Marine Areas 9 and 10
Mark-Selective Recreational Chinook Fishery,
July 16-August 31, 2009

Post-season Report

REVISED DRAFT

June 28, 2010

Prepared by:

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

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife (WDFW) implemented mark-selective Chinook fisheries (MSFs) in Marine Areas 9 and 10 for the third time, from July 16 through August 31, 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 9 and 10 during their respective summer seasons in order to collect the data needed to provide in-season catch estimates and 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, efforts 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[1], and *v*) the total mortality of marked and unmarked double index tag (DIT) CWT stocks.

Creel samplers staffed eight different access sites (4 in Area 9, 4 in Area 10; 2 total in each area on any given sampling day) for a total of 68 sampling-site days in each of Areas 9 and 10. Samplers interviewed an estimated 22% and 28% of all anglers fishing in Area 9 (n = 9,255 private and 6 charter anglers) and Area 10 (n = 6,482 private and 76 charter anglers), respectively. Additionally, they sampled 19% (Area 9) and 30% (Area 10) of all marked Chinook harvested in the two areas (n = 629 in Area 9, n = 483 in Area 10). Other PSSU staff conducted 12 on-the-water effort surveys (6 in Area 9, 6 in Area 10), and spent 66 days (353 hours) on the water pursuing Chinook using test-fishing methods, in support of Areas 9 and 10 monitoring efforts.

Based on the combination of sampling activities, we estimated that 65,480 angler trips (42,225 in Area 9, 23,255 in Area 10) were completed by private and charter anglers in the two combined areas between July 16th and August 31st. With a season-wide CPUE of 0.08 Chinook retained per angler trip in Area 9 and 0.07 in Area 10, these anglers harvested a grand total of 3,229 and 1,621 marked Chinook in the two respective areas (4,850 total). Anglers additionally released an estimated 12,895 Chinook (8,718 marked, 4,177 unmarked) in Area 9 and 3,807 Chinook (2,708 marked, 1,099 unmarked) in Area 10 (i.e., 16,702 estimated releases overall).

Over the two areas, harvested Chinook averaged 73 cm (range: 18 to 99 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, >93% of legal size). For both areas combined,

[1] 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.

approximately 49% all harvested individuals were 3-year olds (brood year 2006), and 40% were 4-year olds (brood year 2005).

In addition to taking length measurements and scale samples, ramp samplers recovered 105 decoded CWTs from marked Chinook harvested in the Areas 9 (n = 57) and 10 (n = 48) fisheries. The majority of Area 9 tag recoveries were from Hood Canal (30%), South Puget Sound (28%), and Central Puget Sound (23%) release sites. The remaining Area 9 recoveries were from release sites in North Puget Sound (12%), Columbia River (5%), and British Columbia (2%). As for individual hatcheries, tag recoveries from the Hoodsport Hatchery were most abundant (19% of fishery total), followed by Garrison Hatchery (12% of total) and Nisqually Hatchery (11% of total). Ten of the Area 9 CWT recoveries were from double index tag (DIT) releases. Of the 48 CWTs recovered in the Area 10 fishery, over half (52%; 25 tags) originated from Central Puget Sound release sites. The remaining 23 recoveries consisted of Chinook from South Puget Sound (29%), Hood Canal (15%), and North Puget Sound (4%) production facilities. Of the individual release sites, Grover's Creek tags had the greatest representation (23% of total) in the Area 10 fishery. Finally, 16 of the 48 CWTs were associated with DIT releases.

During their 1.5 months of sampling in Areas 9 and 10 while the areas were open under mark-selective regulations, test fishers encountered 154 (100 in 9, 54 in 10) Chinook salmon, 76% (74% in 9, 80% in 10) of which were marked and on average one-third (30% in 9, 33% in 10) of which were of legal size. With a "CPUE" (legal-marked Chinook *encounters* / angler trip) of 0.33 in Area 9 and 0.26 in Area 10, test fishers encountered legal-marked Chinook at a higher rate than private fleet anglers but at a rate similar to that of charter anglers. Test-fishery Chinook total lengths averaged 49 cm (marked and unmarked mean, range: 15-93 cm) in Area 9 and 47 cm (range: 15-100 cm) in Area 10. Thus, Chinook total lengths were on average slightly greater in Area 9 than Area 10, but highly variable in both areas. This was assumedly due to the presence of both juvenile resident and mature migrant Chinook in both Areas during the latter half of the season. For the entire 47-day season, we estimated the season-wide size/mark-status composition at 22% legal-marked (LM), 8% legal-unmarked (LU), 52% sublegal-marked (SM), and 18% sublegal-unmarked (SU) in Area 9, and 32% LM, 2% LU, 48% SM, and 19% SU in Area 10.

By combining dockside-sampling results (i.e., legal-marked Chinook harvest estimates), test fishery encounters data, and charter census results, we generated size/mark-status group-specific estimates of encounters and mortalities for the two areas. In total, 16,143 Chinook were encountered (retained and released) during the Area 9 fishery, with 3,552 of these being legal-marked, 1,291 legal-unmarked, 8,395 sublegal-marked, and 2,905 sublegal-unmarked individuals; in Area 10, 5,450 Chinook were encountered (1,725 LM, 104 LU, 2,604 SM, and 1,017 SU). Among released encounters, an estimated 102 legal-marked, 203 legal-unmarked, 2,149 sublegal-marked, and 784 sublegal-unmarked Chinook (3,238 overall, 77% in Area 9, 23% in Area 10) were estimated to have died due to handling and release effects of the Areas 9 and 10 fisheries combined. Thus, in total, 7,100 marked (68% due to direct harvest) and 1,028 unmarked Chinook mortalities occurred as a result of the Areas 9 and 10 fisheries. Overall, estimated impacts were considerably less than what was expected based on pre-season Fishery Regulation Assessment Model runs (model run 2309) for both Areas 9 and 10.

Finally, regarding impacts of the Areas 9 and 10 summer 2009 MSFs on the coded-wire tag (CWT) program, we estimated that a total of 16 (10 in Area 9 and 6 in Area 10) unmarked Chinook belonging to double-index tag (DIT) groups may have died due to the handling-and-release impacts in the fisheries.

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[2].

