

**Marine Areas 8-1 and 8-2  
Mark-Selective Recreational Chinook Fishery,  
January 1 - April 30, 2009**

**Post-season Report**

**REVISED DRAFT**

**June 14, 2010**

**Prepared by:**

**Mark Baltzell, Laurie Peterson, Steve Caromile, and Karen Kloempken**

**Washington Department of Fish and Wildlife  
Fish Program  
600 Capitol Way North  
Olympia, Washington 98501**

## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>1</b>
<b>LIST OF TABLES</b> .....	<b>3</b>
<b>LIST OF FIGURES</b> .....	<b>4</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>5</b>
<b>INTRODUCTION</b> .....	<b>7</b>
<b>METHODS</b> .....	<b>8</b>
<b>Marine Catch Area Description</b> .....	<b>8</b>
<b>Monitoring Program Overview</b> .....	<b>8</b>
<b>Catch and Effort: Sampling and Estimation</b> .....	<b>10</b>
<b>Test Fishery Methods</b> .....	<b>11</b>
<b>Estimating Fishery Impacts</b> .....	<b>13</b>
Total Encounters and Mortalities.....	13
CWT Impacts .....	14
<b>RESULTS &amp; DISCUSSION</b> .....	<b>15</b>
<b>Summary of Sampling Efforts</b> .....	<b>15</b>
Sampled Access Sites .....	15
On-the-Water Survey Summary .....	15
Boat Survey Summary .....	16
<b>Fishery Characteristics</b> .....	<b>17</b>
Estimates of Fishing Effort and Chinook Catch .....	17
Characteristics of Harvested Chinook .....	21
<b>Test Fishing Results</b> .....	<b>23</b>
Fishing Time and Gear Types.....	23
Encounters, Mark Rates, and Size/Mark-status Composition .....	24
Chinook Size and Age .....	29
Other Fish Species Encountered .....	30
<b>Overall Fishery Impacts</b> .....	<b>32</b>
Total Encounters and Mortalities.....	32
FRAM versus Creel Comparison.....	32
Estimated CWT-DIT Impacts .....	36
<b>ACKNOWLEDGEMENTS</b> .....	<b>37</b>
<b>APPENDICES</b> .....	<b>40</b>
<b>Appendix A.</b> Mark-selective fishery impact estimation details.....	<b>41</b>
<b>Appendix B.</b> Statistical week calendar for the period during which the Areas 8-1 and 8-2 mark-selective fishery was open, January 1-April 30, 2009.....	<b>47</b>
<b>Appendix C.</b> Monthly sample rates (Total retained Chinook sampled <sup>a/</sup> / Estimated retained Chinook) in the Areas 8-1 and 8-2 winter (January 1-April 30, 2009) mark-selective Chinook fishery. ....	<b>48</b>
<b>Appendix D-1.</b> Fishery-total estimates of retained and released salmon (Chinook and other species) catch for the <b>Area 8-1</b> January 1-April 30, 2009 mark-selective Chinook fishery. Displayed Chinook harvest values are equivalent to those displayed in <b>Table 4-1</b> . Whereas the Chinook release estimates displayed in <b>Table 4-1</b> are based on the Conrad and McHugh	

(2008) method, values displayed here are based solely on angler-reported data. Values may not add exactly due to rounding error. .... 49

**Appendix D-2.** Fishery-total estimates of retained and released salmon (Chinook and other species) catch for the **Area 8-2** January 1-April 30, 2009 mark-selective Chinook fishery. Displayed Chinook harvest values are equivalent to those displayed in **Table 4-2**. Whereas the Chinook release estimates displayed in **Table 4-2** are based on the Conrad and McHugh (2008) method, values displayed here are based solely on angler-reported data. Values may not add exactly due to rounding error. .... 50

**Appendix E-1.** Summary of the total number of anglers intercepted in Area 8-1 during on-the-water surveys from January 1 through April 30, 2009. Grayed cells represent sites included in the dockside sample frame. .... 51

**Appendix E-2.** Summary of the total number of anglers intercepted in Area 8-2 during on-the-water surveys from January 1 through April 30, 2009. Grayed cells represent sites included in the dockside sample frame. .... 52

**Appendix F-1.** Size measures of sites sampled during the Area 8-1 January-April 2009 creel survey, by statistical week. .... 53

**Appendix F-2.** Size measures of sites sampled during the Area 8-2 January-April 2009 creel survey, by statistical week. .... 56

**Appendix G-1.** Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon in the Area 8-1 mark-selective Chinook fishery, January 1-April 30, 2009. .... 59

**Appendix G-2.** Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon in the Area 8-2 mark-selective Chinook fishery, January 1-April 30, 2009. .... 60

**Appendix H.** CWTs recovered from Chinook salmon during the Areas 8-1 and 8-2 January 1-April 30, 2009 mark-selective Chinook fishery. .... 61

**Appendix I.** Season-total estimates of Chinook encounters by size/mark status, and total estimates of angler effort, summarized for all seasons to date of the Areas 8-1 and 8-2 winter mark-selective Chinook fishery. .... 62

## LIST OF TABLES

<b>Table 1.</b> Sampling/estimation details on target parameters associated with the overall Areas 8-1 and 8-2 mark-selective fishery monitoring program ( <b>Figure 1</b> ). .....	13
<b>Table 2-1.</b> List of sites sampled during the Area 8-1 selective Chinook fishery, January 1 through April 30, 2009. ....	16
<b>Table 2-2.</b> List of sites sampled during the Area 8-2 selective Chinook fishery, January 1 through April 30, 2009. ....	16
<b>Table 3.</b> Monthly summary of boat surveys conducted during the Areas 8-1 and 8-2 selective fishery, January 1 through April 30 2009. ....	16
<b>Table 4-1.</b> Estimates of total fishing effort and the total number of salmon kept and released during the January 1-April 30, 2009 Area 8-1 selective Chinook fishery. Values may not add exactly due to rounding error. ....	18
<b>Table 5.</b> Summary of length samples collected during dockside angler interviews from retained Chinook salmon, Areas 8-1 and 8-2, January 1 - April 30, 2009. <i>Note:</i> two legal-size fish of undetermined mark status were sampled in Area 8-1. ....	22
<b>Table 6.</b> Summary of coded-wire tags recovered from Chinook salmon harvested during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery. The field “No. DITs” corresponds to the number of tags that belonged to double-index tag groups. ....	23
<b>Table 7.</b> Fishing methods employed by private recreational anglers (from dockside interviews, based on number of boat trips sampled) and test fishers (based on hours fished) during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery. ....	25
<b>Table 8-1.</b> Chinook encounters by size/mark-status group for the January 1 -April 30, 2009 Area 8-1 test fishery. Variances associated with season-total size/mark status group proportions and mark rates are provided in parentheses. ....	26
<b>Table 8-2.</b> Chinook encounters by size/mark-status group for the January 1-April 30, 2009 Area 8-2 test fishery. Variances associated with season-total size/mark status group proportions and mark rates are provided in parentheses. ....	27
<b>Table 9.</b> Total Chinook encountered (retained and released) by private-boat anglers logging their trips on voluntary trip reports (VTRs) during the January 1-April 30, 2009 mark-selective Chinook fishery in Areas 8-1 and 8-2, from with estimates of legal, sublegal, and overall mark rates. ....	28
<b>Table 10.</b> Test fishery catches of species other than Chinook salmon during the Areas 8-1 and 8-2 January 1 -April 30, 2009 mark-selective Chinook fishery. ....	30
<b>Table 11.</b> Summary of season-wide fishery impact estimates for the Areas 8-1 and 8-2 mark-selective Chinook fishery, January 1 – April 30, 2009. Values may not add up perfectly due to rounding error. ....	33
<b>Table 12.</b> Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook encounters for the combined Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery. ....	34
<b>Table 13.</b> Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook mortalities for the combined Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery. ....	34
<b>Table 14.</b> 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 Areas 8-1 and 8-2 January 1-April 30, 2009 mark-selective Chinook fishery. ....	36

## LIST OF FIGURES

**Figure 1.** Map of Marine Catch Areas 8-1 (left panel) and 8-2 (right panel) in Puget Sound, where the fourth season of the pilot selective Chinook fishery occurred from January 1-April 30, 2009. Circled numbers correspond to access sites sampled during the winter 2009 selective fishery (*Area 8-1*: 1 = Camano Island State Park, 2 = Coupeville Ramp, 3 =Maple Grove Ramp, 4 = Oak Harbor Ramp, and 5= Norton Street [Everett] Ramp [refer to site number 1 in the Area 8-2 map]. *Area 8-2*: 1 = Norton Street [Everett] Ramp, 2 = Camano Island State Park, 3 = Dagmar’s Landing, 4 = Mukilteo State Park, and 5 = Tulalip Marina)..... 9

**Figure 2.** Conceptual diagram of the monitoring plan implemented in Areas 8-1 and 8-2 during the January-April 2009 mark-selective Chinook season. Circles represent discrete sampling activities, dashed boxes represent parameters that are estimated using data from a given activity, and solid boxes depict key quantities estimated from the comprehensive plan. ‘Encounters’ includes both harvested and released Chinook salmon. .... 12

**Figure 3.** Temporal patterns in fishing effort during the Areas 8-1 and 8-2, January-April 2009, mark-selective Chinook fishery. .... 17

**Figure 4.** Temporal patterns in CPUE (landed Chinook per angler trip) during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery..... 20

**Figure 5.** Temporal patterns in total Chinook harvest and releases during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) January-April 2009 mark-selective Chinook fishery..... 21

**Figure 6.** Length-frequency distributions of retained marked Chinook sampled at dockside during the Areas 8-1 (*left panel*) and 8-2 (*right panel*) January 1 -April 30, 2009 mark-selective Chinook fishery. .... 22

**Figure 7.** Trends in mark rates (% adipose clipped) for legal-sized Chinook encountered by test fishers during the Areas 8-1 and 8-2 January 1 -April 30, 2009 mark-selective Chinook fishery. The horizontal solid (0.69) and dashed (0.82) lines correspond to the average monthly mark rate for Areas 8-1 and 8-2, respectively. .... 28

**Figure 8.** Length-frequency distributions of marked (*left column*) and unmarked (*right column*) Chinook encountered by test fishers during the Areas 8-1 (*upper row*) and 8-2 (*lower row*) January-April 2009 mark-selective Chinook fishery. The dashed vertical line in the length-frequency histograms for marked Chinook corresponds to the legal size limit (22 in or 56 cm). *Note: x and y axis ranges differ between panels*..... 29

**Figure 9.** Monthly mean total length (+/- 95% CIs) of Chinook (marked and unmarked combined) sampled by test fishers during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) January-April 2009 mark-selective Chinook fishery, by brood year..... 31

**Figure 10.** Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook encounters and mortalities for the Areas 8-1 and 8-2 (combined) January 1 – April 30, 2009 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates. .... 35

## EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife (WDFW) implemented a pilot winter mark-selective Chinook fishery (MSF) in Marine Areas 8-1 and 8-2 for the fourth time from January 1 through April 30, 2009. Consistent with the 2004 Puget Sound Chinook Harvest Management Plan (Puget Sound Indian Tribes and WDFW 2004) and the intent of previous Puget Sound/Strait of Juan de Fuca mark-selective Chinook fisheries, the primary goal for this fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Puget Sound Chinook salmon. WDFW's Puget Sound Sampling Unit (PSSU) implemented an intensive monitoring program in Areas 8-1 and 8-2 during the January-April season in order to collect the data needed to estimate key parameters characterizing the fishery and its impacts on unmarked salmon. Sampling activities included dockside creel sampling, test fishing, and on-the-water effort surveys. 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] group), *iii*) the total number of Chinook salmon released (by size/mark-status group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook mortalities<sup>1</sup>, and *v*) the total mortality of marked and unmarked double index tag (DIT) CWT stocks.

Creel samplers staffed 10 different access sites (5 in 8-1 and 5 in 8-2; two total on any given sampling day) on 67 of the 120 days that Areas 8-1 and 8-2 were open to Chinook retention under mark-selective regulations. Samplers interviewed an estimated 25% and 34% of all anglers fishing in Areas 8-1 ( $n = 617$  anglers) and 8-2 ( $n = 2,014$  anglers), respectively. Additionally, they sampled 44% and 41% of all marked Chinook harvested in the two respective areas ( $n = 182$  in 8-1, 214 in 8-2). Other PSSU staff conducted 10 on-the-water effort surveys (3 in 8-1 and 7 in 8-2), and spent 33 days (142 hours) on the water pursuing Chinook using test fishing methods, in support of Areas 8-1 and 8-2 monitoring efforts.

Based on the combination of sampling activities, we estimated that a total of 8,464 angler trips (2,518 in 8-1; 5,946 in 8-2) were completed by private and charter anglers in the two combined areas from January 1 through April 30, 2009. With a season-wide CPUE of 0.16 Chinook retained per angler trip in Area 8-1 and 0.09 in Area 8-2, these anglers harvested a grand total of 402 and 509 marked Chinook in the respective areas (911 total); they released an estimated 2,456 Chinook (1,502 marked, 954 unmarked) in Area 8-1 and 2,119 Chinook (1,632 marked, 487 unmarked) in Area 8-2 (i.e., 4,575 releases overall). Over the two areas, harvested Chinook averaged 70 cm (range: 54 to 92 cm) in total length and were larger than the legal minimum size limit ( $\geq 22$  in or 56 cm TL) in most instances (dockside marked Chinook observations, 98 and 97% of legal size). Nearly three-quarters of all harvested individuals were 4-year olds (i.e., brood year 2005). In addition to taking length measurements and scale samples, ramp samplers recovered 23 CWTs from marked Chinook harvested in the Areas 8-1 and 8-2 fishery. The majority of these tags (70%) were from Puget Sound release sites, while the remaining tags (30%) were from Hood Canal release sites.

---

<sup>1</sup> Though the necessary tissue samples have been collected, DNA-based estimates of stock composition are presently unavailable for Puget Sound/Strait of Juan de Fuca mark-selective fisheries. In the present report, CWT-based (unexpanded) estimates of the stock composition of marked Chinook harvest are provided.

During their four months of sampling in Areas 8-1 and 8-2 while it was open under mark-selective regulations, test fishers encountered 180 Chinook salmon, 73% (66% in 8-1, 81% in 8-2) of which were marked and 20% (18% in 8-1, 23% in 8-2) of which were of legal size. With a “CPUE” of 0.24 (legal-marked Chinook encounters / angler trip; 0.24 for 8-1, 0.22 for 8-2), test fishers encountered legal-marked Chinook at a higher rate than private fleet anglers. With mean lengths of 44 cm (8-1 marked and unmarked mean) and 45 cm (8-2 marked and unmarked mean), the distribution of encountered Chinook lengths was centered below the legal size limit (56 cm) in both areas. Further, based on scale-reading results, brood year 2007 fish made up the majority (50%) of the test fishery encounters. Throughout the four-month season, test fishery samples indicated that high mark rates and low legal-size fractions persisted during each month, with one in five Chinook encounters being legally harvestable (i.e.,  $\geq 22$  in [56 cm] and marked) on average. In total, we estimated the season-wide size/mark-status composition at 15.8% legal-marked (LM), 2.0% legal-unmarked (LU), 50.5% sublegal-marked (SM), and 31.7% sublegal-unmarked (SU) in Area 8-1 and 21.5% LM, 1.3% LU, 59.5% SM, and 17.7% SU in Area 8-2.

By combining dockside-sampling results (i.e., legal-marked Chinook harvest estimates) and test fishery encounters data, we generated size/mark-status group-specific estimates of encounters and mortalities for the two combined areas. In total, 5,511 Chinook were encountered (retained and released) during the combined Areas 8-1 and 8-2 fishery, with 1,023 of these being legal-marked, 90 legal-unmarked, 3,021 sublegal-marked, and 1,377 sublegal-unmarked individuals. Among released encounters, an estimated 20 legal-marked, 10 legal-unmarked, 600 sublegal-marked, and 276 sublegal-unmarked Chinook (905 overall, 54% in 8-1 and 44% in 8-2) were estimated to have died due to handling and release effects. Thus, in total, 1,531 marked (60% due to direct harvest) and 312 unmarked Chinook mortalities occurred as a result of the Areas 8-1 and 8-2 fishery. Although estimated unmarked (legal and sublegal) and sublegal-marked Chinook impacts were considerably less than what was expected based on pre-season Fishery Regulation Assessment Model runs (model run 2108), the impact of the Areas 8-1 and 8-2 fishery on legal-sized, marked Chinook (i.e., modeled harvest) was similar to what was anticipated.

Finally, regarding impacts of MSFs on the coded-wire tag (CWT) program, we estimated that two unmarked Chinook belonging to double-index tag (DIT) groups may have died due to the handling-and-release impacts of 2008-09 Areas 8-1 and 8-2 fishery.

## INTRODUCTION

In recent years, abundant runs of hatchery Chinook salmon (*Oncorhynchus tshawytscha*) have been mixed with depressed runs of wild Chinook salmon in the marine environments of the Puget Sound and Strait of Juan de Fuca. Providing recreational anglers with opportunities to harvest abundant hatchery stocks while simultaneously protecting weaker, wild stocks has proven to be a significant conservation and management challenge. The combination of large-scale hatchery marking (i.e., fin clipping) programs and mark-selective harvest regulations makes it possible for anglers to pursue and harvest hatchery Chinook salmon while minimally impacting wild salmon populations. In such “mark-selective fisheries” (MSFs), anglers are generally allowed to retain adipose-fin clipped (“marked”) hatchery fish and are required to release unharmed any unclipped (“unmarked”, predominantly wild) salmon encountered<sup>2</sup>.

Since the first marine selective Chinook fishery occurred in Marine Catch Areas 5 and 6 (Strait of Juan de Fuca) in 2003 (WDFW 2008a), mark-selective Chinook salmon fishing regulations have been implemented on a pilot basis in multiple Puget Sound Marine Catch Areas during both summer and winter seasons. As of the close of the 2007-08 fishing season, pilot summer selective Chinook seasons have occurred in Areas 5 and 6 for six years (2003-2008; WDFW 2008a; WDFW 2009a) and in Areas 9, 10, 11, and 13 for two years (2007 and 2008; WDFW 2007a and 2007b, WDFW 2009b and 2009c). Pilot winter selective Chinook fisheries have occurred in Areas 8-1 and 8-2 for three complete seasons (2005-06, 2006-07, and 2007-08; WDFW 2008b, WDFW 2009d) prior to the current winter 2009 season reported herein.

