 17 | 23 | 95 | 103 | 39 | 46 | 178 | 179 |
| Area 4 | July | 110 | 106 | 96 | 98 | 414 | 235 | 189 | 185 |
| | August | 44 | 26 | 17 | 11 | 48 | 22 | 20 | 16 |
| | TOTAL | 154 | 132 | 113 | 109 | 462 | 257 | 209 | 201 |

Table 13: Comparison of modeled (FRAM model run #1637) and estimated total coho encounters in the 2016 ocean coho mark-selective fishery.

| Data Source | Area | Retained | Released | Total Encounters |
|-----------------------------|--------------|------------|---------------|------------------|
| FRAM | Area 4 | 0 | 8,795 | 8,795 |
| | Area 3 | 0 | 3,500 | 3,500 |
| | Area 2 | 0 | 32,832 | 32,832 |
| | TOTAL | 0 | 45,126 | 45,126 |
| Estimated Actual Encounters | Area 4 | 53 | 4,148 | 4,201 |
| | Area 3 | 5 | 1,257 | 1,262 |
| | Area 2 | 43 | 8,123 | 8,166 |
| | TOTAL | 101 | 13,528 | 13,630 |
| Variance: | | 326 | 338,248 | 338,575 |
| Standard Error: | | 18 | 582 | 582 |
| CV (%): | | 18% | 4% | 4% |
| 95% CI: | | 66-137 | 12,389-14,668 | 12,489-14,770 |

Table 14: Comparison of modeled (FRAM model run #1637) and estimated total coho mortalities in the 2016 ocean coho mark-selective fishery.

| Data Source | Area | Release Mortality | Drop Off Mortality ^{1/} | Landed Catch | Total Mortality |
|----------------------------|--------------|-------------------|----------------------------------|--------------|-----------------|
| FRAM | Area 4 | 1,231 | 440 | 0 | 1,671 |
| | Area 3 | 490 | 175 | 0 | 665 |
| | Area 2 | 4,596 | 1,642 | 0 | 6,238 |
| | TOTAL | 6,318 | 2,256 | 0 | 8,574 |
| Estimated Actual Mortality | Area 4 | 588 | 210 | 53 | 852 |
| | Area 3 | 177 | 63 | 5 | 245 |
| | Area 2 | 1,143 | 408 | 43 | 1,594 |
| | TOTAL | 1,908 | 681 | 101 | 2,691 |
| Variance: | | NA | NA | NA | NA |
| Standard Error: | | NA | NA | NA | NA |
| CV (%): | | NA | NA | NA | NA |
| 95% CI: | | NA | NA | NA | NA |

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