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 2008-09 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 four complete seasons (2005-06, 2006-07, 2007-08, and 2009; WDFW 2008b, WDFW 2009d, WDFW 2009f), Areas 9 and 10 for two winter seasons (WDFW 2009g, WDFW 2009h), and Area 7 for two winter seasons (WDFW 2009e, WDFW 2009i). From July 16 through August 31, 2009, the Washington Department of Fish and Wildlife (WDFW) implemented a summer mark-selective Chinook fishery in Areas 9 and 10 for the third 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 9 and 10 selective Chinook fishery, WDFW's Puget Sound Sampling Unit was tasked with implementing an intensive monitoring program during the entirety of its 47-day summer 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 2009), 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

[2]The regulations specific to the 2009 Areas 9 and 10 summer mark-selective fishery allowed for the retention of up to two legal-sized (≥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 9 and 10 mark-selective fishery, and *iii*) held to a handling rule that prevented them from bringing unmarked and/or sublegal Chinook aboard their vessels.

group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and unmarked Chinook mortalities[3], and *v*) 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 9 and 10 monitoring activities. We first provide a brief review of 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 and Fishery Description

Marine Area 9 is a relatively large area, encompassing approximately 200 square miles (512 km^2) of marine water in central Puget Sound. Area 9 starts at the mouth of Admiralty Inlet (i.e., its northern boundary is at the Partridge Point–Point Wilson line) and extends southward to the Apple Cove Point–Edwards Point line, including the marine waters extending south from Foulweather Bluff to the Hood Canal Bridge (**Figure 1-1**). Marine Area 10 is the catch area immediately south of Area 9, which includes the waters immediately adjacent to the largest population center in the Puget Sound Region (i.e., Seattle). Encompassing between 100 and 200 square miles (206-512 km^2) of marine water, Area 10 extends southward from the Apple Cove Point–Edwards Point line to an east-west line projected through the north tip of Vashon Island (**Figure 1-2**). During the summer, both areas draw appreciable local, tourist, and charter-based angling effort. In addition to Chinook salmon, these anglers pursue and encounter coho salmon (*O. kisutch*) and, during odd years, pink salmon (*O. gorbuscha*).

During summer 2009, the Areas 9 and 10 mark-selective Chinook fisheries were managed on a season basis, from July 16 through August 31 (i.e., maximum season length of 47 days), with general harvest management guidelines (as modeled pre-season; FRAM model run 2309) of 8,851 landed marked Chinook in Area 9 and 2,923 in Area 10. As implemented, both areas were open continuously from July 16th to August 31st (47 days of fishing).

[3] 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.

Monitoring Program Overview

Our sampling program for the Areas 9 and 10 fisheries 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 the field and analytical methods associated with our sampling efforts here, we refer the reader to WDFW (2007b or 2008b) for additional detail.

Catch and Effort: Sampling and Estimation

We collected data on total catch (observed harvest and reported releases[4]) and total angling effort using a two-stage stratified cluster sample design. At the first stage, we selected five sample days from three temporal strata (weekday [Monday-Thursday], with $n = 2$ days sampled; Friday, with $n = 1$ day sampled; and weekend [Saturday-Sunday], with $n = 2$ 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 9 and 10 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 (the Yates-Grundy or "natural" 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 all moderate-to-high-effort public boat launch facilities that are used to access Areas 9 and 10 (*Area 9*: Norton Street [Everett], Fort Casey [Keystone] State Park, Mukilteo State Park, and Port Townsend Boat Haven ramps; *Area 10*: Armeni, Kingston, Manchester, and Shilshole ramps). 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+ individuals for later lab processing. Additionally, samplers took length measurements (fork and total) and scale samples from landed Chinook.

[4] In a 2008 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 (**Appendices H-1** and **H-2**), we focus exclusively on bias-corrected "Method 2" estimates of Chinook encounters (and releases) in our review of the Area 9 and 10 fishery.