From January 1 to April 30 2009, the Washington Department of Fish and Wildlife (WDFW) implemented a winter mark-selective Chinook fishery in Areas 8-1 and 8-2 for the fourth time. Consistent with the 2004 Puget Sound Chinook Harvest Management Plan (Puget Sound Indian Tribes and WDFW 2004) and the intent of previous mark-selective Chinook fisheries, the primary goal for this pilot fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Puget Sound Chinook salmon.

Given the pilot nature of the Areas 8-1 and 8-2 selective Chinook fishery, WDFW’s Puget Sound Sampling Unit was tasked with implementing an intensive monitoring program during the entirety of its January-April 2009 season. Our primary goal was to collect the data needed to estimate key parameters characterizing this fishery and its impacts on unmarked salmon. As per State–Tribal agreement (WDFW and NWIFC 2008), we tailored our sampling so that we could reliably estimate: *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] group), *iii*) the total number of Chinook salmon released (by size and mark-status group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook

---

<sup>2</sup>The regulations specific to the 2009 winter Areas 8-1 and 8-2 mark-selective fishery allowed for the retention of up to two legal-sized ( $\geq 22$  inches [56 cm]) marked Chinook salmon per day and required the immediate release of all unmarked or sublegal Chinook. Additionally, anglers were: *i*) required to use single-point, barbless hooks while fishing for salmon, *ii*) held to a combined (all salmon species) two-fish daily limit during the Areas 8-1 and 8-2 mark-selective fishery, and *iii*) held to a handling rule that prevented them from bringing unmarked and/or sublegal Chinook aboard their vessels.

mortalities<sup>3</sup>, and  $\nu$ ) the total mortality of marked and unmarked double index tag (DIT) CWT stocks. In addition, we acquired and analyzed relevant data characterizing other aspects of the pilot fishery, including descriptors of fishing effort, fishing success (catch [landed Chinook] per unit effort), the length and age composition of encountered Chinook, and the overall intensity of our sampling efforts.

In the following pages, we report the results generated through our Areas 8-1 and 8-2 monitoring activities. We first provide a brief review our in-season sampling and post-season assessment methods and then present detailed results for each component of our selective-fishery monitoring program. Results are presented according to the following sequence: *i*) the intensity (i.e., spatial and temporal coverage) of sampling efforts is described; *ii*) estimates of fishery characteristics obtained from creel survey data are reviewed; *iii*) the results from our recreational test fishery are presented; and *iv*) total fishery impacts—estimated based on the combination of creel and test fishery data—are reviewed and compared with pre-season expectations (i.e., based on Fishery Regulation Assessment Model [FRAM] predictions). Finally, we provide a detailed description of our estimation scheme as well as additional and relevant data in a series of appendices (i.e., sample-rate tables and sampling summaries; age composition tables [for landed catch and test fishery encounters]; and raw CWT recoveries).

## METHODS

### **Marine Catch Area Description**

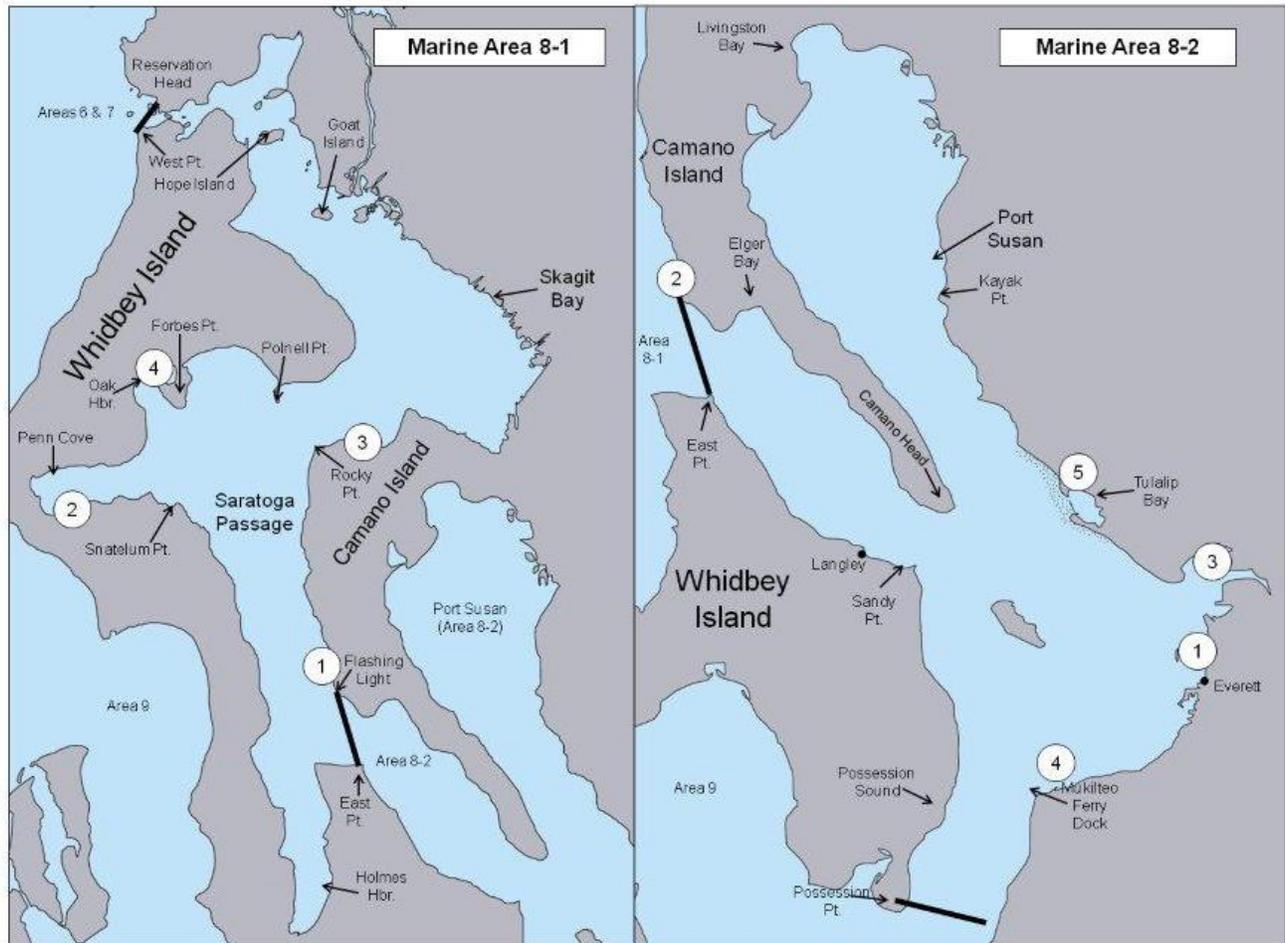
Area 8-1 includes the marine waters extending from Deception Pass southward through Skagit Bay and Saratoga Passage (south of Fidalgo Island) between Whidbey Island and Camano Island. Area 8-2 encompasses all marine waters from Port Susan south to Port Gardner, between Everett and Whidbey Island (**Figure 1**). During the winter 2009 season, fishing was permitted throughout both areas, excluding waters in and immediately adjacent to Tulalip Bay (Area 8-2). As in other winter salmon fisheries in Puget Sound, immature Chinook salmon (“blackmouth”) were the predominant fish targeted and encountered in Areas 8-1 and 8-2 during the winter months.

### **Monitoring Program Overview**

Our sampling program for the Areas 8-1 and 8-2 fishery incorporated comprehensive and complementary data collection strategies, including dockside angler interviews (with catch sampling), on-the-water (instantaneous) effort surveys, test-fishery-based sampling, and voluntary reports of completed trips provided by charter boats and private anglers (**Figure 2**). Although we provide a brief review of the field and analytical methods associated with our sampling efforts here, we refer the reader to WDFW (2007b or 2008b) for additional detail.

---

<sup>3</sup> Though the necessary tissue samples have been collected, DNA-based estimates of stock composition are presently unavailable for Puget Sound/Strait of Juan de Fuca mark-selective fisheries. In the present report, CWT-based (unexpanded) estimates of the stock composition of marked Chinook harvest are provided.



**Figure 1.** Map of Marine Catch Areas 8-1 (left panel) and 8-2 (right panel) in Puget Sound, where the fourth season of the pilot selective Chinook fishery occurred from January 1-April 30, 2009. Circled numbers correspond to access sites sampled during the winter 2009 selective fishery (*Area 8-1*: 1 = Camano Island State Park, 2 = Coupeville Ramp, 3 = Maple Grove Ramp, 4 = Oak Harbor Ramp, and 5 = Norton Street [Everett] Ramp [refer to site number 1 in the *Area 8-2* map]. *Area 8-2*: 1 = Norton Street [Everett] Ramp, 2 = Camano Island State Park, 3 = Dagmar's Landing, 4 = Mukilteo State Park, and 5 = Tulalip Marina).

## **Catch and Effort: Sampling and Estimation**

We collected data on total catch (observed harvest and reported releases<sup>4</sup>) and total angling effort using a two-stage stratified cluster sample design (**Table 1**). At the first stage, we selected five sample days from two temporal strata (weekday [Monday-Thursday], with  $n = 2$  days sampled; weekend [Friday-Sunday], with  $n = 3$  days sampled) during each week of the fishery. On each selected sample day, we selected two access points (i.e., public ramps, boathouses, etc.) from our Areas 8-1 and 8-2 sample frames for creel sampling. Access site (i.e., cluster) selection was achieved at the second stage using a probability-proportional-to-size (PPS) sampling algorithm (Brewer's method, Cochran 1977). The measure of size used in PPS sampling was equivalent to the fraction of total sample-frame effort attributed to a given site; this quantity was estimated using data collected during instantaneous on-the-water surveys (i.e., "boat surveys") conducted routinely during the course of the fishery. Our sample frame included the moderate-to-high effort, public boat launch facilities that are used to access Areas 8-1 and 8-2 (*Area 8-1*: Camano Island State Park, Coupeville Ramp, Maple Grove Ramp, Oak Harbor Ramp, and Norton Street [Everett] Ramp; *Area 8-2*: Norton Street [Everett] Ramp, Camano Island State Park, Dagmar's Landing, Mukilteo State Park, and Tulalip Marina). Given that some effort was excluded from our sample frame (i.e., private and/or low-effort access sites), we also estimated the out-of-frame effort proportion from boat survey data and accounted for this quantity in estimates of fishery-wide totals (e.g., catch and effort).

At access sites selected for sampling on scheduled sample days, samplers interviewed *all* anglers exiting the fishery. During interviews, samplers acquired data on trip duration, trip intent (i.e., targeted species), fishing method(s) employed (downrigger or diver trolling, jigging, mooching, or other), and fish encountered (kept and/or released, by species). When an interviewed party possessed Chinook or coho salmon, samplers inspected them for CWTs using wand detectors, and collected snouts from CWT-positive individuals for later lab processing. Additionally, samplers took length measurements (fork and total) and scale samples from landed Chinook.

By combining dockside interview data with estimated size measures, we generated daily estimates (and variances) of total fishing effort and landed Chinook catch (by mark-status group) for our sample frame using Murthy's population-total estimator (Murthy 1957, Cochran 1977, WDFW 2008b). We then expanded these estimates to account for the out-of-frame effort proportion and then again to obtain stratum-wide totals (**Table 1**). To minimize the influence of recall bias on our assessment, we estimated Chinook releases as the difference between retained catch (i.e., from the Murthy estimator, based on *observed* landings) and total Chinook encounters (i.e., releases = encounters – retained catch) generated using the bias-corrected Conrad and McHugh (2008) approach. Briefly, encounters were estimated by dividing the creel estimate of legal-marked Chinook harvest by a test fishery-based estimate of the proportion of the fishable Chinook population that is of legal size and marked (i.e., our former "Method 2" approach; e.g., WDFW 2007b). Given that this approach yields negatively biased estimates if anglers release

---

<sup>4</sup> In an evaluation of bias in mark-selective fishery parameter estimates, Conrad and McHugh (2008) concluded that recall errors likely cause bias in interview-based estimates of total salmon *releases*. Thus, although estimates of total salmon releases based solely on angler-reported data were generated for this report (**Appendix D**), we focus exclusively on bias-corrected "Method 2" estimates of Chinook encounters (and releases) in our review of the Area 8-1 and 8-2 fishery.

any of the legal-marked Chinook they encounter, Conrad and McHugh estimated a “correction” factor to account for this phenomenon and incorporated it into their estimator (See **Appendix A** for complete computational details). Although we do not review estimates of Chinook releases based solely on angler accounts in our assessment, we supply these estimates, as well estimates of retained catch and/or reported releases for other salmon species, in appendices to this report (**Appendix D**).

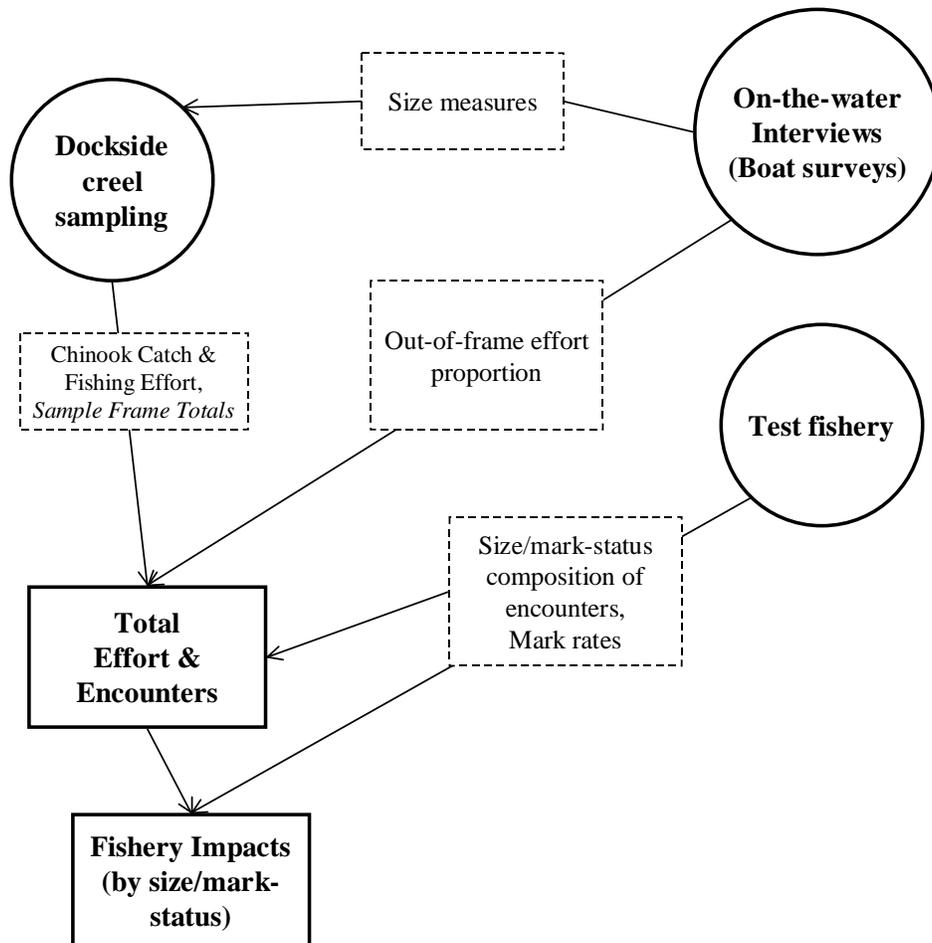
Although they were not used in producing creel estimates, Voluntary Trip Reports (VTRs) were also completed and returned by a subset of private fleet anglers, to obtain additional information on Chinook encounter rates by mark status and size class in the Areas 8-1 & 8-2 winter selective fishery. Anglers were asked to record the date, number of anglers, target species, catch Area, each Chinook or coho hooked, whether the fish was kept or released, species (if they positively identified the fish), total length to the nearest 1/8th inch, and whether the fish was adipose fin-clipped (marked) or not clipped (unmarked).

As a final note, given the higher catch per unit effort (CPUE) of charter anglers relative to that of the private recreational fleet and the difficulty in directly sampling their catch (e.g., due to private moorage), we acquired creel data for these anglers through a separate but comprehensive effort. We contacted all salmon charters known to be operating in Areas 8-1 and 8-2 during the winter months and coordinated with them so that they would complete and return creel information for all trips taken using supplied Voluntary Trip Report (VTR) forms. For these anglers, total salmon catch (kept and released) and fishing effort data were assumed to be the result of a complete census and therefore simply added to the survey-based estimates generated for the private fleet.

### **Test Fishery Methods**

In order to obtain accurate estimates (i.e., free from survey-based recall error) of the size (legal or sublegal) and mark-status (marked or unmarked) composition of the pool of Chinook salmon encountered by anglers participating in the fishery, we conducted a recreational test fishery during the entirety of the mark-selective Chinook season (**Table 1**). In contrast to our approach employed in the previous three seasons of the Areas 8-1 & 8-2 winter selective fishery, during winter 2009 we operated one test boat that was shared between the two Areas, rather than operating a separate test boat in each Area.

Our test boat crew consisted of two WDFW technicians, each fishing with a single rod for five days a week (Monday-Friday). Test fishers focused their efforts at locations that optimized their overall encounter rate and mirrored choices made by the at-large private fleet. Also, test fishers fished for Chinook using the same methods as the recreational fleet, as prescribed by supervisory staff based on dockside interview results for the preceding week. For each fish brought to boat, test fishers logged details on its identity (species), size (fork length and total length), and, if appropriate, mark status (marked or unmarked). For Chinook salmon encounters only, test fishers additionally collected scale and DNA samples (~1-cm<sup>2</sup> piece of dorsal fin tissue).



**Figure 2.** Conceptual diagram of the monitoring plan implemented in Areas 8-1 and 8-2 during the January-April 2009 mark-selective Chinook season. Circles represent discrete sampling activities, dashed boxes represent parameters that are estimated using data from a given activity, and solid boxes depict key quantities estimated from the comprehensive plan. ‘Encounters’ includes both harvested and released Chinook salmon.

**Table 1.** Sampling/estimation details on target parameters associated with the overall Areas 8-1 and 8-2 mark-selective fishery monitoring program (**Figure 1**).

Activity	Focal Parameter(s)	Secondary Parameter(s)	Sample Unit(s)	Finest Estimation Time Step	Comments
Dockside Creel Sampling	Fishing effort (boat & angler trips); kept and released fish <sup>1</sup>	Catch rates (CPUE); length, age, and CWT composition of harvest <sup>2</sup>	Angler trip; kept fish; reported fish release	Week <sup>1</sup>	Within weeks, estimates are also produced by strata (weekday/weekend).
Test Fishing	Size (legal/sublegal) and mark-status composition (marked, unmarked) of encountered Chinook	Chinook length, age, and DNA-based <sup>3</sup> stock composition; species composition of non-Chinook encounters	Fish encounter	Season (4 months)	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 (4 months)	
Coded-wire tag (CWT) Impacts Estimation	Marked/unmarked double-index tag (DIT) encounters and mortalities	N/A	N/A	Season (4 months)	The temporal resolution of DIT impacts is constrained by the total number of tags recovered.

<sup>1</sup> Under the "bias-corrected Method-2" approach, Chinook releases can be estimated only as finely as test fishery data allow.

<sup>2</sup> The length and CWT composition of landed catch was assessed on a season-wide basis for impact estimation.

<sup>3</sup> Though samples were collected, DNA-based estimates of stock composition are not yet available for this fishery.

## **Estimating Fishery Impacts**

### *Total Encounters and Mortalities*

We characterized the overall impacts of the fishery in terms of grand-total estimates of 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**). As indicated above and in contrast to previous post-season Areas 8-1 and 8-2 reports (e.g., 2005-06 and 2006-07 seasons), we used only one approach to estimate total Chinook encounters and, consequently, mortalities. This single method was selected as a result of a thorough state-tribal review of bias potential in estimators of encounters in MSFs (see Conrad and McHugh 2008 for details). In brief, encounters were estimated by dividing creel estimates of legal-marked Chinook harvest by the test fishery-based proportion of the targeted Chinook population that was of legal size and marked, inclusive of a bias correction accounting for the modest level legal-marked Chinook release that occurs in this fishery. We then decomposed total encounters into size/mark-status group-specific estimates using test-fishery encounters composition data.

We estimated total Chinook mortality resulting from the 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 selective fishing mortality (*sfm*)

rates of 15% and 20% to legal (marked and unmarked) and sublegal (marked and unmarked) release totals, respectively, to estimate release mortality. 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. 2108) for each size and mark status category.

### *CWT Impacts*

To understand the potential effects of the Areas 8-1 and 8-2 fishery on the CWT program, we estimated the total number of unmarked-tagged Chinook mortalities that may have occurred during the course of its four-month, January-April season. 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 Selective Fisheries Evaluation Committee – Analysis Work Group (SFEC-AWG 2002) to estimate the number of unmarked DIT fish encountered<sup>5</sup>. We subsequently estimated the number of these fish that may have died due to hook-and-release impacts using an *sfm* analogous 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* value of 10% in all unmarked-DIT mortality calculations. Thus, we used 10% instead of 15% (applied above to legal-sized releases) since unseen drop-off mortality (the 5% differential) is a feature common to selective and non-selective recreational Chinook fisheries.

---

<sup>5</sup> For all unmarked-DIT encounters and mortalities calculations, we relied on the unmarked-to-marked abundance ratio ( $\lambda$ ) estimated for DIT groups at the time of juvenile release.

## RESULTS & DISCUSSION

### Summary of Sampling Efforts

#### *Sampled Access Sites*

Between January 1 and April 30, 2009, we sampled the recreational creel on a grand total of 67 sample-days out of 120 open days for mark-selective Chinook fishing in the Areas 8-1 and 8-2 fishery, visiting five different access sites in each of the two respective areas (**Tables 2-1 and 2-2**). In Area 8-1, we visited Camano Island State Park (66% of sampled days) and Oak Harbor ramp (18% of sampled days) most frequently. The majority of remaining Area 8-1 sampling effort was spent at Maple Grove, Coupeville, and Norton Street (Everett) ramps. In Area 8-2, we sampled Norton Street (Everett) Ramp on 69% of all sample days; Camano Island State Park and Dagmar's Landing comprised the majority of the remaining sampling effort. In both areas, we made minor alterations to our sample frame in response to in-season changes in size measures (i.e., from on-the-water surveys, described below) or due to logistical considerations.

In total, our Area 8-1 angler interview efforts allowed us to directly sample 617 completed angler trips and 314 completed boat trips. In Area 8-2, we collected data on a total of 2,014 angler trips and 1,008 boat trips. In addition to interviewing these anglers and sampling their catch, we also obtained samples from baseline recreational sampling activities that were ongoing during the Areas 8-1 and 8-2 season.

#### *On-the-Water Survey Summary*

During the 4-month period that Area 8-1 was open under mark-selective regulations, we conducted 247 on-the-water interviews over a total of 3 boat surveys (**Table 3; Appendix E-1**). In Area 8-2, we conducted 7 total surveys and intercepted 558 anglers; **Table 3; Appendix E-2**). These surveys yielded quantitative details about the set of sites anglers used to access Areas 8-1 and 8-2 and thus allowed us to estimate the proportion of effort originating at each of our sample-frame sites (i.e., size measures; **Appendices F-1 & F-2**). As suggested in **Table 2-1**, Camano Island State Park was the site anglers most frequently reported using to access Area 8-1, followed closely by Oak Harbor and Everett (Norton Street) ramps. Pooled over all surveys, 26% of all anglers interviewed during Area 8-1 boat surveys indicated that their trip would end at either a private or never-sampled launch site (**Appendix E-1**). In Area 8-2, 40% of all anglers interviewed reported using Everett (Norton Street) Ramp to access the fishery (**Appendix E-2**); 27% reported using private and/or never-sampled access sites. Boat surveys revealed a modest level of short-term and seasonal variability in the relative "size" of sampled access sites (i.e., in the 8-1/8-2 sample frames; **Appendices F-1 and F-2**). We incorporated this variation into our PPS site-selection framework.

**Table 2-1.** List of sites sampled during the Area 8-1 selective Chinook fishery, January 1 through April 30, 2009.

Area 8-1 Sampled Sites	Total sample days	% of total
Camano Island State Park Public Ramp	66	66.0%
Coupeville Public Ramp	3	3.0%
Maple Grove Ramp; Camano Island	7	7.0%
Norton Street (Everett) Ramp	6	6.0%
Oak Harbor Marina & Public Ramp	18	18.0%
<b>TOTAL</b>	<b>100</b>	<b>100.0%</b>

**Table 2-2.** List of sites sampled during the Area 8-2 selective Chinook fishery, January 1 through April 30, 2009.

Area 8-2 Sampled Sites	Total sample days	% of total
Camano Island State Park Public Ramp	18	18.8%
Norton Street (Everett) Ramp	66	68.8%
Dagmar's Landing; Forklift Launch	5	5.2%
Mukilteo State Park Public Ramp	4	4.2%
Tulalip Marina & Ramp	3	3.0%
<b>TOTAL</b>	<b>96</b>	<b>100.0%</b>

*Boat Survey Summary*

We conducted a total of 10 boat surveys during the Areas 8-1 and 8-2 winter selective fishery (**Table 3**). Boat surveys were used to estimate the percentage of effort from sites within the sample frame (versus sites out of the sample frame), and the proportion of angler effort originating at each access site. In the 10 boat surveys samplers interviewed 394 boats with 805 anglers; of these, 571 anglers (71%) exited the fishery via sites within the sample frame.

Winter fishery characteristics were such that on foul weather days and weekdays, angling effort was minimal or non-existent. We attempted to complete boat surveys on days when it was logistically feasible and when we expected to capture the most angling effort.

**Table 3.** Monthly summary of boat surveys conducted during the Areas 8-1 and 8-2 selective fishery, January 1 through April 30 2009.

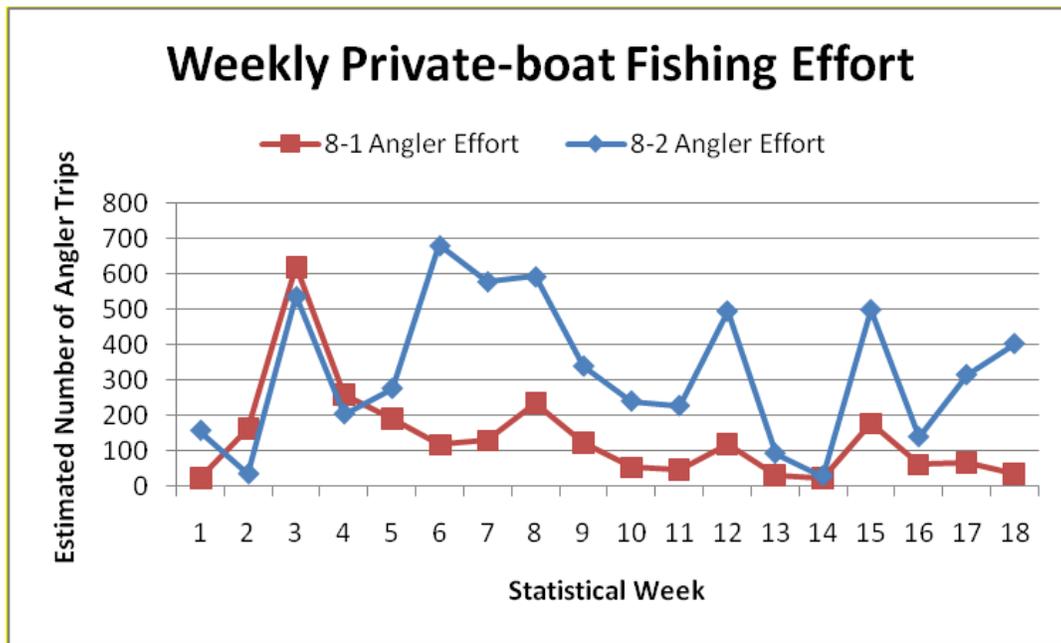
Boat survey schedule		
Month	Area 8-1 Date Conducted	Area 8-2 Date Conducted
January	18 <sup>th</sup>	18 <sup>th</sup> , 24 <sup>th</sup>
February	21 <sup>st</sup>	7 <sup>th</sup> , 21 <sup>st</sup>
March	21 <sup>st</sup>	8 <sup>th</sup> , 22 <sup>nd</sup>
April	-	4 <sup>th</sup>
<b>Total Number</b>	<b>3</b>	<b>7</b>

## Fishery Characteristics

### *Estimates of Fishing Effort and Chinook Catch*

Private anglers completed an estimated total of 8,464 angler trips and 4,262 boat trips during the four-month combined Areas 8-1 and 8-2 mark-selective blackmouth fishery. As in previous seasons, approximately one-third of this effort occurred in Area 8-1 and two-thirds in Area 8-2 (**Table 4-1** and **4-2**). Further, both areas exhibited similar month-to-month patterns in angling effort over the course of the season (**Figure 3**). January was the most active for 8-1, with 50% of the total effort, while February was the most active for 8-2 with 37% of the total effort. March was the least active (10% of 8-1 total, 18% of 8-2 total) month of fishing during the four-month season.

Chinook salmon catch rates (CPUE; landed Chinook per angler trip) averaged 0.16 and 0.09 landed Chinook per angler trip in Areas 8-1 and 8-2, respectively, but varied considerably from month to month. In both areas, CPUE peaked in the first week of January, with 0.27 in 8-1 and 0.18 in 8-2 landed Chinook per angler trip, and then declined with widely variable catch rates throughout the rest of the season. All-season lows for weeks that had harvest were 0.05 CPUE in 8-1 (week 9) and 0.02 CPUE in 8-2 (week 14) (**Figure 4**).



**Figure 3.** Temporal patterns in fishing effort during the Areas 8-1 and 8-2, January-April 2009, mark-selective Chinook fishery.

**Table 4-1.** Estimates of total fishing effort and the total number of salmon kept and released during the January 1-April 30, 2009 Area 8-1 selective Chinook fishery. Values may not add exactly due to rounding error.

Month	Date Range	Est. Effort <sup>1/</sup>		Est. Retained Chinook <sup>1/</sup>		Est. Released Chinook <sup>2/</sup>		Est. Total Chinook Encounters
		Boats	Anglers	AD	UM	AD	UM	
JAN	1/1-2/1	657	1,263	332	12	1,238	785	2,367
FEB	2/2-3/1	310	608	27	0	101	65	194
MAR	3/2-3/29	128	256	11	0	42	27	80
APR	3/30-4/30	204	390	32	0	120	77	229
<b>Season Total:</b>		1,298	2,518	402	12	1,502	954	2,870
<b>Variance:</b>		4,859	20,935	1,304	60	22,529	8,431	65,635
<b>Standard Error:</b>		70	145	36	8	150	92	256
<b>CV (%):</b>		5%	6%	9%	65%	10%	10%	9%
<b>95% CI:</b>		1,162-1,435	2,234-2,802	332-473	3-27	1,207-1,796	774-1,134	2,368-3,372

<sup>1/</sup> Estimated boats, anglers, and retained salmon catch were estimated via the Murthy estimator method.

<sup>2/</sup> Released Chinook were estimated as the difference between total Chinook encounters generated using a bias-corrected "Method 2" estimator (see **Appendix A** and Conrad and McHugh (2008) for additional details) and creel estimates of retained Chinook.

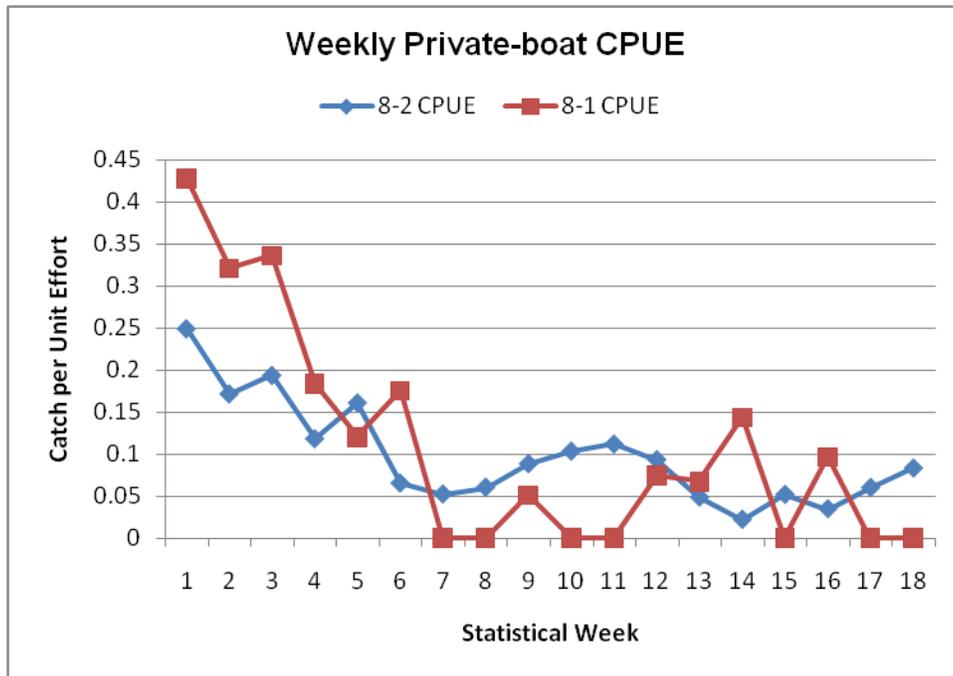
**Table 4-2.** Estimates of total fishing effort and the total number of salmon kept and released during the January 1-April 30, 2009 Area 8-2 selective fishery. Values may not add exactly due to rounding error.

Month	Date Range	Est. Effort <sup>1/</sup>		Est. Retained Chinook <sup>1/</sup>		Est. Released Chinook <sup>2/</sup>		Est. Total Chinook Encounters
		Boats	Anglers	AD	UM	AD	UM	
JAN	1/1-2/1	617	1,211	215	4	689	208	1,116
FEB	2/2-3/1	1,061	2,193	141	0	452	139	732
MAR	3/2-3/29	539	1,058	102	0	327	101	530
APR	3/30-4/30	747	1,484	51	11	164	39	265
<b>Season Total:</b>		2,964	5,946	509	15	1,632	487	2,643
<b>Variance:</b>		50,690	224,948	3,246	80	35,390	4,052	67,751
<b>Standard Error:</b>		225	474	57	9	188	64	260
<b>CV (%):</b>		8%	8%	11%	60%	11%	13%	9%
<b>95% CI:</b>		2,523-3,406	5,017-6,876	397-620	6-32	1,394-2,132	362-612	2,263-3,283

<sup>1/</sup> Estimated boats, anglers, and retained salmon catch were estimated via the Murthy estimator method.

<sup>2/</sup> Released Chinook were estimated as the difference between total Chinook encounters generated using a bias-corrected "Method 2" estimator (see **Appendix A** and Conrad and McHugh (2008) for additional details) and creel estimates of retained Chinook.

Given observed patterns in effort and catch rates, we estimated that anglers harvested a grand total of 938 Chinook salmon in the combined Areas 8-1 and 8-2 fishery (414 in Area 8-1, 524 in Area 8-2; **Tables 4-1** and **4-2**). Of these fish, 911 were marked (402 in Area 8-1 and 509 in Area 8-2) and 27 (2.9% of harvest total) were unmarked (12 in Area 8-1 and 15 in Area 8-2). Monthly harvest totals averaged 104 and ranged from 11 (March) to 344 (January) in Area 8-1; Area 8-2 monthly totals averaged 131 (range: 62 [March] to 219 [January]). See **Figure 5** for a graphical display of week-to-week harvest patterns.