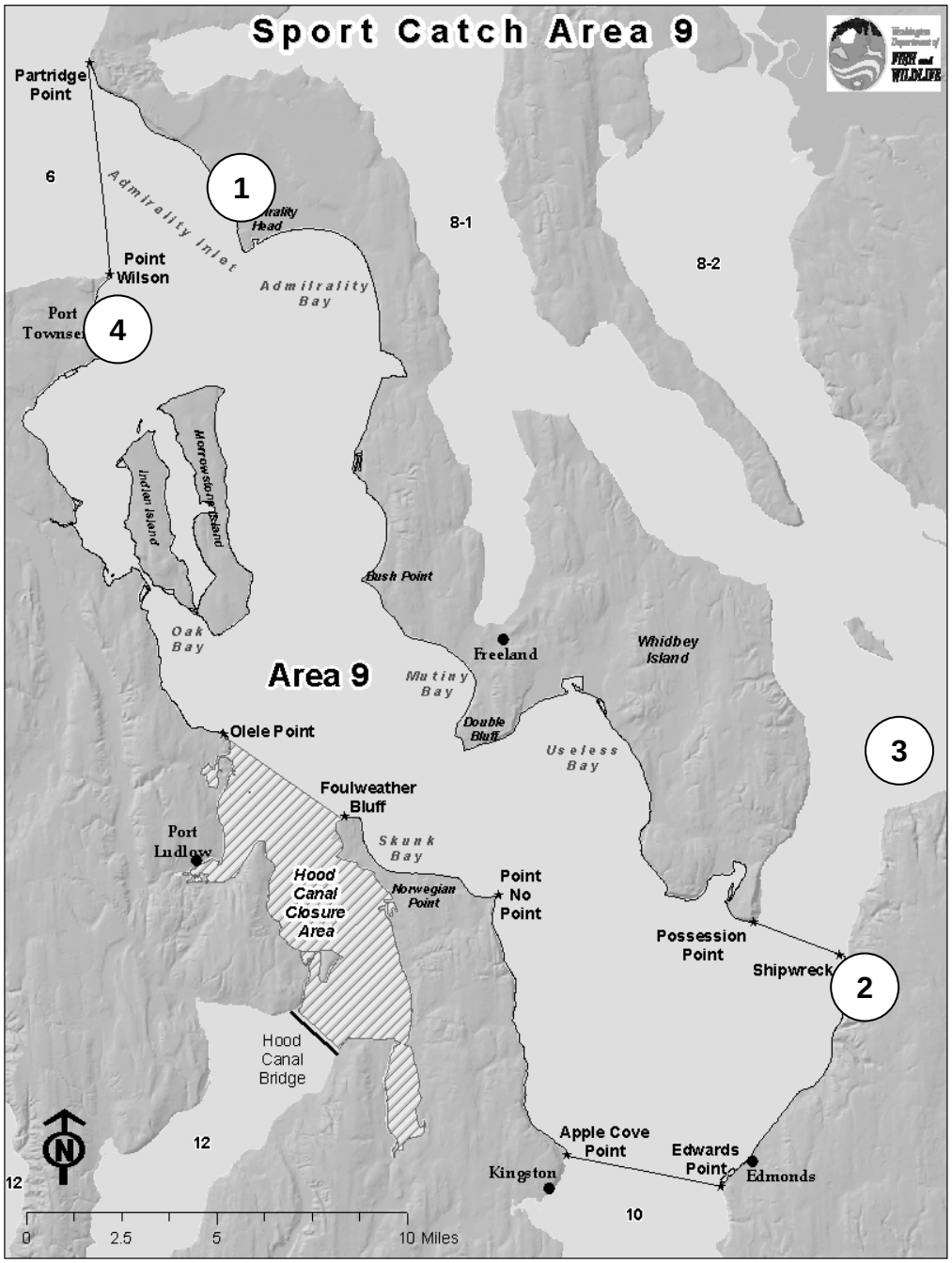

Figure 1-1. Map of Marine Catch Area 9 in Puget Sound, where the third season of the pilot selective Chinook fishery occurred from July 16-August 31, 2009. Circled numbers correspond to locations sampled during the Area 9 selective fishery (1 = Fort Casey [Keystone], 2 = Mukilteo State Park, 3 = Everett [Norton Street], and 4 = Port Townsend Boat Haven ramps).

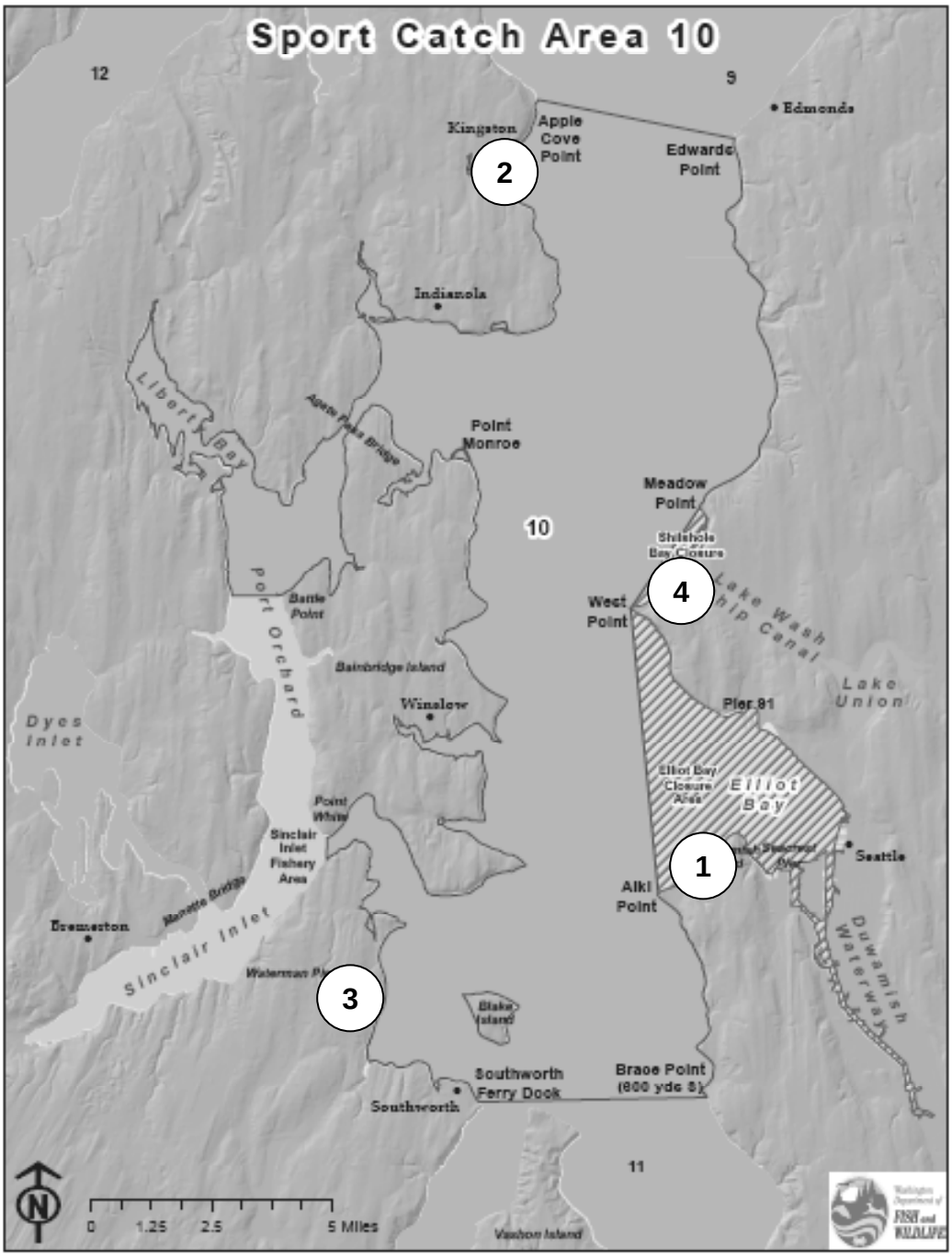

Figure 1-2. Map of Marine Catch Area 10 in Puget Sound, where the third season of the pilot selective Chinook fishery occurred from July 16-August 31, 2009. Circled numbers correspond to locations sampled during the Area 10 selective fishery (1 = Armeni, 2 = Kingston, 3 = Manchester, and 4 = Shilshole ramps).