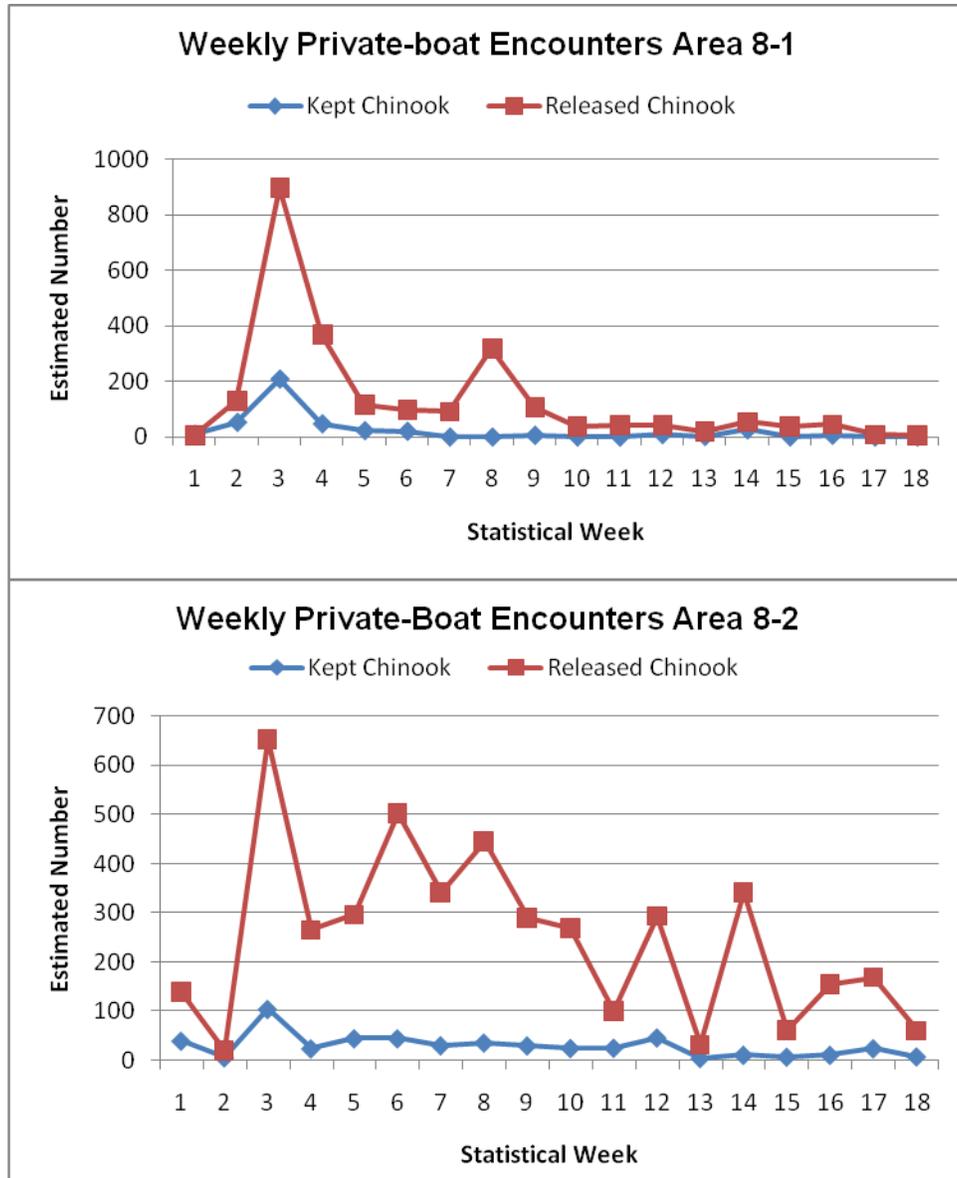


**Figure 4.** Temporal patterns in CPUE (landed Chinook per angler trip) during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery.

In addition to harvesting 938 Chinook salmon, we estimated that anglers participating in the Areas 8-1 and 8-2 MSF caught and released an additional 3,134 marked (1,502 in Area 8-1 and 1,632 in Area 8-2) and 1,441 unmarked Chinook salmon (954 in Area 8-1 and 487 in Area 8-2; **Tables 4-1** and **4-2**)<sup>6</sup>. On a season-total level, anglers released an estimated 3.6 marked and 2.3 unmarked Chinook per harvested fish in Area 8-1; in Area 8-2, they released an estimated 3.1 marked and 0.9 unmarked Chinook per landed fish. For Area 8-1, the greatest number of releases occurred during January (63% of the season total), whereas the fewest occurred during March and April (6% each; **Figure 5**). For Area 8-2, the greatest number of releases occurred in February (36% of season total) and the fewest in March (16%; **Figure 5**). Thus, release rates (Chinook releases per angler trip) were higher during the earlier compared to the latter portion of the season.

<sup>6</sup> Total Chinook releases were estimated using the bias-corrected “Method 2” encounters estimation approach (Conrad and McHugh 2008). For Murthy estimates of Chinook releases based solely on angler-reported releases (i.e., “Method 1” estimates), as well as estimates of harvest and releases for other salmon species, see **Appendix D**.

Combining harvest and release estimates, we estimate that anglers encountered a grand total of 2,870 and 2,643 Chinook in Area 8-1 and 8-2, respectively, during the four-month mark-selective season (**Tables 4-1, 4-2**). For additional discussion of fishery impacts from a total encounters perspective, see the subsequent section titled *Overall Fishery Impacts*.



**Figure 5.** Temporal patterns in total Chinook harvest and releases during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) January-April 2009 mark-selective Chinook fishery.

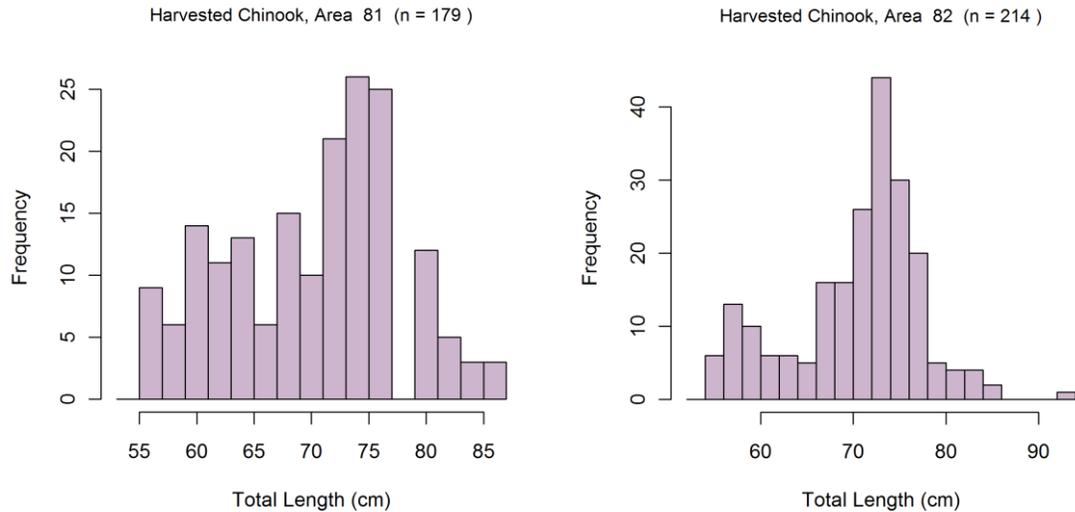
*Characteristics of Harvested Chinook*

Length and Age.—During the combined Areas 8-1 and 8-2 mark-selective fishery, 396 (182 in Area 8-1 and 214 in Area 8-2) retained Chinook were sampled at dockside (**Table 5**). All of these fish were measured and examined for the presence of a CWT. Marked Chinook harvested from Area 8-1 averaged 70.0 cm TL (range: 55.0-86.5, SD = 7.4) and were the

same size as those caught in Area 8-2 (average: 70.2 cm TL [range: 54.2-92.0, SD = 6.9]; **Figure 6**). Legally harvestable ( $\geq 22$  in [56 cm] *and* marked) Chinook comprised 97% of the sampled total in each of the two areas.

**Table 5.** Summary of length samples collected during dockside angler interviews from retained Chinook salmon, Areas 8-1 and 8-2, January 1 - April 30, 2009. *Note:* two legal-size fish of undetermined mark status were sampled in Area 8-1.

Marine Area	Mark Type	Number Sampled		
		Legal-size	Sublegal-size	Total
Area 8-1	Marked	176	3	179
	Unmarked	1	0	1
	Undetermined	2	0	2
	<b>Total</b>	<b>179</b>	<b>3</b>	<b>182</b>
Area 8-2	Marked	208	6	214
	Unmarked	0	0	0
	<b>Total</b>	<b>208</b>	<b>6</b>	<b>214</b>



**Figure 6.** Length-frequency distributions of retained marked Chinook sampled at dockside during the Areas 8-1 (*left panel*) and 8-2 (*right panel*) January 1 -April 30, 2009 mark-selective Chinook fishery.

Though scales were collected from all of the 396 marked Chinook sampled at dockside, 375 ( $n = 171$  in Area 8-1 and  $n = 204$  in Area 8-2) of these could be successfully aged. Based on analysis of these scales, we found that the age composition of Chinook harvest was similar for both areas 8-1 and 8-2 (**Appendix G-1 and G-2**). The majority of the retained Chinook were age-4 individuals (81%); age-3 fish each constituted approximately 20% of the harvest total for both areas. Further, approximately one in ten retained Chinook were yearling outmigrants.

**Table 6.** Summary of coded-wire tags recovered from Chinook salmon harvested during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery. The field “No. DITs” corresponds to the number of tags that belonged to double-index tag groups.

Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
Puget Sound-North	Tulalip Cr 07.0001	Bernie Gobin Hatch	1 (16.7%)	0
	Friday Cr 03.0017	Samish Hatchery	1 (16.7%)	1
	Tulalip Cr 07.0001	Bernie Gobin Hatch	1 (5.9%)	0
	Kalama Cr 11.0017	Kalama Cr Hatchery	2 (11.8%)	0
	Whitehorse Springs	Whitehorse Pond	1 (5.9%)	0
	Clear Cr 11.0013c	Nisqually Hatchery	2 (11.8%)	2
	Friday Cr 03.0017	Samish Hatchery	2 (11.8%)	2
	Wallace R 07.0940	Wallace R Hatchery	1 (5.9%)	0
Puget Sound-Central	Big Soos Cr 09.0072	Soos Creek Hatchery	1 (16.7%)	1
	Voight Cr 10.0414	Voights Cr Hatchery	1 (16.7%)	0
	Issaquah Cr 08.0178	Issaquah Hatchery	1 (16.7%)	0
	Voight Cr 10.0414	Voights Cr Hatchery	1 (5.9%)	0
	Chambers Cr 12.0007	Garrison Hatchery	1 (5.9%)	0
Hood Canal	Finch Cr 16.0222	Hoodsport Hatchery	7 (30.4%)	0
<b>Grand Total</b>			<b>23</b>	<b>6</b>

*CWT Samples.*—In total, 23 (6 in Area 8-1, 17 in Area 8-2) coded-wire tags were recovered from the Areas 8-1 and 8-2 fishery (**Table 6**). At 48% of the total, CWTs from north Puget Sound release sites (i.e., sites in river basins draining to Areas 8-1, 8-2, 7, 9, 11, or 12) dominated our sample. The remaining 12 tags, ranked from greatest to least, were from Hood Canal ( $n = 7$ ) and central Puget Sound ( $n = 5$ ). Finally, 26% of all CWTs were associated with a double-index tag group. See **Appendix H** for complete details on individual CWT recoveries.

### **Test Fishing Results**

#### *Fishing Time and Gear Types*

Test fishers were scheduled to fish five days per week during the four-month January-April season, weather permitting. In total, they spent 314 boat hours (142 in 8-1, 172 in 8-2) and 73 days (33 in 8-1, 40 in 8-2) on the water pursuing and sampling Chinook in the two areas (**Tables 8-1** and **8-2**). As was the case for the private recreational fleet, bad weather conditions precluded test fishers from fishing on several scheduled sample days during the season, particularly during January.

Based on the results from interviews of anglers that reported successfully encountering (retained or released) Chinook salmon, test fishers angled for Chinook using the same methods and in the same proportions as did the private fleet in both areas. Thus, during the four months that the fishery was open, test fishers fished primarily by trolling lures and/or bait with downriggers (98.9% in Area 8-1, 100% in Area 8-2; **Table 7**). In Area 8-1, they spent 1

out of 142 hours (Jan.-Apr. time only) using other methods (i.e., using the “jigging” technique); in Area 8-2, they only used the “downrigger” method.

*Encounters, Mark Rates, and Size/Mark-status Composition*

During the four-month open fishery period (January-April), test fishers encountered 101 Chinook total in Area 8-1 (16 legal-sized and marked [LM], 2 legal-sized and unmarked [LU], 51 sublegal-sized and marked [SM], and 32 sublegal-sized and unmarked [SU]; **Table 8-1**). In Area 8-2, test fishers encountered 79 Chinook total (17 LM, 1 LU, 47 SM, and 14 SU; **Table 8-2**). In Area 8-1, 66% of all Chinook encountered between January 1<sup>st</sup> and April 30<sup>th</sup> were marked (89% mark rate for legal-sized fish only); 18% of all Area 8-1 test fishery encounters were of legal size ( $\geq 22$  in [56 cm]). During this same period in Area 8-2, 81% of all Chinook encounters were marked (94% mark rate for legal-sized fish only) and 23% of all encounters were of legal size. Thus, mark rates were high overall, similar for legal and sublegal fish, and higher (81% versus 66% overall, respectively) in Area 8-2 compared to Area 8-1.

In terms of within-season patterns, the mark rate of legal-sized Chinook remained high ( $>60\%$  [8-1] and  $>75\%$  [8-2]) and varied little from month to month (**Figure 7**). In contrast, the proportion of test fishery encounters that were legal in size decreased in Area 8-1 between January (26%) and April (13%), and was variable for Area 8-2, between 11% (February) and 50% (April). Thus, the ratio of legally harvestable (i.e., LM fish) to non-harvestable fish (i.e., LU, SM, and SU) seen in the test fishery decreased markedly over the season (0.34 to 0.0 in Area 8-1) and was variable in Area 8-2. Overall, legal-size, marked individuals comprised 16% and 22% of all Chinook encountered in Areas 8-1 and 8-2, respectively, during the four-month season. See **Tables 8-1** and **8-2** for a complete account of Area 8-1 and 8-2 test fishery encounters.

Based on voluntary trip reports (VTRs) returned by private-boat anglers fishing in Areas 8-1 ( $n = 14$  VTRs with 38 encounters) and 8-2 ( $n = 9$  VTRs with 45 encounters) during the January-April MSF period, test fishers and private fleet encounters had similar mark rates and size-class fractions. There were no statistical differences in either the size/mark-status composition (Area 8-1,  $\chi^2 = 3.9052$ ,  $df = 3$ ,  $P = 0.2719$ ; Area 8-2,  $\chi^2 = 0.1954$ ,  $df = 3$ ,  $P = 0.9783$ ; **Table 9**) or the overall mark rate for the two Areas combined (test fishery, 73% vs. fleet, 76%;  $\chi^2 = 0.287$ ,  $df = 1$ ,  $P = 0.592$ ; **Table 9**).

**Table 7.** Fishing methods employed by private recreational anglers (from dockside interviews, based on number of boat trips sampled) and test fishers (based on hours fished) during the Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery.

**Area 8-1**

Statistical Week	DR		WB		Diver		Jig		Other	
	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private
1	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
9	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11	80.0%	100.0%	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.0%
12	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
13	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	100.0%	77.0%	0.0%	15.0%	0.0%	0.0%	0.0%	8.0%	0.0%	0.0%
17	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Total</b>	<b>98.9%</b>	<b>98.7%</b>	<b>0.0%</b>	<b>0.8%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>1.1%</b>	<b>0.4%</b>	<b>0.0%</b>	<b>0.0%</b>

**Area 8-2**

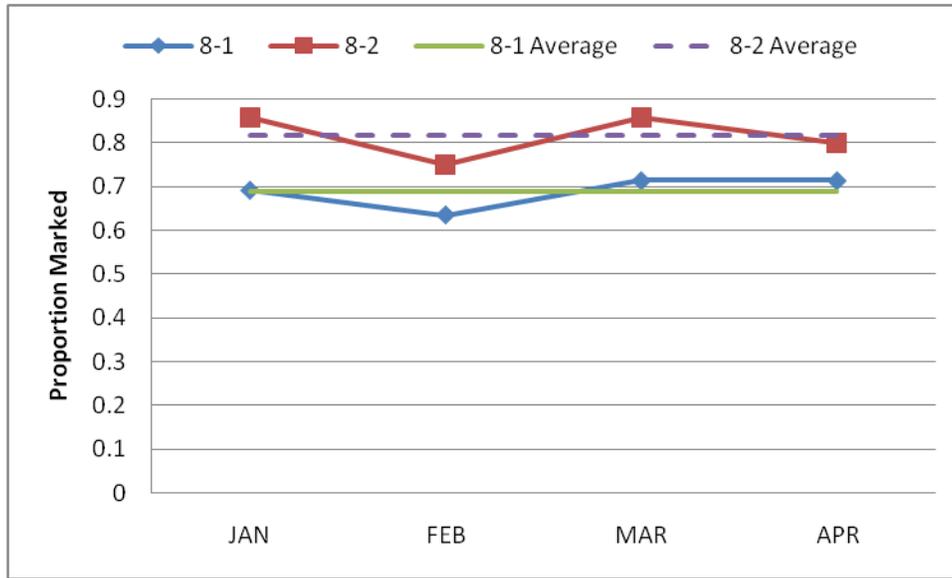
Statistical Week	DR		WB		Diver		Jig		Other	
	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private	Tst Boat	Private
1	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
9	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11	100.0%	95.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
13	100.0%	93.0%	0.0%	7.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	100.0%	98.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Total</b>	<b>100.0%</b>	<b>99.6%</b>	<b>0.0%</b>	<b>0.4%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>

**Table 8-1.** Chinook encounters by size/mark-status group for the January 1 -April 30, 2009 Area 8-1 test fishery. Variances associated with season-total size/mark status group proportions and mark rates are provided in parentheses.

Stat Week	Fishing Effort		Legal		Sublegal		Total
	Days	Boat Hours Fished	AD	UM	AD	UM	
1	0	0.0	0	0	0	0	0
2	0	0.0	0	0	0	0	0
3	4	21.9	4	0	10	6	20
4	0	0.0	0	0	0	0	0
5	5	21.5	6	0	7	6	19
6	4	18.0	4	0	11	6	21
7	2	9.5	1	1	8	10	20
8	2	9.0	0	0	4	0	4
9	2	7.0	1	0	1	2	4
10	1	2.8	0	0	2	0	2
11	1	5.0	0	0	0	0	0
12	2	5.3	0	0	1	0	1
13	3	13.0	0	0	1	1	2
14	1	1.5	0	0	0	0	0
15	2	9.5	0	1	1	1	3
16	2	9.0	0	0	4	0	4
17	0	0.0	0	0	0	0	0
18	2	9.0	0	0	1	0	1
<b>Total</b>	<b>33</b>	<b>142</b>	<b>16</b>	<b>2</b>	<b>51</b>	<b>32</b>	<b>101</b>
<b>Size/mark-status composition:</b>		0.158 (0.001)	0.020 (0.000)	0.505 (0.002)	0.317 (0.002)		
<b>Legal size mark rate:</b>		0.89 (0.006)					
<b>Overall mark rate:</b>		0.66 (0.002)					

**Table 8-2.** Chinook encounters by size/mark-status group for the January 1-April 30, 2009 Area 8-2 test fishery. Variances associated with season-total size/mark status group proportions and mark rates are provided in parentheses.