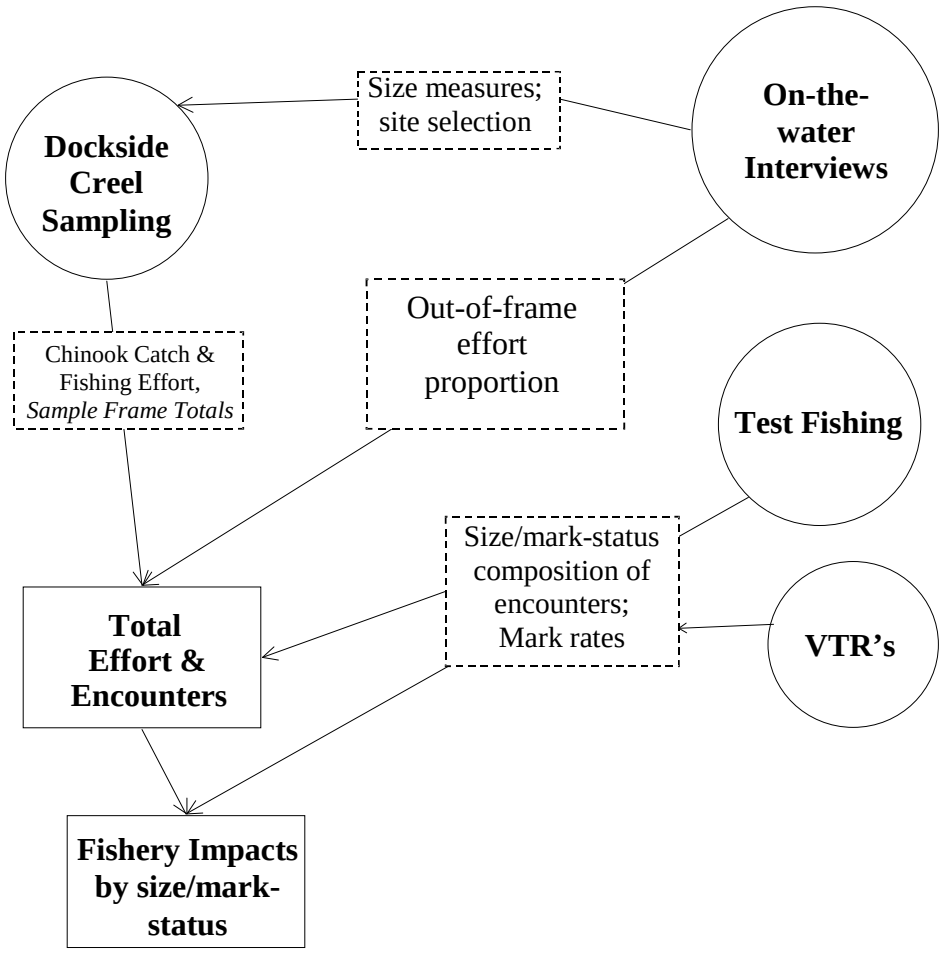

Figure 2. Conceptual diagram of the monitoring plan implemented in Areas 9 and 10 during the July 16-August 31, 2009 mark-selective Chinook season. Circles represent discrete sampling activities, dashed boxes represent parameters that are estimated using data from a given activity, and solid boxes depict key quantities estimated from the comprehensive plan. 'Encounters' includes both harvested and released Chinook salmon.

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 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 (**Appendices H-1** and **H-2**).

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 catch and effort data for these anglers through a separate effort. We contacted all salmon charters known to be operating in Areas 9 and 10 during the summer months and coordinated with them so that they would provide us with routine (i.e., after each day of fishing), in-season updates of retained and released catch (encounters) and effort. Charter-reported Chinook encounters were considered a total count with no variance. To arrive at fishery-wide estimates, charter totals were simply added to creel survey-based (private fleet) estimates of Chinook encounters.

Test Fishery Methods

In order to obtain accurate estimates 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**). Our test boat crew consisted of two WDFW technicians, each fishing with a single rod for approximately 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^2 piece of dorsal fin tissue).

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 our 2007 post-season summer Areas 9 and 10 report (WDFW 2007a), 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. 2309) for each size and mark status category.

Table 1. Sampling/estimation details on target parameters associated with the overall Areas 9 and 10 mark-selective fishery monitoring program (**Figure 2**).

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[1]	Catch rates (CPUE); length, age, and CWT composition of harvest[2]; collection of angler fishing methods.	Angler trip; kept fish; reported fish release	Week[1]	Within weeks, estimates are also produced by strata (weekday/weekend). For quota purposes, finer-scale estimation is pursued when needed.
Test Fishing	Size (legal/sublegal) and mark-status composition (marked, unmarked) of encountered Chinook	Chinook length, age, and DNA-based[3] stock composition; species composition of non-Chinook encounters	Fish encounter	Season (47 days)	Though they were qualitatively examined, too few encounters occurred to rigorously 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 (47 days)	Estimated on a monthly time step but considered at the season-total level.
Coded-wire tag (CWT) Impacts Estimation	Marked/unmarked double-index tag (DIT) encounters and mortalities	N/A	N/A	Season (47 days)	The temporal resolution of DIT impacts is constrained by the total number of tags recovered.

[1] Under the "bias-corrected Method-2" approach, Chinook releases can be estimated only as finely as test fishery data allow.
[2] The length and CWT composition of landed catch was assessed on a season-wide basis for impact estimation.
[3] Though samples were collected, DNA-based estimates of stock composition are not yet available for this fishery.

CWT Impacts

To understand the potential effects of the Areas 9 and 10 fisheries on the CWT program, we estimated the total number of unmarked-tagged Chinook mortalities that may have occurred during the course of their respective 47-day seasons. 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[5]. We subsequently estimated the number of these fish that may have died due to hook-and-release impacts using an *sfm* analogous to that used in FRAM modeling. Given our interest in characterizing the impacts of mark-selective regulations on the CWT program and not recreational fishing in general, we used an *sfm* of 10% in all unmarked-DIT mortality calculations. 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.

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

RESULTS & DISCUSSION

Summary of Sampling Efforts

Sampled Access Sites

From July 16 through August 31, 2009, we sampled the recreational fleet in Areas 9 and 10 via dockside creel surveys on a grand total of 68 site-days in each of the areas, visiting four different access sites in each of the two respective areas (**Table 2**). In Area 9, we sampled anglers at Port Townsend Boat Haven (44% of all site-days) and Everett Public Ramp (41% of all site-days) most frequently; remaining dockside sampling effort was split between Mukilteo (9%) and Fort Casey (6%) ramps. In Area 10, we sampled Shilshole Ramp on every scheduled sample day (50% of site-days). The remaining sampling effort was spent at Kingston (25%), Manchester (15%), and Armeni (10%) ramps (**Table 2**). Our dockside sampling efforts were generally distributed across sites in a manner proportional to the level of angler effort originating at each (i.e., as estimated from boat survey data, described below; **Appendices D** and **E**).