Stat Week	Fishing Effort		Legal		Sublegal		Total
	Days	Boat Hours Fished	AD	UM	AD	UM	
1	0	0.0	0	0	0	0	0
2	3	12.8	2	0	6	3	11
3	0	0.0	0	0	0	0	0
4	4	17.0	8	0	10	2	20
5	0	0.0	0	0	0	0	0
6	2	11.5	1	0	8	3	12
7	5	14.5	1	0	5	2	8
8	2	9.0	0	0	3	2	5
9	2	9.5	1	0	2	0	3
10	2	9.0	1	0	2	0	3
11	3	14.2	0	0	0	0	0
12	2	7.5	0	0	3	1	4
13	2	9.7	1	0	5	1	7
14	3	10.0	0	0	1	0	1
15	4	20.5	0	1	1	0	2
16	2	9.0	1	0	0	0	1
17	1	5.5	1	0	0	0	1
18	3	12.5	0	0	1	0	1
<b>Total</b>	<b>40</b>	<b>172</b>	<b>17</b>	<b>1</b>	<b>47</b>	<b>14</b>	<b>79</b>
<b>Size/mark-status composition:</b>			0.215 (0.002)	0.013 (0.000)	0.595 (0.003)	0.177 (0.002)	
<b>Legal size mark rate:</b>			0.94 (0.003)				
<b>Overall mark rate:</b>			0.81 (0.002)				



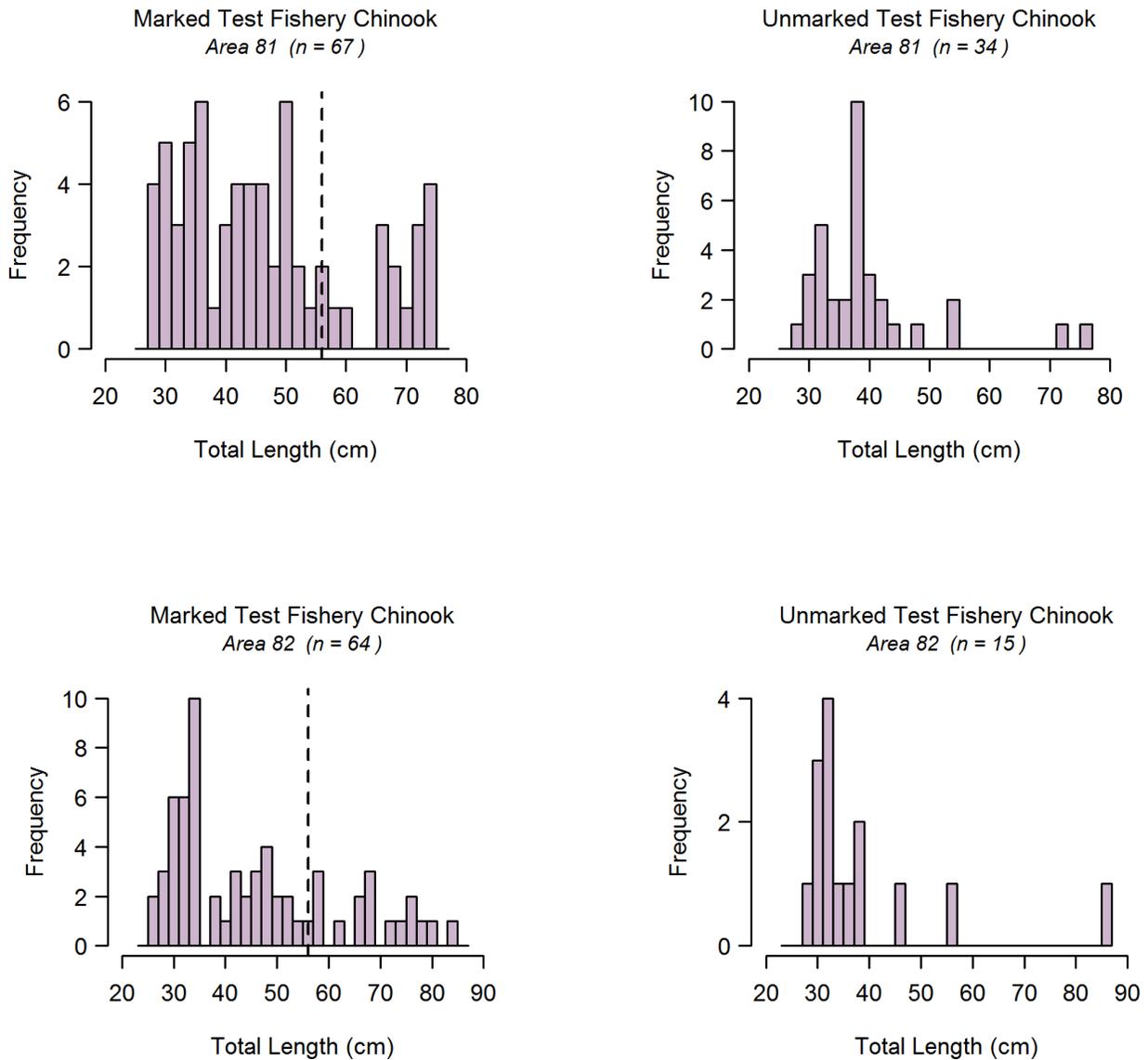
**Figure 7.** Trends in mark rates (% adipose clipped) for legal-sized Chinook encountered by test fishers during the Areas 8-1 and 8-2 January 1 -April 30, 2009 mark-selective Chinook fishery. The horizontal solid (0.69) and dashed (0.82) lines correspond to the average monthly mark rate for Areas 8-1 and 8-2, respectively.

**Table 9.** Total Chinook encountered (retained and released) by private-boat anglers logging their trips on voluntary trip reports (VTRs) during the January 1-April 30, 2009 mark-selective Chinook fishery in Areas 8-1 and 8-2, with estimates of legal, sublegal, and overall mark rates.

Area	Size	Mark Status	January	February	March	April	Total	% Marked
Area 8-1 (n=14)	Legal	Marked	4	0	0	3	7	70.0%
		Unmarked	1	0	0	2	3	
	Sublegal	Marked	15	5	0	0	20	71.4%
		Unmarked	3	4	0	1	8	
	<b>Total</b>			<b>23</b>	<b>9</b>	<b>0</b>	<b>6</b>	<b>38</b>
Area 8-2 (n=9)	Legal	Marked	3	2	1	3	9	90.0%
		Unmarked	0	0	0	1	1	
	Sublegal	Marked	9	5	1	12	27	77.1%
		Unmarked	4	1	0	3	8	
	<b>Total</b>			<b>16</b>	<b>8</b>	<b>2</b>	<b>19</b>	<b>45</b>
<b>Grand Total, Areas 8-1 and 8-2</b>			<b>39</b>	<b>17</b>	<b>2</b>	<b>25</b>	<b>83</b>	<b>75.9%</b>

*Chinook Size and Age*

During the period that the Area 8-1 and 8-2 fishery was open (i.e., for January-April 2009 test fishery samples only), marked and unmarked Chinook sampled by test fishers were dominated by sublegal fish (i.e., less than 22 inches [56 cm]). In Area 8-1, Chinook (marked and unmarked combined) averaged 44 cm (SD = 14 cm) and ranged from 27 to 77 cm in total length (TL), whereas in Area 8-2 they averaged 45 cm TL (SD = 16 cm; range: 26-86 cm; **Figure 8**). Thus, there was little difference in the size of Chinook caught in the two areas (two-sample *t*-test:  $t = -0.4$ ,  $df = 148$ ,  $P = 0.4$ ).



**Figure 8.** Length-frequency distributions of marked (*left column*) and unmarked (*right column*) Chinook encountered by test fishers during the Areas 8-1 (*upper row*) and 8-2 (*lower row*) January-April 2009 mark-selective Chinook fishery. The dashed vertical line in the length-frequency histograms for marked Chinook corresponds to the legal size limit (22 in or 56 cm). *Note:* *x* and *y* axis ranges differ between panels.

Test fishery total length data demonstrate a trend towards larger Chinook sizes from the start to the close of the fishery (i.e., positive growth; **Figure 9**), though slight. In Area 8-2, the average size of 2005- and 2006-brood (based on scales, described below) Chinook increased by ~10 cm between January 1, 2009 and April 30, 2009. Although 2005-brood Chinook were on average of legal size at the start of the fishery, 2006-brood Chinook did not average  $\geq 56$  cm (22 in) until March in Area 8-2 and did not reach this size in Area 8-1.

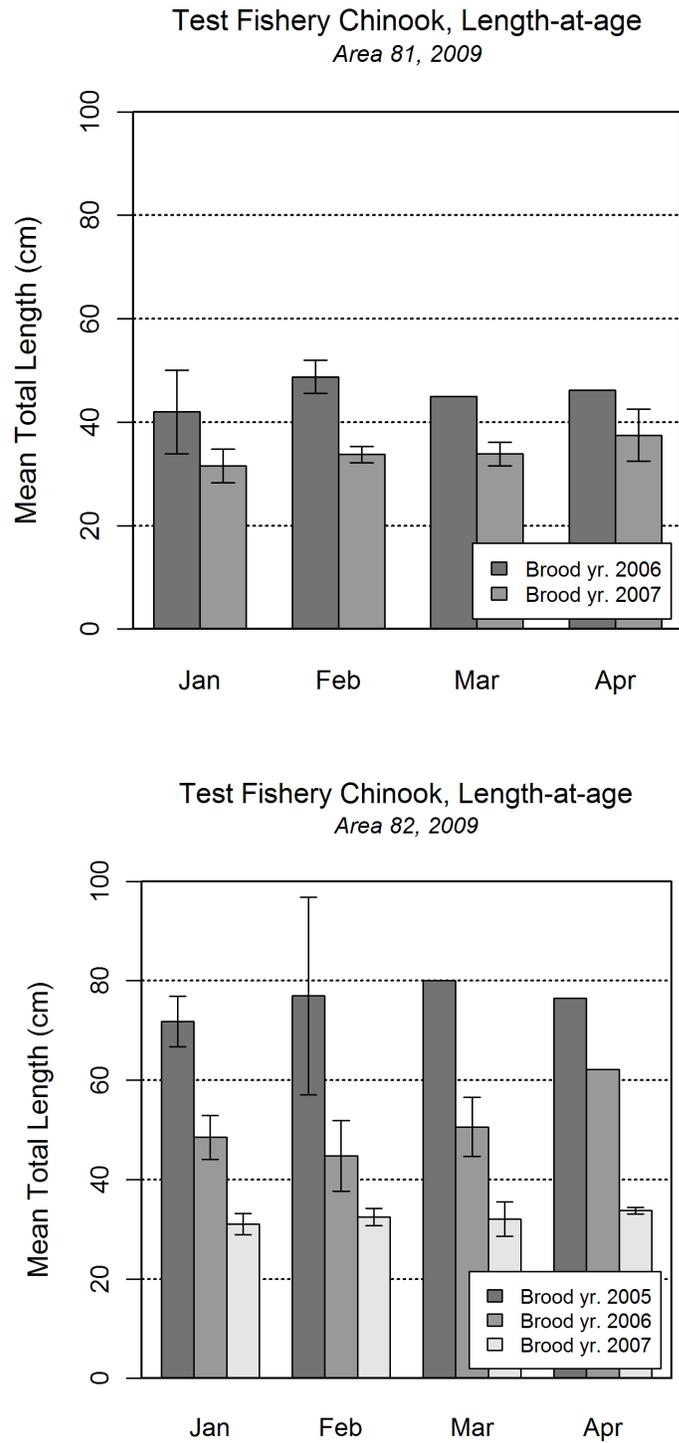
Of the 180 Chinook encountered and sampled by test fishers during the four-month Areas 8-1 and 8-2 fishery, 154 (78 [51 AD, 27 UM, ] in 8-1; 76 in 8-2 [61 AD, 15 UM]) had scales that could be successfully read. Within areas, marked and unmarked individuals had a similar age structure (**Appendix G-1 and G-2**), with age-2 (2.1 and 2.2) individuals comprising the majority (50% on average) of samples from both areas and for both marked and unmarked groups combined.

*Other Fish Species Encountered*

Though they fished exclusively for Chinook, test fishers encountered two other species of fish during their Areas 8-1 and 8-2, January-April sampling efforts (**Table 10**). Over the two areas combined, test fishers encountered 13 Pacific sanddab (2 in Area 8-1 and 11 in Area 8-1) and 3 copper rockfish (all in Area 8-2).

**Table 10.** Test fishery catches of species other than Chinook salmon during the Areas 8-1 and 8-2 January 1 - April 30, 2009 mark-selective Chinook fishery.

Common Name	Scientific Name	Area 8-1	Area 8-2
Pacific sanddab	<i>Citharichthys sordidus</i>	2	11
Copper rockfish	<i>Sebastes caurinus</i>	0	3
<b>Grand Total (n = 2 species)</b>		<b>2</b>	<b>14</b>



**Figure 9.** Monthly mean total length ( $\pm$  95% CIs) of Chinook (marked and unmarked combined) sampled by test fishers during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) January-April 2009 mark-selective Chinook fishery, by brood year.

## **Overall Fishery Impacts**

### *Total Encounters and Mortalities*

We derived size/mark-status group-specific estimates of Chinook encounters from a combination of dockside sampling results (i.e., legal-marked Chinook harvest estimates in Tables 4-1 and 4-2; see Appendix A for computational details) and test fishery size/mark-status composition data (Tables 8-1 and 8-2). In total, we estimated that anglers fishing in Area 8-1 encountered a total of 455 LM, 57 LU, 1,449 SM, and 909 SU Chinook (2,870 total) between January and April (Table 11). For Area 8-2, we estimated Chinook encounters at 568 LM, 33, LU, 1,572 SM, and 468 SU (2,641 total; Table 11).

Given our estimates of harvest and the assumed selective fishing mortality (*s<sub>fm</sub>*) mortality rates of 0.15 for legal-sized and 0.20 for sublegal-sized Chinook, the estimated encounters translated into 900 (Area 8-1) and 943 (Area 8-2) mortalities (1,843 total) for the two areas (Table 11). Of the estimated mortality in Areas 8-1 and 8-2, 44% and 52%, respectively, was due to the direct harvest of legal-marked Chinook. Unmarked Chinook mortality totaled 313 fish (201 in Area 8-1, 112 in Area 8-2) over the two areas, which corresponds to 0.3 unmarked mortalities per legal-marked Chinook kept. In addition, given the 101 (16 LM, 2 LU, 51 SM, 32 SU) and 79 (17 LM, 1 LU, 47 SM, 14 SU) Chinook caught and released in the respective Areas 8-1 and 8-2 test fisheries between January and April, an estimated 34 (19 in Area 8-1 and 15 in Area 8-2) Chinook may have died as a result of our sampling activities.

### *FRAM versus Creel Comparison*

Pre-season Fishery Regulation Assessment Model (FRAM, model run 2108) planning efforts suggested that the combined Areas 8-1 and 8-2 fishery would have a substantially greater impact on marked and unmarked Chinook than field data indicate actually occurred during its four-month season. With the exception of legal-marked Chinook harvest, which was fairly accurately predicted, FRAM encounters (Table 12, Figure 10) and mortalities (Table 13, Figure 10) predictions were anywhere from 2 (total marked encounters) to 23 (unmarked legal-sized releases) times greater than what was estimated through intensive field sampling efforts. Additionally, observed mark rates for total encounters (combined 8-1/8-2 mark rate: 73%) were substantially higher than what was expected based on pre-season modeling (i.e., 61%; Table 12).

**Table 11.** Summary of season-wide fishery impact estimates for the Areas 8-1 and 8-2 mark-selective Chinook fishery, January 1 – April 30, 2009. Values may not add up perfectly due to rounding error.

<b>Total Encounters (E): 2,870<sup>a/</sup></b> <b>V(E): 504,744</b>										
Size/mark group	Encounters	No. Retained	No. Rel'd	Rel. Mort. Rate	Rel. Mort.	Total Mortality	Var	SE	95% CI	CV (%)
Legal marked	455	396	59	0.15	9	404	1,342	37	333 - 476	9
Legal unmarked	57	12	45	0.15	7	19	99	10	1-39	54
Sublegal marked	1,449	7	1,443	0.20	289	295	5,937	77	144 - 446	26
Sublegal unmarked	909	0	909	0.20	182	182	2,696	52	80 - 284	29
All groups combined	<b>2,870</b>	<b>414</b>	<b>2,456</b>		<b>486</b>	<b>900</b>	<b>10,074</b>	<b>100</b>	<b>703 - 1097</b>	<b>11</b>

<sup>a/</sup> Estimate of total-Area Chinook encounters includes both private (non-charter) and charter boat catches (i.e. charters were part of creel [Murthy] estimates).

<b>Total Encounters (E): 2,641<sup>a/</sup></b> <b>V(E): 414,651</b>										
Size/mark group	Encounters	No. Retained	No. Rel'd	Rel. Mort. Rate	Rel. Mort.	Total Mortality	Var	SE	95% CI	CV (%)
Legal marked	568	495	74	0.15	11	506	3,261	57	394 - 618	11
Legal unmarked	33	15	18	0.15	3	18	107	10	2 - 38	58
Sublegal marked	1,572	14	1,557	0.20	311	326	6,718	82	165 - 486	25
Sublegal unmarked	468	0	468	0.20	94	94	1,012	32	31 - 156	34
All groups combined	<b>2,641</b>	<b>524</b>	<b>2,118</b>		<b>419</b>	<b>943</b>	<b>11,097</b>	<b>105</b>	<b>736 - 1149</b>	<b>11</b>

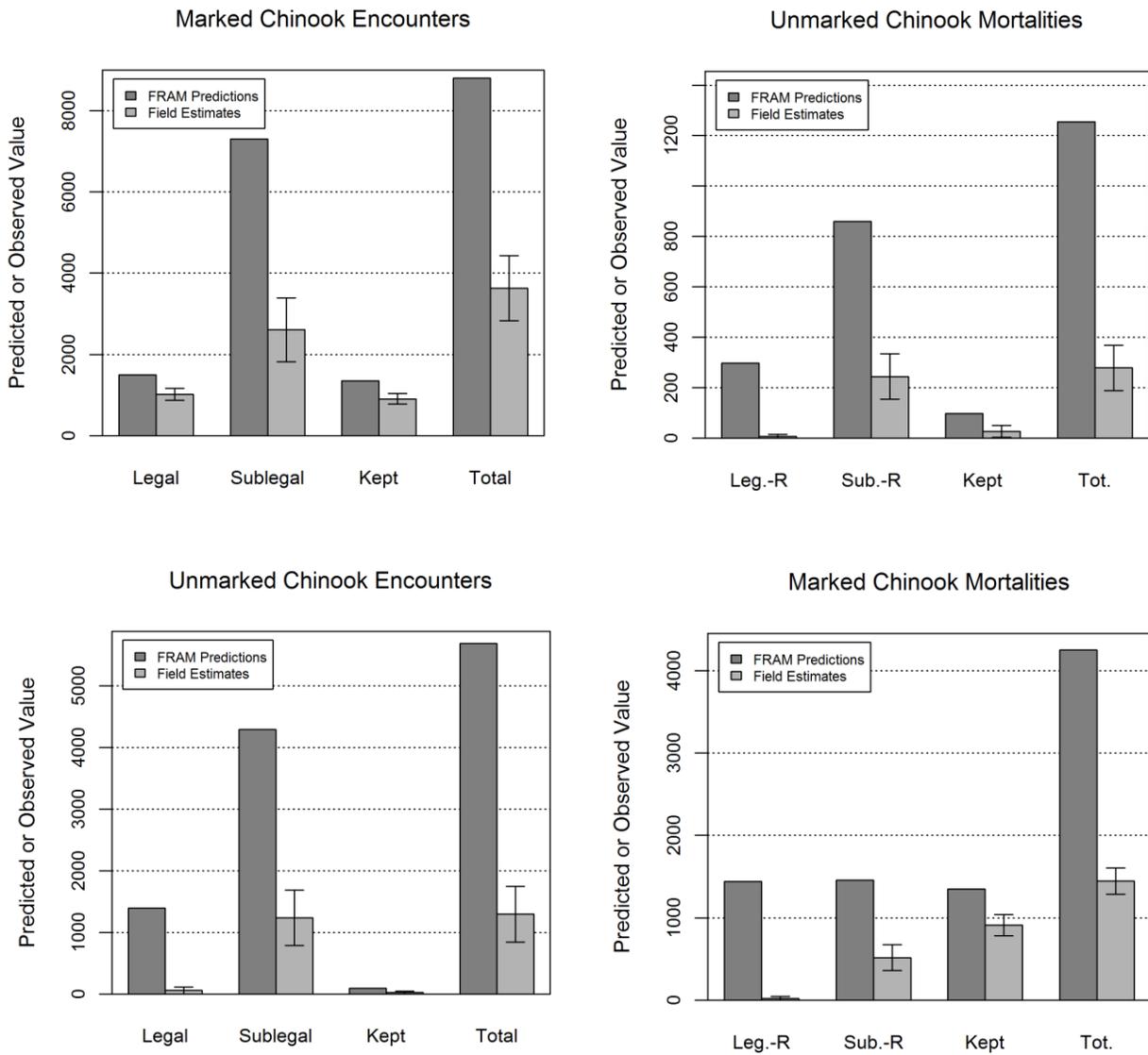
<sup>a/</sup> Estimate of total-Area Chinook encounters includes both private (non-charter) and charter boat catches (i.e. charters were part of creel [Murthy] estimates).

**Table 12.** Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook encounters for the combined Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery.

<b>Data Source</b>	<b>Group</b>	<b>Total Encounters</b>	<b>Legal</b>	<b>Sublegal</b>	<b>Landed Only</b>
FRAM Encounters	Unmark.	5,688	1,393	4,295	98
	Mark.	8,796	1,501	7,295	1,351
	Total	14,484	2,894	11,590	1,449
	% Mark.	61	52	63	93
Estimated (Creel) Encounters	Unmark.	1,468	90	1,377	27
	Mark.	4,044	1,023	3,021	911
	Total	5,512	1,113	4,398	938
	% Mark.	73	92	69	97

**Table 13.** Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook mortalities for the combined Areas 8-1 and 8-2 January-April 2009 mark-selective Chinook fishery.

<b>Mortality Category</b>	<b>FRAM Chinook Mortalities</b>			<b>Estimated Chinook Mortalities</b>		
	<b>Unmark.</b>	<b>Mark.</b>	<b>Total</b>	<b>Unmark.</b>	<b>Mark.</b>	<b>Total</b>
Total (Landed + Released)	1,255	4,251	5,506	312	1,531	1,843
Released Legal	298	1,441	1,739	10	20	29
Released Sublegal	859	1,459	2,318	275	600	875
Landed Only	98	1,351	1,449	27	911	938



**Figure 10.** Comparison of modeled (i.e., using FRAM, model run 2108) and estimated total Chinook encounters and mortalities for the Areas 8-1 and 8-2 (combined) January 1 – April 30, 2009 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates.

*Estimated CWT-DIT Impacts*

Of the 23 coded-wire tags recovered during the 2009 Areas 8-1 and 8-2 (combined) mark-selective Chinook fishery, 6 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 ( $\lambda$ ) 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 Areas 8-1 and 8-2 fishery. In total, we estimated that 21 unmarked-DIT Chinook were caught and released during the fishery. Given an *sfm* rate of 0.10, we estimate that as many as two of these unmarked-DIT Chinook may have died as a result of the 2009 Areas 8-1 and 8-2 mark-selective fishery.

**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 Areas 8-1 and 8-2 January 1-April 30, 2009 mark-selective Chinook fishery.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
Nisqually Hatchery	2005	1	2.81	5.08	3.16	0.32	0.06	0.25
	2006	1	2.81	5.08	2.82	0.28	0.05	0.23
Samish River Hatchery	2005	3	10.61	29.82	9.64	0.96	0.25	0.82
Soos Creek Hatchery	2005	1	4.93	19.34	5.05	0.50	0.20	0.45
<b>TOTAL</b>		<b>6</b>	<b>21.15</b>	<b>59.31</b>	<b>20.67</b>	<b>2.07</b>	<b>0.56</b>	<b>1.75</b>

## ACKNOWLEDGEMENTS

This review of the winter 2009 Areas 8-1 and 8-2 mark-selective Chinook fishery is a result of the dedicated efforts of several individuals. Steve Axtell (Area 8-1 Sampling Supervisor), Slim Simpson (Area 8-2 Sampling Supervisor), and their sampling crews collected creel, test-fishery, and on-the-water survey data throughout the season. In Area 8-1, dockside samplers included Nathan Layman, Lynn Stricker, Mary Mureau, and Mariah Brown-Pounds. In Area 8-2, dockside samplers included Sue Kraemer and Amy Willoughby. Central Sound year-round staff Slim Simpson, Jeff McKee, and Kathy Young-Berg greatly assisted in the summarization and error checking of data, and on other aspects of Area 8-2 sampling. Steve Axtell provided similar support for Area 8-1. Jim Pykonen and Mike Petronelli conducted test fishing and boat survey activities in both Areas 8-1 and 8-2.

At WDFW Headquarters in Olympia, we thank both Lance Campbell and John Sneva for their scale-reading expertise. We also thank Gil Lensegrav and the CWT Lab staff for their help and expertise in providing decoded CWT data. Also at the Olympia Headquarters office, Lee Dyer provided substantial help with personnel logistics and support services for the project. Karen Kloempken managed the WDFW sampling databases and provided finalized post-season data. WDFW Biologists Steve Caromile and Are Strom worked on database development in order to better manage, query, and report on the selective fishery data; in addition, Are Strom completed “R” programming updates to enable efficient analyses of selective fishery data and produce tables and figures for this post-season report. Biologists Mark Baltzell, Karen Kloempken, Steve Caromile, and Laurie Peterson prepared this post-season report.

## REFERENCES

- Cochran, W.G. 1977. Sampling Techniques (third edition). John Wiley and Sons. New York.
- Conrad, R., and P. McHugh. 2008. Assessment of Two Methods for Estimating Total Chinook Salmon Encounters in Puget Sound/Strait of Juan de Fuca Mark-Selective Chinook Fisheries. Northwest Fishery Resource Bulletin Manuscript Series No. 2. <http://www.nwifc.org/publications/northwest-fishery-resource-bulletin/>; [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- SFEC-AWG. 2002. Pacific Salmon Commission, Joint Selective Fisheries Evaluation Committee Report, Investigation of methods to estimate mortalities of unmarked salmon in mark-selective fisheries through the use of double index tag groups. TCSFEC (02)-1, February 2002.
- Murthy, M.N. 1957. Ordered and unordered estimators in sampling without replacement. *Sankhya* 18:379-390.
- Puget Sound Indian Tribes and WDFW. 2004. Comprehensive Management Plan for Puget Sound Chinook: Harvest Management Component. Olympia, WA. 253 pp.
- Washington Department of Fish and Wildlife (WDFW). 2007a. Marine Areas 9 and 10 Selective Chinook Fishery, July 16-31, 2007: Post-season Report. Draft Report: October 3, 2007. Washington Department of Fish and Wildlife. Olympia, Washington. 82 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2007b. Marine Areas 11 and 13 Selective Chinook Fishery, 2007: Post-season Report. Draft Report: October 30, 2007. Washington Department of Fish and Wildlife. Olympia, Washington. 80 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2008a. A Multi-year Assessment of the Marine Areas 5 and 6 Selective Chinook Fishery: 2005-2007. Final Report Draft: March 14, 2008. Washington Department of Fish and Wildlife. Olympia, Washington. 177 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2008b. A Multi-year Assessment of the Marine Areas 8-1 and 8-2 Selective Chinook Fishery: 2005-2007. Final Report Draft: February 25, 2008. Washington Department of Fish and Wildlife. Olympia, Washington. 149 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2009a. Marine Areas 5 and 6 Mark-Selective Recreational Chinook Fishery, Summer 2008: Post-season Report. Revised Draft Report: February 17, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 64 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2009b. Marine Areas 9 and 10 Mark-Selective Recreational Chinook Fishery, July 16-August 15, 2008. Revised Draft Report: February 23, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 60 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).

- Washington Department of Fish and Wildlife (WDFW). 2009c. Marine Areas 11 and 13 Mark-Selective Recreational Chinook Fishery, Summer 2008. Revised Draft Report: February 24, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 64 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2009d. Marine Areas 8-1 and 8-2 Mark-Selective Recreational Chinook Fishery, November 1, 2007-April 30 2008. Revised Draft Report: February 20, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 62 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW). 2009e. Marine Area 10 Mark-Selective Recreational Chinook Fishery, December 1, 2007-January 31, 2008. Revised Draft Report: February 23, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 47 pp. [http://wdfw.wa.gov/fish/salmon/suggested\\_reading.htm](http://wdfw.wa.gov/fish/salmon/suggested_reading.htm).
- Washington Department of Fish and Wildlife (WDFW) and Northwest Indian Fisheries Commission (NWIFC). 2008. 2008-09 Co-managers' List of Agreed Fisheries. Olympia, Washington.

**APPENDICES**

**Appendix A.** Mark-selective fishery impact estimation details.

Below are definitions and equations for all quantities used in estimating mark-selective fishery impacts from the combination of creel survey information, test fishery results, and (where applicable) charter and/or derby accounts. The estimation sequence builds from monthly<sup>7</sup> estimators of encounters-by-class (i.e., the four size [legal, sublegal] × mark-status [marked, unmarked] groups) to season-wide impact estimates. Where necessitated, details regarding the treatment of charter and/or derby encounters (kept plus released Chinook; assumed the result of a complete census with zero variance) in a particular estimation step are provided and denoted by the symbol †.

*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. Secondly, encounters are apportioned to the appropriate size/mark-status group using encounters-composition data collected in the test fishery (See *Test-fishery 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 ( $\hat{K}_{LMi}$ , defined on subsequent page) with a test fishery-based estimate of the proportion of the fishable Chinook population that is of legal size and marked ( $\hat{p}_{LMi}$ , 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.,  $1-p_{LM-R}$ , where  $p_{LM-R}$  is the estimated legal-marked Chinook release rate)<sup>8</sup>.  $\hat{E}_i$  and its variance are estimated as:

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

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

† If  $\hat{E}_i$  is being estimated solely to characterize total encounters (i.e., regardless of size/mark-status composition), then charter and/or derby encounters can be added to Eqn. 1 above; otherwise, class-specific encounters should be added at the appropriate stage below.

<sup>7</sup> **Note:** For fisheries characterized by short-duration seasons (i.e., ~ 1 month), the “monthly” estimators described in this appendix are synonymous season-total estimators.

<sup>8</sup> Equations 1 and 2 were modified based on a recent 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  $p_{LM-R}$  (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.

*Test-fishery Encounter Composition*

$\hat{p}_{LMi}$  = the test-fishery estimate of the proportion of Chinook encounters that are legal-sized (*L*) and marked (*M*) during month *i*

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

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

$\hat{p}_{SUi}$  = 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*),  $\hat{p}_{XYi}$  and its variance is estimated as:

$$(3) \quad \hat{p}_{XYi} = n_{XYi} / n_i, \text{ and}$$

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

where  $n_i$  = the total number of fish encountered by test boats during month *i*.

*Encounters by Size/Mark-status Class*

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

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

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

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

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

$$(5) \quad \hat{E}_{XYi} = \hat{E}_i * \hat{p}_{XYi} \dagger$$

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

† If  $\hat{E}_{XYi}$  is being estimated for the purpose solely to characterize class-specific encounters in month *i*, class-specific charter and/or derby encounters should be incorporated into 5 above; otherwise, these values can be added as kept or released encounters at the appropriate stage below (i.e., for class-specific mortality).

*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 (i.e., Murthy estimates or otherwise), 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*<sup>9</sup> 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:

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

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

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*

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

$\hat{K}_{LUi}$  = 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:

$$(9) \quad \hat{K}_{XMi} = \hat{d}_{XMK} * \hat{N}_{MKi} \dagger$$

$$(10) \quad \text{var}(\hat{K}_{XMi}) = \text{var}(\hat{N}_{MKi}) * \hat{d}_{XMK}^2 + \hat{N}_{MKi}^2 * \text{var}(\hat{d}_{XMK}) - \text{var}(\hat{N}_{MKi}) * \text{var}(\hat{d}_{XMK})$$

where  $\hat{d}_{XMK}$  and its variance are from 7 and 8 above and  $\hat{N}_{MKi}$  is the survey estimate of retained marked fish for month  $i$  defined in Eqn. 1.

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

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

---

<sup>9</sup> 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  $\hat{d}_{xyk}$  S.

† Charter- and/or derby-based harvest values—censused to size/mark-status class—are added to equation 9 for the appropriate grouping.

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.

#### Estimating Release Numbers by Class

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

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

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

$\hat{R}_{SUi}$  = 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 ( $\hat{E}_{XYi}$ ) and retention ( $\hat{K}_{XYi}$ ) during month  $i$ . The estimator and its variance are:

$$(11) \quad \hat{R}_{XYi} = \hat{E}_{XYi} - \hat{K}_{XYi} \dagger$$

$$(12) \quad \text{var}(\hat{R}_{XYi}) = \text{var}(\hat{E}_{XYi}) + \text{var}(\hat{K}_{XYi}) \ddagger\ddagger$$

† Charter and/or derby-based  $R_{XYi}$ s are incorporated into equation 11 for complete  $\hat{R}_{XYi}$  estimation.

‡‡ Given that  $\hat{R}_{LMi}$  was generated by applying a small (0.13) bias-correction constant to  $\hat{K}_{LMi}$  it was assumed to have negligible variance (i.e.,  $\text{var}(\hat{R}_{LMi}) = 0$ ).

#### 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 15%

$sfm_S$  = release mortality rate for sublegal ( $S$ ) Chinook, assumed to be a constant 20%

##### Retention-mortality Estimates

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

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

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

$\hat{M}_{SUKi}$  = estimated mortality due to harvest of sublegal ( $S$ ), unmarked ( $U$ ) Chinook in month  $i$  ( $= \hat{K}_{SUi}$ ).

*Release-mortality Estimates*

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

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

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

$\hat{M}_{SURi}$  = 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:

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

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

*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.,

$$\hat{M}_{total} = \sum_{i=1}^{\max i} (\hat{M}_{XYKi} + \hat{M}_{XYRi}) \text{ and variances}$$

[ $\text{var}(\hat{M}_{total}) = \sum_{i=1}^{\max i} [\text{var}(\hat{M}_{XYKi}) + \text{var}(\hat{M}_{XYRi})]$ ], 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.,  $\hat{M}_{total}$ ,  $\hat{K}_{LMi}$ ,  $\hat{E}_i$ , etc.), these metrics are estimated using:

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

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

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

**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).

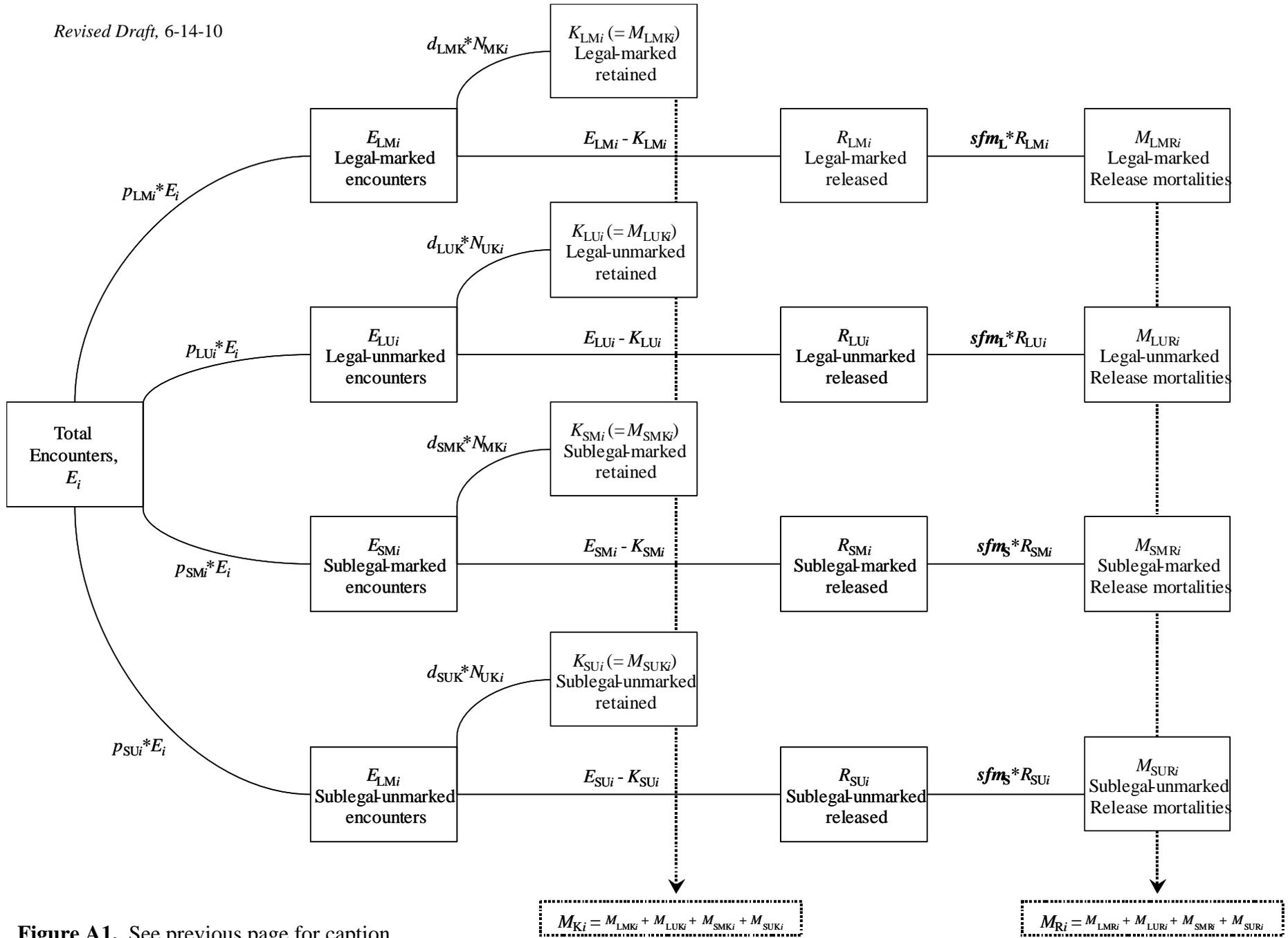


Figure A1. See previous page for caption.