In total, our Area 9 angler-interview efforts allowed us to directly sample 9,255 completed angler trips and 4,118 completed boat trips. In Area 10, we collected data on a total of 6,482 angler trips and 3,272 boat trips. These efforts also yielded samples from 1,121 landed Chinook salmon over the two areas (633 in Area 9 and 488 in Area 10; **Appendix C**). In addition to interviewing anglers and sampling their catch within the context of this MSF-specific study, we obtained additional samples from baseline recreational sampling activities that were ongoing during the Areas 9 and 10 seasons.

On-the-Water Survey Summary

During the 47-day period that Area 9 was open under mark-selective regulations, we conducted 1,874 on-the-water interviews (i.e., total anglers intercepted) over a total of three weekday and three weekend boat surveys (**Appendix D-1**). In Area 10, we conducted 6 total surveys (2 weekend, 4 weekday) and intercepted 1,111 anglers (**Appendix D-2**). These surveys yielded quantitative details about the set of sites anglers used to access Areas 9 and 10 and thus allowed us to estimate the proportion of effort originating at each of our sample-frame sites (i.e., size measures; **Appendix E-1, E-2**) during both weekday and weekend strata. As suggested above, Everett (Norton Street) Ramp was the sample-frame site that anglers most frequently reported using to access Area 9, followed by Port Townsend, Fort Casey, and Mukilteo ramps. Pooled over all surveys, just over half (58%) of all anglers interviewed during Area 9 boat surveys indicated that their trip would end at either a private or never-sampled launch site (**Appendix D-1**). In Area 10, 26% of anglers interviewed reported using Shilshole Ramp to access the fishery, for weekend and weekday surveys combined; 49% of all anglers encountered reported using private and/or never-sampled access sites (**Appendix D-2**). Boat surveys revealed a modest level of variability in the relative "size" of sampled access sites (**Appendix E-1, E-2**); we incorporated this variation into our PPS site-selection framework.

Table 2. Dockside sampling locations for the summer 2009 mark-selective fisheries in Areas 9 and 10, July 16-August 31, 2009.

Marine Area	Sampled Sites	Number Site-Days Sampled	% of Total
9	Fort Casey Public Ramp (Keystone)	4	5.9%
	Mukilteo State Park Public Ramp	6	8.8%
	Norton Street (Everett) Ramp	28	41.2%
	Port Townsend Boat Haven Ramp	30	44.1%
	Total	**68**	**100.0%**
10	Armeni Public Ramp	7	10.3%
	Kingston Public Ramp	17	25.0%
	Manchester Public Ramp	10	14.7%
	Shilshole Public Ramp	34	50.0%
	Total	**68**	**100.0%**

Table 3. Boat-survey sampling dates during the July 16-August 31 2009 mark selective Chinook fisheries in Areas 9 and 10.

Marine Area	Boat Survey Sampling Dates, Areas 9 and 10		
	Month	**Weekday**	**Weekend**
9	**July**	23rd	18th, 26th
	August	5th, 13th	8th
	Total Number	**3**	**3**
10	**July**	22nd,	19th, 25th
	August	6th, 12th	9th
	Total Number	**3**	**3**

Fishery Characteristics

Estimates of Fishing Effort and Chinook Catch

Across the Areas 9 and 10 summer MSF seasons combined, charter and private anglers completed an estimated total of 65,480 angler trips between July 16 and August 31, 2009. Approximately 65% of this effort occurred in Area 9 and 35% in Area 10 (**Tables 4-1** and **4-2**). A total of three charter operators reported taking clients fishing in the two areas during the summer selective Chinook fishery seasons. Charter anglers accounted for a minor portion of the Area 9 and 10 effort (0.1%) total.

For private fleet anglers, both areas exhibited similar trends in angling effort over their 47-day seasons (**Figure 3**). In particular, average weekly effort levels increased slightly from July 16 through August 30 (statistical weeks 29 through 30; **Appendix B**) but dropped substantially on the last day of the fishery (August 31; statistical week 36).

Over the season, Chinook salmon catch rates (CPUE, landed Chinook per angler trip) in Area 9 totaled 0.08 for private boats and 0.17 for charter boats. In Area 10, CPUE totaled 0.07 for private boats and 0.47 for charter boats. Weekly CPUE values in Area 9 started off relatively high, at 0.20 landed Chinook per angler trip, and then decreased steadily through the last week of the fishery, to 0.02 (**Figure 4**). In contrast, weekly CPUE in Area 10 started off relatively lower (0.06) during the first week and then increased to its highest weekly value (0.11) during the fourth week of the fishery. Finally, charter anglers in Area 9 experienced success rates (i.e., CPUE) over two times higher than the private fleet (private = 0.08, charter = 0.17), whereas in Area 10, charter anglers were almost 7 times more successful than private fleet anglers (private CPUE = 0.07, charter CPUE = 0.47).

Given observed patterns in effort and catch rates, we estimated that anglers harvested a grand total of 4,892 Chinook salmon in the combined Areas 9 and 10 fishery (3,249 [>99% private,<1% charter] in Area 9, 1,643 [98% private, 2% charter] in Area 10; **Tables 4-1** and **4-2**). In both areas, virtually all (>99%) Chinook harvested were marked. For private fleet anglers fishing in Area 9, weekly Chinook harvest totals were variable and averaged 406 (range: 20-1,094); Area 10 weekly Chinook harvest totals were lower and less variable, averaging 201 (range: 11-380). See **Figure 5** for a graphical display of temporal harvest patterns. Finally, in addition to Chinook salmon, anglers harvested 3,769 (1,785 in Area 9 and 1,984 in Area 10) coho salmon (*O. kisutch*), 38,499 (30,726 in Area 9 and 7,773 in Area 10) pink salmon (*O. gorbuscha*), as well as 3 chum (Area 9) and 3 sockeye (Area 9) during the July 16-August 31, 2009 Areas 9 and 10 fisheries (**Appendix H-1** and **H-2**).

In addition to harvesting an estimated 4,892 Chinook salmon, we estimated that anglers (from private and charter boats combined) participating in the Areas 9 and 10 MSFs caught and released an additional 11,426 marked (8,718 in Area 9, 76%; 2,708 in Area 10, 24%) and 5,276 unmarked Chinook salmon (4,177 in Area 9, 79%; 1,099 in Area 10, 21%; **Tables 4-1** and **4-2**, **Figure 5**)[6]. On a season-total level, anglers released an estimated 2.7 marked and 1.3 unmarked Chinook per marked, harvested fish in Area 9; in Area 10, they released an estimated 1.7 marked and 0.7 unmarked Chinook per marked, harvested fish.

Combining harvest and release estimates, we estimated that anglers (from private and charter boats combined) encountered a grand total of 16,143 and 5,450 Chinook in Areas 9 and 10, respectively, during their 47-day mark-selective seasons (**Tables 4-1**, **4-2**). For additional discussion of fishery impacts from a total encounters perspective, see the subsequent section titled *Overall Fishery Impacts*.

[6] 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 H-1** and **H-2**.

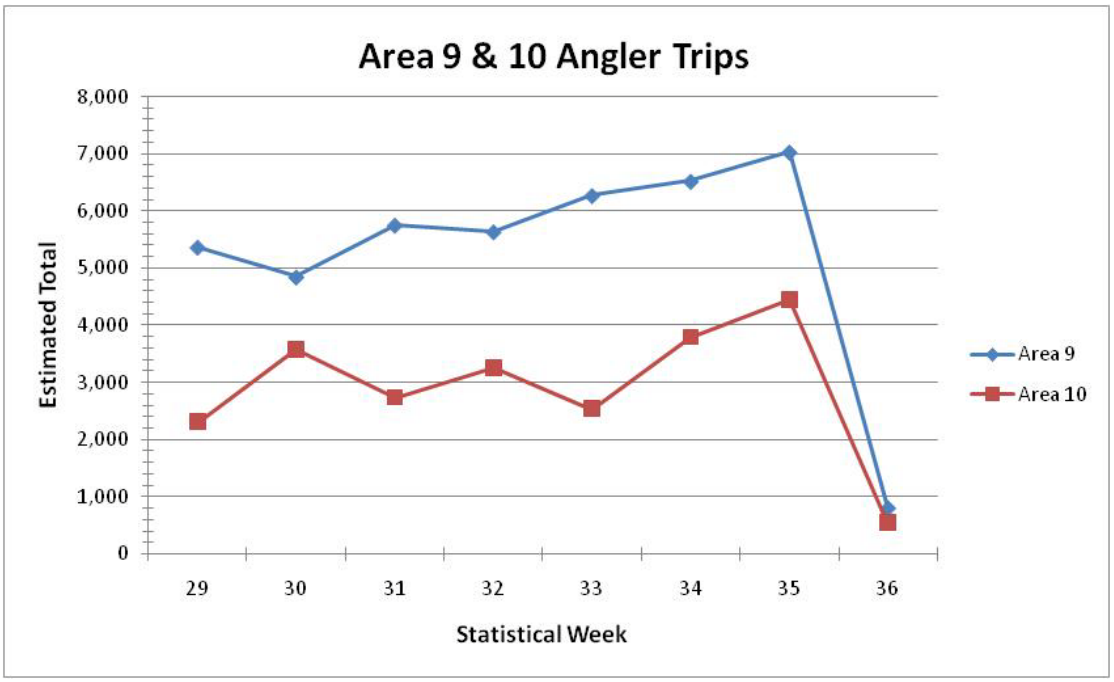

Figure 3. Temporal patterns in private fleet (i.e., excluding charters) fishing effort during the Areas 9 and 10, July 16-August 31, 2009, mark-selective Chinook fisheries. Note: the fisheries did not begin until Thursday, July 16th (statistical week 29); statistical week 36 includes just one day (August 31st).

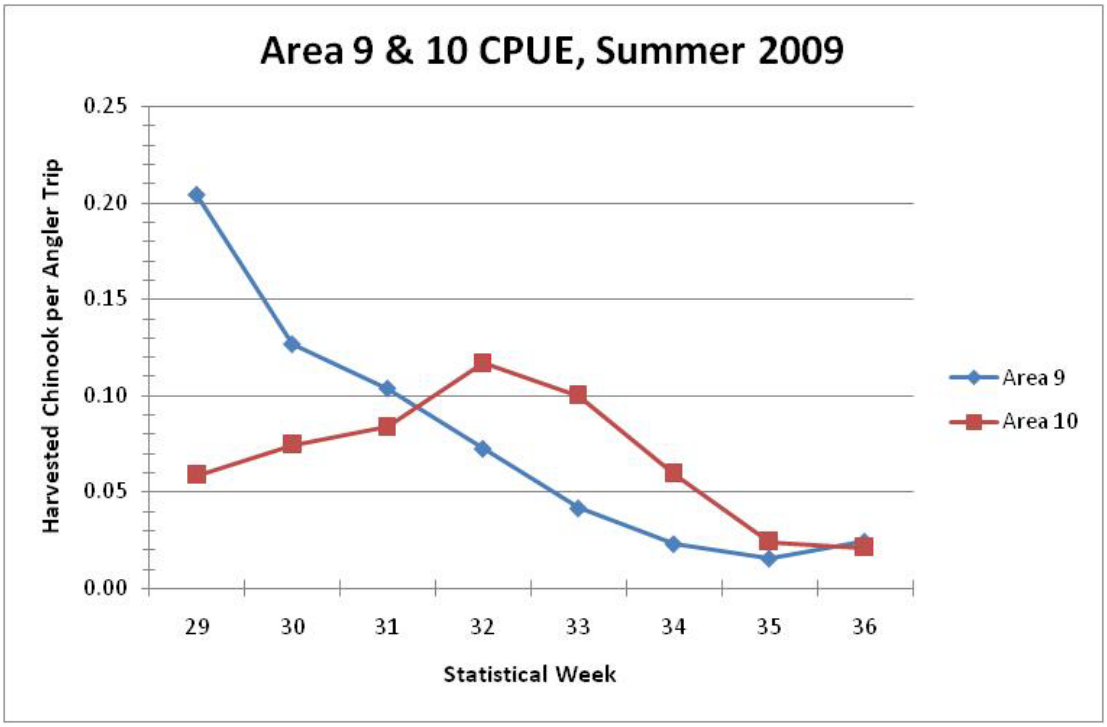

Figure 4. Temporal patterns in CPUE (landed Chinook per angler trip) during the Areas 9 and 10 July 16-August 31, 2009 mark-selective Chinook fisheries. Note: the fisheries did not begin until Thursday, July 16th (statistical week 29); statistical week 36 includes just one day (August 31st).