**Appendix B.** Statistical week calendar for the period during which the Areas 8-1 and 8-2 mark-selective fishery was open, January 1-April 30, 2009.

Year	Stat Month	Week #	Start Date	End Date
2009	1	1	01-Jan	04-Jan
		2	05-Jan	11-Jan
		3	12-Jan	18-Jan
		4	19-Jan	25-Jan
		5	26-Jan	01-Feb
	2	6	02-Feb	08-Feb
		7	09-Feb	15-Feb
		8	16-Feb	22-Feb
		9	23-Feb	01-Mar
	3	10	02-Mar	08-Mar
		11	09-Mar	15-Mar
		12	16-Mar	22-Mar
		13	23-Mar	29-Mar
	4	14	30-Mar	05-Apr
		15	06-Apr	12-Apr
		16	13-Apr	19-Apr
		17	20-Apr	26-Apr
		18	27-Apr	03-May

**Appendix C.** Monthly sample rates (Total retained Chinook sampled <sup>1/</sup> / Estimated retained Chinook) in the Areas 8-1 and 8-2 winter (January 1-April 30, 2009) mark-selective Chinook fishery.

Area	Time period			Estimated Retained Chinook				Number of Retained Chinook Sampled <sup>a/</sup>				Sample Rate
	Month	Stat. Weeks	Dates	Marked	Un-marked	Unk.	Total	Marked	Un-marked	Unk.	Total	
Area 8-1	January	1-5	Jan 1 - Feb 1	332	12	0	344	124	2	1	127	36.9%
	February	6-9	Feb 2 - Mar 1	27	0	0	27	30	0	0	30	111.1%
	March	10-13	Mar 12 - Mar 29	11	0	0	11	3	0	0	3	27.3%
	April	14-18	Mar 30 - Apr 30	32	0	0	32	22	0	0	22	68.8%
	<b>Season Total</b>				<b>402</b>	<b>12</b>	<b>0</b>	<b>414</b>	<b>179</b>	<b>2</b>	<b>1</b>	<b>182</b>
Area 8-2	January	1-5	Jan 1 - Feb 1	215	4	0	219	71	0	0	71	32.4%
	February	6-9	Feb 2 - Mar 1	141	0	0	141	66	0	0	66	46.8%
	March	10-13	Mar 2 - Mar 29	102	0	0	102	41	0	0	41	40.2%
	April	14-18	Mar 30 - Apr 30	51	11	0	62	36	0	0	36	58.0%
	<b>Season Total</b>				<b>509</b>	<b>15</b>	<b>0</b>	<b>524</b>	<b>214</b>	<b>0</b>	<b>0</b>	<b>214</b>

<sup>1/</sup> Number of retained Chinook sampled includes all retained Chinook inspected for CWT's, from all sites sampled during the four-month Areas 8-1 and 8-2 selective Chinook fishery (i.e., the two selected sites per sampling day for creel [Murthy] estimates, plus the fish sampled as part of baseline [non-Murthy] sampling).

**Appendix D-1.** Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the **Area 8-1** January 1-April 30, 2009 mark-selective Chinook fishery. Displayed Chinook harvest values are equivalent to those displayed in **Table 4-1**. Whereas the Chinook release estimates displayed in **Table 4-1** are based on the Conrad and McHugh (2008) method, values displayed here are based solely on angler-reported data. Values may not add exactly due to rounding error.

Stat Week	Est. Effort		Est. Retained Catch					Est. Releases					
	Boats	Anglers	Chinook			Coho	Chum	Chinook				Total Coho (Unk.)	Unk. Salmon
			Mark	Unmark	Total			Mark	Unmark	Unk.	Total		
1	10	24	7	3	10	0	0	3	3	0	7	0	0
2	95	165	53	0	53	0	0	22	55	53	130	0	0
3	320	621	201	8	209	0	0	508	135	257	899	0	0
4	128	260	48	0	48	0	0	78	37	256	370	0	0
5	104	192	23	0	23	0	0	68	19	30	116	0	0
6	63	118	21	0	21	0	0	32	7	59	98	0	0
7	69	130	0	0	0	0	0	40	11	39	91	0	0
8	120	236	0	0	0	0	0	122	53	144	319	0	0
9	58	124	6	0	6	0	0	58	17	32	107	0	0
10	35	55	0	0	0	0	0	24	14	0	38	0	0
11	24	49	0	0	0	0	0	26	0	16	42	0	0
12	54	121	9	0	9	0	0	9	0	34	43	0	0
13	15	33	2	0	2	0	0	15	6	0	21	0	0
14	97	204	26	0	26	0	0	30	8	16	54	0	0
15	40	62	0	0	0	0	0	8	20	12	39	0	0
16	36	68	7	0	7	0	0	41	4	0	45	2	0
17	20	36	0	0	0	0	0	4	4	0	8	0	0
18	10	21	0	0	0	0	0	0	0	5	5	0	0
<b>Total</b>	<b>1,298</b>	<b>2,518</b>	<b>402</b>	<b>12</b>	<b>414</b>	<b>0</b>	<b>0</b>	<b>1,086</b>	<b>393</b>	<b>953</b>	<b>2,433</b>	<b>2</b>	<b>0</b>
<b>Summary Statistics for Area 8-1:</b>													
SE	70	145	36	8	37			91	35	108	145	2	
CV	5.4%	5.7%	9.0%	65.3%	8.9%			8.4%	8.8%	11.3%	6.0%	73.5%	
95% CI	1,162-1,435	2,234-2,802	332-473	3-27	342-487			908-1,264	325-461	742-1,164	2,148-2,717	1-5	

**Appendix D-2.** Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the **Area 8-2** January 1-April 30, 2009 mark-selective Chinook fishery. Displayed Chinook harvest values are equivalent to those displayed in **Table 4-2**. Whereas the Chinook release estimates displayed in **Table 4-2** are based on the Conrad and McHugh (2008) method, values displayed here are based solely on angler-reported data. Values may not add exactly due to rounding error.

Stat Week	Est. Effort		Est. Retained Catch					Est. Releases								
	Boats	Anglers	Chinook			Coho	Chum	Chinook				Coho				Unk. Salmon
			Mark	Unmark	Total			Mark	Unmark	Unk.	Total	AD	Unmark	Unk.	Total	
1	82	158	40	0	40	0	0	33	7	99	139	0	0	2	2	0
2	18	35	6	0	6	0	0	8	0	11	19	0	0	0	0	2
3	262	537	100	4	104	0	0	167	85	400	652	0	0	5	5	0
4	110	205	24	0	24	0	0	179	22	63	264	0	0	4	4	0
5	145	277	45	0	45	0	0	136	50	110	296	0	0	0	0	8
6	342	681	45	0	45	0	0	196	93	213	502	2	2	2	6	18
7	253	579	30	0	30	0	0	118	30	192	341	0	0	0	0	0
8	306	593	36	0	36	0	0	226	70	149	445	0	0	0	0	11
9	160	340	30	0	30	0	0	103	88	98	289	0	0	2	2	0
10	122	241	25	0	25	0	0	101	60	108	269	0	0	0	0	0
11	125	228	26	0	26	0	0	13	35	52	101	0	0	0	0	0
12	243	496	46	0	46	0	0	125	60	108	292	2	0	2	4	4
13	49	93	5	0	5	0	0	11	15	5	31	0	0	5	5	0
14	11	29	0	0	0	0	0	18	3	0	20	0	0	0	0	0
14	240	500	0	11	11	0	0	176	55	90	321	0	0	0	0	0
15	83	140	7	0	7	0	0	32	15	15	62	0	0	0	0	0
16	154	316	11	0	11	0	0	88	46	21	154	0	0	0	0	0
17	206	404	24	0	24	0	0	69	18	81	168	0	0	4	4	0
18	53	95	8	0	8	0	0	27	0	34	60	0	0	6	6	0
<b>Total</b>	<b>2,964</b>	<b>5,946</b>	<b>509</b>	<b>15</b>	<b>524</b>	<b>0</b>	<b>0</b>	<b>1,825</b>	<b>753</b>	<b>1,847</b>	<b>4,425</b>	<b>4</b>	<b>2</b>	<b>32</b>	<b>38</b>	<b>43</b>
<b>Summary Statistics for Area 8-2:</b>																
SE	225	474	57	9	58			157	56	182	247	2	1	7	8	12
CV	7.6%	8.0%	11.2%	59.6%	11.0%			8.6%	7.4%	9.9%	5.6%	50.4%	57.7%	23.1%	20.4%	28.4%
95% CI	2,523-3,406	5,017-6,876	397-620	6-32	411-637			1,517-2,133	644-862	1,489-2,204	3,940-4,909	2-8	2-5	18-47	23-54	19-67

**Appendix E-1.** Summary of the total number of anglers intercepted in Area 8-1 during on-the-water surveys from January 1 through April 30, 2009. Grayed cells represent sites included in the dockside sample frame.

Site Name	Total Anglers	Season Total (unadjusted) Size Measure
Camano Island State Park	70	0.283
Bayside Dry Storage	2	0.008
Cornet Bay Ramp	5	0.020
Coupeville Ramp	14	0.057
Dagmars Landing	7	0.028
Everett Ramp (Norton)	29	0.117
Everett Marina	5	0.020
Holmes Harbor Ramp(Freeland Ramp)	2	0.008
LaConner Ramp	4	0.016
Maple Grove Ramp	28	0.113
Misc. Private Launch	26	0.105
Monroes Landing	0	0.000
Mukilteo	0	0.000
Oak Harbor Public	41	0.166
Tulalip Ramp	6	0.024
Utsalady Ramp	8	0.032
<b>Total Anglers</b>	<b>247</b>	<b>1.000</b>

**Appendix E-2.** Summary of the total number of anglers intercepted in Area 8-2 during on-the-water surveys from January 1 through April 30, 2009. Grayed cells represent sites included in the dockside sample frame.

Site Name	Total Anglers	Season Total (unadjusted) Size Measure
Bayside Marina	9	0.016
Camano State Park	96	0.172
Cavalero County Park	0	0.000
Clinton Ramp	0	0.000
Dagmars Landing	31	0.056
Ebey Waterfront Park	13	0.023
Edmonds Marina	2	0.004
Edmonds Dry Storage	6	0.011
Edmonds Sling	1	0.002
Everett Marina	61	0.109
Everett YC	0	0.000
Hat Island Marina	8	0.014
Holmes Harbor (Freeland)	0	0.000
Jetty Island	0	0.000
Kayak Pt.	9	0.016
Kingston Marina	0	0.000
Langley Marina	6	0.011
Langley Ramp	6	0.011
Marysville Ramp	4	0.007
Misc. Private Launch	29	0.052
Mukilteo Public Ramp	29	0.052
Norton Ramp	224	0.401
Oak Harbor	4	0.007
Possession Pt	0	0.000
Sandy Hook Marina	0	0.000
Seattle Marina (Lk Union)	0	0.000
Shilshole Ramp	0	0.000
Tulalip Marina	0	0.000
Tulalip Ramp	20	0.036
<b>Total Anglers</b>	<b>558</b>	<b>1.000</b>

**Appendix F-1.** Size measures of sites sampled during the Area 8-1 January-April 2009 creel survey, by statistical week.

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
1/2/2009	1	0.304	Camano Island State Park Public Ramp	3/1/2009	9	0.36	Camano Island State Park Public Ramp
1/2/2009	1	0.283	Oak Harbor Marina & Public Ramp	3/1/2009	9	0.36	General - Area 81
1/4/2009	1	0.304	Camano Island State Park Public Ramp	3/3/2009	10	0.362	Camano Island State Park Public Ramp
1/4/2009	1	0.304	General - Area 81	3/3/2009	10	0.141	Norton Street (Everett) Ramp
1/5/2009	2	0.304	Camano Island State Park Public Ramp	3/4/2009	10	0.362	Camano Island State Park Public Ramp
1/5/2009	2	0.283	Oak Harbor Marina & Public Ramp	3/4/2009	10	0.362	General - Area 81
1/8/2009	2	0.304	Camano Island State Park Public Ramp	3/7/2009	10	0.362	Camano Island State Park Public Ramp
1/8/2009	2	0.304	General - Area 81	3/7/2009	10	0.268	Oak Harbor Marina & Public Ramp
1/9/2009	2	0.304	Camano Island State Park Public Ramp	3/8/2009	10	0.362	Camano Island State Park Public Ramp
1/9/2009	2	0.304	General - Area 81	3/8/2009	10	0.362	General - Area 81
1/11/2009	2	0.304	Camano Island State Park Public Ramp	3/11/2009	11	0.362	Camano Island State Park Public Ramp
1/11/2009	2	0.098	Coupeville Public Ramp	3/11/2009	11	0.141	Maple Grove Ramp; Camano Is
1/14/2009	3	0.304	Camano Island State Park Public Ramp	3/12/2009	11	0.362	Camano Island State Park Public Ramp
1/14/2009	3	0.304	General - Area 81	3/12/2009	11	0.362	General - Area 81
1/15/2009	3	0.304	Camano Island State Park Public Ramp	3/13/2009	11	0.362	Camano Island State Park Public Ramp
1/15/2009	3	0.239	Maple Grove Ramp; Camano Is	3/13/2009	11	0.268	Oak Harbor Marina & Public Ramp
1/17/2009	3	0.304	Camano Island State Park Public Ramp	3/15/2009	11	0.362	Camano Island State Park Public Ramp
1/17/2009	3	0.098	Coupeville Public Ramp	3/15/2009	11	0.362	General - Area 81
1/18/2009	3	0.304	Camano Island State Park Public Ramp	3/17/2009	12	0.366	Camano Island State Park Public Ramp
1/18/2009	3	0.304	General - Area 81	3/17/2009	12	0.268	Oak Harbor Marina & Public Ramp
1/22/2009	4	0.304	Camano Island State Park Public Ramp	3/18/2009	12	0.366	Camano Island State Park Public Ramp
1/22/2009	4	0.076	Norton Street (Everett) Ramp	3/18/2009	12	0.366	General - Area 81
1/23/2009	4	0.304	Camano Island State Park Public Ramp	3/20/2009	12	0.366	Camano Island State Park Public Ramp
1/23/2009	4	0.304	General - Area 81	3/20/2009	12	0.366	General - Area 81
1/24/2009	4	0.304	Camano Island State Park Public Ramp	3/21/2009	12	0.366	Camano Island State Park Public Ramp
1/24/2009	4	0.283	Oak Harbor Marina & Public Ramp	3/21/2009	12	0.141	Norton Street (Everett) Ramp
1/26/2009	5	0.36	Camano Island State Park Public Ramp	3/23/2009	13	0.366	Camano Island State Park Public Ramp
1/26/2009	5	0.287	Oak Harbor Marina & Public Ramp	3/23/2009	13	0.141	Maple Grove Ramp; Camano Is
1/29/2009	5	0.36	Camano Island State	3/24/2009	13	0.366	Camano Island State