Table 4-1. Estimates of total fishing effort and the total number of salmon kept and released during the Area 9, July 16-August 31, 2009 selective fishery. Values may not add exactly due to rounding error.

Sampling Month	Stat. Week	Start Date	End Date	Est. Effort[1/]		Est. Retained Chinook[1/]		Est. Released Chinook[2/]		Est. Chinook Encounters Total
				Boats	Anglers	AD	UM	AD	UM	
July	29	16-Jul	19-Jul	2,499	5,365	1,092	2	2,950	1,418	5,462
	30	20-Jul	26-Jul	2,280	4,844	613	0	1,656	797	3,066
	31	27-Jul	02-Aug	2,771	5,750	586	10	1,582	752	2,930
August	32	03-Aug	09-Aug	2,563	5,636	408	0	1,100	530	2,038
	33	10-Aug	16-Aug	2,852	6,271	260	0	701	338	1,298
	34	17-Aug	23-Aug	2,768	6,522	149	0	403	194	747
	35	24-Aug	30-Aug	3,102	7,032	102	6	275	127	510
	36	31-Aug	31-Aug	384	798	18	2	48	22	89
Total Private Boat Estimates:				19,219	42,219	3,228	20	8,716	4,177	16,140
Total from Charter Boats (count):				2	6	1	0	2	0	3
Grand Total				19,221	42,225	3,229	20	8,718	4,177	16,143
Variance:				1,384,152	7,016,778	144,967	96	4,442,433	1,056,464	12,972,085
Standard Error:				1176	2649	381	10	2108	1028	3602
CV (%):				6.1%	6.3%	11.8%	50.0%	24.2%	24.6%	22.3%
95% CI:				16,913-21,524	37,027-47,410	2,481-3,974	3-39	4,585-12,847	2,162-6,191	9,081-23,199

[1/] Estimated boats, anglers, and retained salmon catch were estimated via the Murthy estimator method.
[2/] 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 Area 10, July 16-August 31, 2009 mark-selective fishery. Values may not add exactly due to rounding error.

Sampling Month	Stat. Week	Start Date	End Date	Est. Effort[1]		Est. Retained Chinook[1/]		Est. Released Chinook[2/]		Est. Chinook Encounters Total
				Boats	Anglers	AD	UM	AD	UM	
July	29	16-Jul	19-Jul	1,128	2,308	133	3	226	89	450
	30	20-Jul	26-Jul	1,820	3,570	266	0	451	183	900
	31	27-Jul	02-Aug	1,365	2,734	227	2	384	154	767
August	32	03-Aug	09-Aug	1,690	3,252	368	12	624	242	1,246
	33	10-Aug	16-Aug	1,273	2,537	251	3	426	170	850
	34	17-Aug	23-Aug	1,891	3,789	225	0	382	155	763
	35	24-Aug	30-Aug	2,344	4,451	104	2	177	69	352
	36	31-Aug	31-Aug	295	537	11	0	19	8	38
Total Private Boat Estimates:				11,805	23,179	1,585	22	2,689	1,071	5,367
Total from Charter Boats (count):				22	76	36	0	19	28	83
Grand Total				11,827	23,255	1,621	22	2,708	1,099	5,450
Variance:				134,709	528,815	12,033	21	461,944	133,578	1,325,420
Standard Error:				367	727	110	5	680	365	1151
CV (%):				3.1%	3.1%	6.9%	20.7%	25.3%	34.1%	21.5%
95% CI:				11,086-12,524	21,753-24,604	1,370-1,800	13-31	1,357-4,021	355-1,788	3,110-7,623

[1/] Estimated boats, anglers, and retained salmon catch were estimated via the Murthy estimator method.
[2/] 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.