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
			Park Public Ramp				Park Public Ramp
1/29/2009	5	0.36	General - Area 81	3/24/2009	13	0.366	General - Area 81
1/30/2009	5	0.36	Camano Island State Park Public Ramp	3/28/2009	13	0.366	Camano Island State Park Public Ramp
1/30/2009	5	0.36	General - Area 81	3/28/2009	13	0.268	Oak Harbor Marina & Public Ramp
2/1/2009	5	0.36	Camano Island State Park Public Ramp	3/29/2009	13	0.366	Camano Island State Park Public Ramp
2/1/2009	5	0.287	Oak Harbor Marina & Public Ramp	3/29/2009	13	0.366	General - Area 81
2/2/2009	6	0.36	Camano Island State Park Public Ramp	3/30/2009	14	0.385	Camano Island State Park Public Ramp
2/2/2009	6	0.104	Norton Street (Everett) Ramp	3/30/2009	14	0.225	Oak Harbor Marina & Public Ramp
2/4/2009	6	0.36	Camano Island State Park Public Ramp	4/2/2009	14	0.385	Camano Island State Park Public Ramp
2/4/2009	6	0.36	General - Area 81	4/2/2009	14	0.385	General - Area 81
2/7/2009	6	0.36	Camano Island State Park Public Ramp	4/4/2009	14	0.385	Camano Island State Park Public Ramp
2/7/2009	6	0.36	General - Area 81	4/4/2009	14	0.385	General - Area 81
2/8/2009	6	0.36	Camano Island State Park Public Ramp	4/5/2009	14	0.385	Camano Island State Park Public Ramp
2/8/2009	6	0.287	Oak Harbor Marina & Public Ramp	4/5/2009	14	0.159	Norton Street (Everett) Ramp
2/9/2009	7	0.36	Camano Island State Park Public Ramp	4/7/2009	15	0.385	Camano Island State Park Public Ramp
2/9/2009	7	0.36	General - Area 81	4/7/2009	15	0.154	Maple Grove Ramp; Camano Is
2/10/2009	7	0.36	Camano Island State Park Public Ramp	4/8/2009	15	0.385	Camano Island State Park Public Ramp
2/10/2009	7	0.201	Maple Grove Ramp; Camano Is	4/8/2009	15	0.385	General - Area 81
2/13/2009	7	0.36	Camano Island State Park Public Ramp	4/10/2009	15	0.385	Camano Island State Park Public Ramp
2/13/2009	7	0.287	Oak Harbor Marina & Public Ramp	4/10/2009	15	0.385	General - Area 81
2/15/2009	7	0.36	Camano Island State Park Public Ramp	4/12/2009	15	0.385	Camano Island State Park Public Ramp
2/15/2009	7	0.36	General - Area 81	4/12/2009	15	0.225	Oak Harbor Marina & Public Ramp
2/19/2009	8	0.36	Camano Island State Park Public Ramp	4/13/2009	16	0.385	Camano Island State Park Public Ramp
2/19/2009	8	0.287	Oak Harbor Marina & Public Ramp	4/13/2009	16	0.385	General - Area 81
2/21/2009	8	0.36	Camano Island State Park Public Ramp	4/14/2009	16	0.385	Camano Island State Park Public Ramp
2/21/2009	8	0.049	Coupeville Public Ramp	4/14/2009	16	0.159	Norton Street (Everett) Ramp
2/22/2009	8	0.36	Camano Island State Park Public Ramp	4/17/2009	16	0.385	Camano Island State Park Public Ramp
2/22/2009	8	0.36	General - Area 81	4/17/2009	16	0.385	General - Area 81
2/25/2009	9	0.36	Camano Island State Park Public Ramp	4/18/2009	16	0.385	Camano Island State Park Public Ramp
2/25/2009	9	0.36	General - Area 81	4/18/2009	16	0.225	Oak Harbor Marina & Public Ramp
2/26/2009	9	0.36	Camano Island State	4/22/2009	17	0.385	Camano Island State

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
			Park Public Ramp				Park Public Ramp
2/26/2009	9	0.201	Maple Grove Ramp; Camano Is	4/22/2009	17	0.225	Oak Harbor Marina & Public Ramp
2/28/2009	9	0.36	Camano Island State Park Public Ramp	4/23/2009	17	0.385	Camano Island State Park Public Ramp
2/28/2009	9	0.287	Oak Harbor Marina & Public Ramp	4/23/2009	17	0.385	General - Area 81
				4/24/2009	17	0.385	Camano Island State Park Public Ramp
				4/24/2009	17	0.154	Maple Grove Ramp; Camano Is
				4/26/2009	17	0.385	Camano Island State Park Public Ramp
				4/26/2009	17	0.385	General - Area 81
				4/28/2009	18	0.385	Camano Island State Park Public Ramp
				4/28/2009	18	0.385	General - Area 81
				4/29/2009	18	0.385	Camano Island State Park Public Ramp
				4/29/2009	18	0.225	Oak Harbor Marina & Public Ramp

**Appendix F-2.** Size measures of sites sampled during the Area 8-2 January-April 2009 creel survey, by statistical week.

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
1/2/2009	1	0.145	Camano Island State Park Public Ramp	3/1/2009	9	0.399	Norton Street (Everett) Ramp
1/2/2009	1	0.711	Norton Street (Everett) Ramp	3/1/2009	9	0.399	General - Area 82
1/4/2009	1	0.711	Norton Street (Everett) Ramp	3/3/2009	10	0.161	Camano Island State Park Public Ramp
1/4/2009	1	0.711	General - Area 82	3/3/2009	10	0.38	Norton Street (Everett) Ramp
1/5/2009	2	0.711	Norton Street (Everett) Ramp	3/4/2009	10	0.38	Norton Street (Everett) Ramp
1/8/2009	2	0.711	Norton Street (Everett) Ramp	3/4/2009	10	0.38	General - Area 82
1/8/2009	2	0.711	General - Area 82	3/7/2009	10	0.067	Mukilteo State Park Public Ramp
1/9/2009	2	0.711	Norton Street (Everett) Ramp	3/7/2009	10	0.38	Norton Street (Everett) Ramp
1/9/2009	2	0.711	General - Area 82	3/8/2009	10	0.38	Norton Street (Everett) Ramp
1/11/2009	2	0.711	Norton Street (Everett) Ramp	3/8/2009	10	0.38	General - Area 82
1/14/2009	3	0.711	Norton Street (Everett) Ramp	3/11/2009	11	0.38	Norton Street (Everett) Ramp
1/14/2009	3	0.711	General - Area 82	3/11/2009	11	0.058	Tulalip Marina & Ramp
1/15/2009	3	0.039	Dagmar's Landing; Forklift Launch	3/12/2009	11	0.38	Norton Street (Everett) Ramp
1/15/2009	3	0.711	Norton Street (Everett) Ramp	3/12/2009	11	0.38	General - Area 82
1/17/2009	3	0.145	Camano Island State Park Public Ramp	3/13/2009	11	0.161	Camano Island State Park Public Ramp
1/17/2009	3	0.711	Norton Street (Everett) Ramp	3/13/2009	11	0.38	Norton Street (Everett) Ramp
1/18/2009	3	0.711	Norton Street (Everett) Ramp	3/15/2009	11	0.38	Norton Street (Everett) Ramp
1/18/2009	3	0.711	General - Area 82	3/15/2009	11	0.38	General - Area 82
1/22/2009	4	0.145	Camano Island State Park Public Ramp	3/17/2009	12	0.078	Mukilteo State Park Public Ramp
1/22/2009	4	0.711	Norton Street (Everett) Ramp	3/17/2009	12	0.399	Norton Street (Everett) Ramp
1/23/2009	4	0.711	Norton Street (Everett) Ramp	3/18/2009	12	0.399	Norton Street (Everett) Ramp
1/23/2009	4	0.711	General - Area 82	3/18/2009	12	0.399	General - Area 82
1/24/2009	4	0.711	Norton Street (Everett) Ramp	3/20/2009	12	0.399	Norton Street (Everett) Ramp
1/26/2009	5	0.145	Camano Island State Park Public Ramp	3/20/2009	12	0.399	General - Area 82
1/26/2009	5	0.658	Norton Street (Everett) Ramp	3/21/2009	12	0.109	Camano Island State Park Public Ramp
1/29/2009	5	0.658	Norton Street (Everett) Ramp	3/21/2009	12	0.399	Norton Street (Everett) Ramp
1/29/2009	5	0.658	General - Area 82	3/23/2009	13	0.109	Camano Island State Park Public Ramp
1/30/2009	5	0.658	Norton Street (Everett) Ramp	3/23/2009	13	0.399	Norton Street (Everett) Ramp

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
1/30/2009	5	0.658	General - Area 82	3/24/2009	13	0.399	Norton Street (Everett) Ramp
2/1/2009	5	0.039	Dagmar's Landing; Forklift Launch	3/24/2009	13	0.399	General - Area 82
2/1/2009	5	0.658	Norton Street (Everett) Ramp	3/28/2009	13	0.399	Norton Street (Everett) Ramp
2/2/2009	6	0.145	Camano Island State Park Public Ramp	3/28/2009	13	0.07	Tulip Marina & Ramp
2/2/2009	6	0.658	Norton Street (Everett) Ramp	3/29/2009	13	0.399	Norton Street (Everett) Ramp
2/4/2009	6	0.658	Norton Street (Everett) Ramp	3/29/2009	13	0.399	General - Area 82
2/4/2009	6	0.658	General - Area 82	3/30/2009	14	0.119	Camano Island State Park Public Ramp
2/7/2009	6	0.658	Norton Street (Everett) Ramp	3/30/2009	14	0.411	Norton Street (Everett) Ramp
2/7/2009	6	0.658	General - Area 82	4/2/2009	14	0.411	Norton Street (Everett) Ramp
2/8/2009	6	0.145	Camano Island State Park Public Ramp	4/2/2009	14	0.411	General - Area 82
2/8/2009	6	0.658	Norton Street (Everett) Ramp	4/4/2009	14	0.411	Norton Street (Everett) Ramp
2/9/2009	7	0.436	Norton Street (Everett) Ramp	4/4/2009	14	0.411	General - Area 82
2/9/2009	7	0.436	General - Area 82	4/5/2009	14	0.063	Mukilteo State Park Public Ramp
2/10/2009	7	0.436	Norton Street (Everett) Ramp	4/5/2009	14	0.411	Norton Street (Everett) Ramp
2/13/2009	7	0.079	Dagmar's Landing; Forklift Launch	4/7/2009	15	0.411	Norton Street (Everett) Ramp
2/13/2009	7	0.436	Norton Street (Everett) Ramp	4/7/2009	15	0.056	Tulip Marina & Ramp
2/15/2009	7	0.436	Norton Street (Everett) Ramp	4/8/2009	15	0.411	Norton Street (Everett) Ramp
2/15/2009	7	0.436	General - Area 82	4/8/2009	15	0.411	General - Area 82
2/19/2009	8	0.267	Camano Island State Park Public Ramp	4/10/2009	15	0.411	Norton Street (Everett) Ramp
2/19/2009	8	0.399	Norton Street (Everett) Ramp	4/10/2009	15	0.411	General - Area 82
2/20/2009	8	0.399	Norton Street (Everett) Ramp	4/12/2009	15	0.119	Camano Island State Park Public Ramp
2/20/2009	8	0.399	General - Area 82	4/12/2009	15	0.411	Norton Street (Everett) Ramp
2/21/2009	8	0.267	Camano Island State Park Public Ramp	4/13/2009	16	0.404	Norton Street (Everett) Ramp
2/21/2009	8	0.399	Norton Street (Everett) Ramp	4/13/2009	16	0.404	General - Area 82
2/25/2009	9	0.399	Norton Street (Everett) Ramp	4/14/2009	16	0.063	Mukilteo State Park Public Ramp
2/25/2009	9	0.399	General - Area 82	4/14/2009	16	0.404	Norton Street (Everett) Ramp
2/26/2009	9	0.218	Camano Island State Park Public Ramp	4/17/2009	16	0.404	Norton Street (Everett) Ramp
2/26/2009	9	0.399	Norton Street (Everett) Ramp	4/17/2009	16	0.404	General - Area 82
2/28/2009	9	0.069	Dagmar's Landing; Forklift Launch	4/18/2009	16	0.118	Camano Island State Park Public Ramp

SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE	SAMPLE DATE	WEEK	SITE SIZE	SAMPLING SITE
2/28/2009	9	0.399	Norton Street (Everett) Ramp	4/18/2009	16	0.404	Norton Street (Everett) Ramp
				4/22/2009	17	0.118	Camano Island State Park Public Ramp
				4/22/2009	17	0.404	Norton Street (Everett) Ramp
				4/23/2009	17	0.404	Norton Street (Everett) Ramp
				4/23/2009	17	0.404	General - Area 82
				4/24/2009	17	0.039	Dagmar's Landing; Forklift Launch
				4/24/2009	17	0.404	Norton Street (Everett) Ramp
				4/26/2009	17	0.404	Norton Street (Everett) Ramp
				4/26/2009	17	0.404	General - Area 82
				4/28/2009	18	0.404	Norton Street (Everett) Ramp
				4/28/2009	18	0.404	General - Area 82
				4/29/2009	18	0.118	Camano Island State Park Public Ramp
				4/29/2009	18	0.404	Norton Street (Everett) Ramp

**Appendix G-1.** Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon in the Area 8-1 mark-selective Chinook fishery, January 1-April 30, 2009.

Data Source	Mark-status group	Age <sup>1</sup> Composition										
		Month	1.1	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	Total
Dockside Samples	AD	Total	0	0	0	33	0	124	14	0	0	171
		%	0	0	0	19	0	73	8	0	0	100.0
Test Fishery	AD	Total	0	23	0	10	11	5	2	0	0	51
		%	0	45	0	20	22	10	4	0	0	100.0
Test Fishery	UM	Total	0	16	0	1	8	2	0	0	0	27
		%	0	59	0	4	30	7	0	0	0	100.0

<sup>1</sup>Gilbert-Rich age notation, "Total Age". "Age at outmigration", inclusive of time spent in incubation.

**Appendix G-2.** Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon in the Area 8-2 mark-selective Chinook fishery, January 1-April 30, 2009.

Data Source	Mark-status group	Age <sup>1</sup> Composition										
		Month	1.1	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	Total
Dockside Samples	AD	Total	0	0	0	36	3	150	15	0	0	204
		%	0	0	0	18	1	74	7	0	0	100.0
Test Fishery	AD	Total	0	29	0	11	10	10	1	0	0	61
		%	0	48	0	18	16	16	2	0	0	100.0
Test Fishery	UM	Total	0	10	0	2	2	1	0	0	0	15
		%	0	67	0	13	13	7	0	0	0	100.0

<sup>1</sup>Gilbert-Rich age notation, "Total Age". "Age at outmigration", inclusive of time spent in incubation.

**Appendix H.** CWTs recovered from Chinook salmon during the Areas 8-1 and 8-2 January 1-April 30, 2009 mark-selective Chinook fishery.

Area	Recov Date	Tag Code	BY	Release Site	Rearing Hatchery	Release Agency	DIT Code(s)	FL (cm)	Sex	RecovMark	ReleaseMark	Label
81	08-Jan	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		70	F	AD Fin Clp	AD Fin Clp	42792
81	16-Jan	633369	2005	Friday Cr 03.0017	Samish Hatchery	WDFW	DIT: 633368	80	F	AD Fin Clp	AD Fin Clp	42794
81	16-Jan	633372	2005	Big Soos Cr 09.0072		WDFW	DIT: 633371	68		AD Fin Clp	AD Fin Clp	57026
81	17-Jan	210571	2005	Tulalip Cr 07.0001	Bernie Gobin Hatch	TULA		72		AD Fin Clp	AD Fin Clp	57034
81	17-Jan	633375	2005	Voight Cr 10.0414	Voights Cr Hatchery	WDFW		60		AD Fin Clp	AD Fin Clp	57035
81	25-Apr	633383	2005	Issaquah C 08.0178	Issaquah Hatchery	WDFW		71		AD Fin Clp	AD Fin Clp	57052
82	21-Feb	210571	2005	Tulalip Cr 07.0001	Bernie Gobin Hatch	TULA		68		AD Fin Clp	AD Fin Clp	54927
82	18-Jan	210671	2005	Kalama Cr 11.0017	Kalama Cr Hatchery	NISQ		69		AD Fin Clp	AD Fin Clp	57037
82	3-Jan	210684	2005	Whitehorse Springs	Whitehorse Pond	COOP		65		AD Fin Clp	AD Fin Clp	57024
82	19-Apr	210744	2006	Kalama Cr 11.0017	Kalama Cr Hatchery	NISQ		53		AD Fin Clp	AD Fin Clp	57051
82	17-Jan	633286	2005	Clear Cr 11.0013c	Nisqually Hatchery	NISQ	DIT: 210681	70		AD Fin Clp	AD Fin Clp	54921
82	8-Feb	633369	2005	Friday Cr 03.0017	Samish Hatchery	WDFW	DIT: 633368	74		AD Fin Clp	AD Fin Clp	57045
82	16-Jan	633369	2005	Friday Cr 03.0017	Samish Hatchery	WDFW	DIT: 633368	67		AD Fin Clp	AD Fin Clp	57027
82	5-Feb	633375	2005	Voight Cr 10.0414	Voights Cr Hatchery	WDFW		67		AD Fin Clp	AD Fin Clp	57214
82	18-Jan	633391	2006	Clear Cr 11.0013c	Nisqually Hatchery	NISQ	DIT: 210736	54		AD Fin Clp	AD Fin Clp	57036
82	17-Jan	633468	2005	Wallace R 07.0940	Wallace R Hatchery	WDFW		74	F	AD Fin Clp	AD Fin Clp	42801
82	14-Mar	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		75		AD Fin Clp	AD Fin Clp	54929
82	24-Jan	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		73		AD Fin Clp	AD Fin Clp	57039
82	19-Feb	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		57		AD Fin Clp	AD Fin Clp	57048
82	1-Feb	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		61		AD Fin Clp	AD Fin Clp	57041
82	21-Mar	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		68		AD Fin Clp	AD Fin Clp	57050
82	7-Feb	633469	2005	Finch Cr 16.0222	Hoodsport Hatchery	WDFW		68		AD Fin Clp	AD Fin Clp	57044
82	23-Jan	633968	2006	Chambers Cr 12.0007	Garrison Hatchery	WDFW		60		AD Fin Clp	AD Fin Clp	57038

**Appendix I.** Season-total estimates of Chinook encounters by size/mark status, and total estimates of angler effort, summarized for all seasons to date of the Areas 8-1 and 8-2 winter mark-selective Chinook fishery.

Area	Season Dates	Year	Effort (Angler-trips)	Retained Chinook				Released Chinook				Total Encounters
				LM	LU	SM	SU	LM	LU	SM	SU	
81	October 1, 2005 - April 30, 2006	2005-06	3,976	303	0	39	0	45	188	763	575	1,914
81	October 1, 2006 - April 30, 2007	2006-07	3,454	278	8	37	4	42	118	1,437	857	2,781
81	November 1, 2007 - April 30, 2008	2007-08	3,288	638	5	36	0	95	304	1,345	577	3,000
81	January 1, 2009 - April 30, 2009	2008-09	2,518	396	12	7	0	59	45	1,443	909	2,870
82	October 1, 2005 - April 30, 2006	2005-06	8,521	735	40	35	0	106	618	1,706	876	4,116
82	October 1, 2006 - April 30, 2007	2006-07	7,735	766	18	95	3	113	183	10,486	5,407	17,071
82	November 1, 2007 - April 30, 2008	2007-08	5,678	795	15	74	3	114	181	942	303	2,428
82	January 1, 2009 - April 30, 2009	2008-09	5,946	495	15	14	0	74	18	1,557	468	2,641