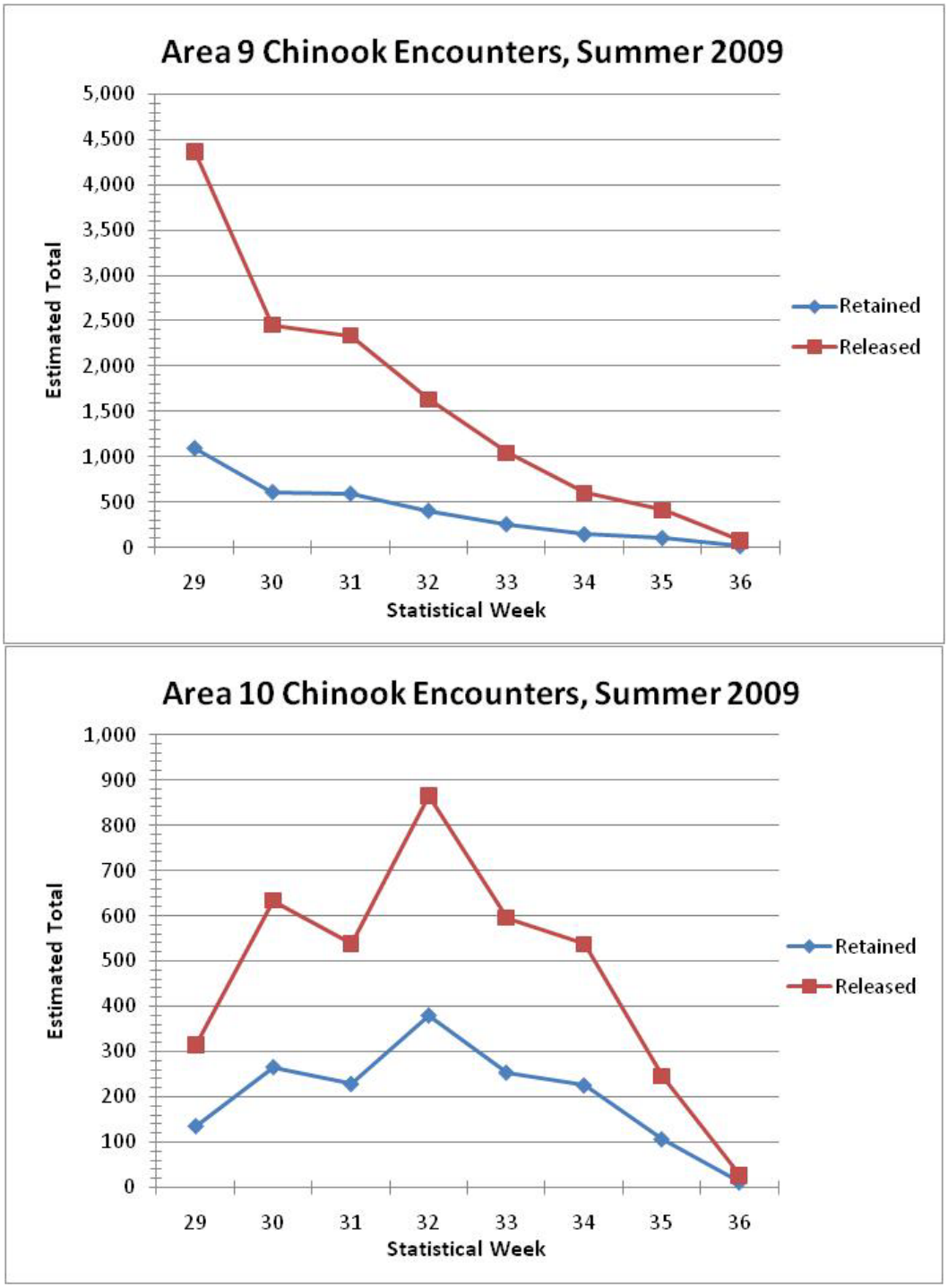

Figure 5. Temporal patterns in total Chinook harvest and releases during the Areas 9 (*upper panel*) and 10 (*lower panel*), July 16-August 31, 2009, mark-selective Chinook fisheries. Note: the fisheries did not begin until Thursday, July 16th (statistical week 29); statistical week 36 includes just one day (August 31st).

Characteristics of Harvested Chinook

Length and Age.—During the combined Areas 9 and 10 mark-selective fishery, 1,121 (633 in Area 9 and 488 in Area 10) retained Chinook were sampled at dockside; of these, 1,112 (629 in Area 9 and 483 in Area 10) were marked (**Table 5**). All of these fish were measured and examined for the presence of a CWT. Marked Chinook harvested from Area 9 averaged 73.2 cm TL (range: 18.4-95.9, SD = 10.9) and were similar to those caught in Area 10 (average: 73.1 cm TL [range: 40.0-98.6, SD = 11.2]; **Figure 6**; $t = 0.25$, df = 1110, P-value = 0.800). Further, legally harvestable ($\geq$ 22 in [56 cm] *and* marked) Chinook comprised over 93% of the sampled total for the two respective areas.

Table 5. Summary of length samples collected during dockside angler interviews from retained Chinook salmon, Areas 9 and 10 mark selective Chinook fisheries, July 16-August 31, 2009.

	Number Sampled		
Mark Type	**Legal-size**	**Sublegal-size**	**Total**
Marked	602	27	629
Unmarked	4	0	4
Undetermined	0	0	0
Total	606	27	633
	Number Sampled		
Mark Type	**Legal-size**	**Sublegal-size**	**Total**
Marked	448	35	483
Unmarked	1	0	1
Undetermined	2	2	4
Total	451	37	488

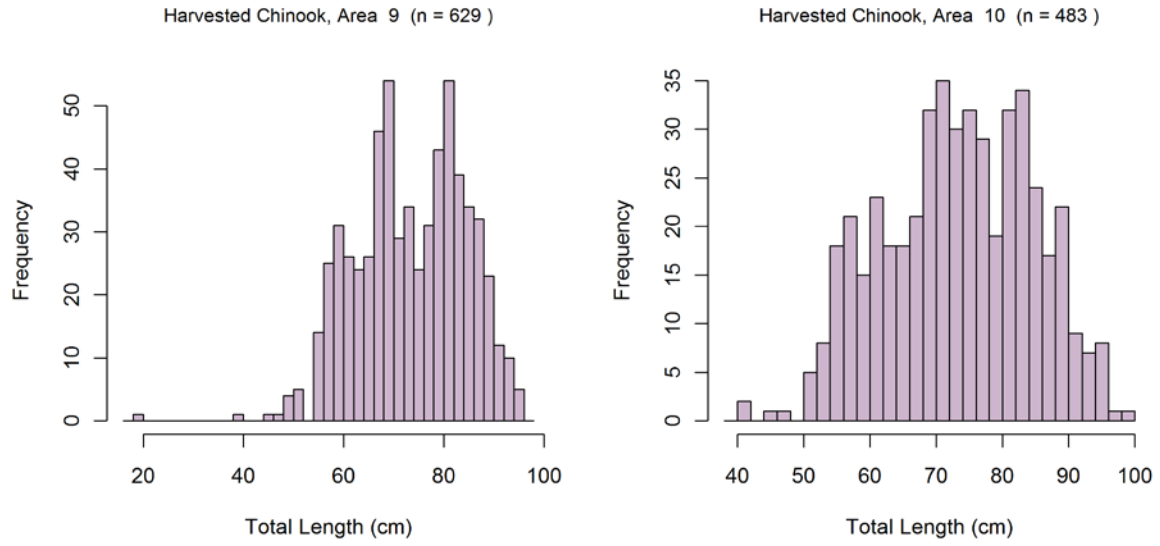

Figure 6. Length-frequency distributions of retained marked Chinook sampled at dockside during the Areas 9 (*left panel*) and 10 (*right panel*) July 16-August 31, 2009 mark-selective Chinook fisheries.

Scales were collected from all of the 1,112 marked Chinook sampled at dockside, but only 1,003 (90%; n = 571 in Area 9 and n = 432 in Area 10) of these could be successfully aged. Based on these scale samples, we found that the age composition of Chinook harvest was similar in Areas 9 and 10 (**Appendix F**). The majority of the retained Chinook were age-3 (48% in Area 9 and 49% in Area 10) and age-4 individuals (43% in Area 9 and 39% in Area 10); the majority of the remaining fish were age-2 (9% in Area 9 and 13% in Area 10). Further, for the two areas, 94% of all retained Chinook were subyearling outmigrants.

CWT Samples.—In total, 105 (57 in Area 9, 48 in Area 10) decoded coded-wire tags were recovered from the Areas 9 and 10 summer selective fisheries. In Area 9, the majority of these recoveries were from Hood Canal (30%), South Puget Sound (28%), and Central Puget Sound (23%) hatcheries (**Table 6-1**). The remaining Area 9 CWT recoveries were from release sites in North Puget Sound (12%), Columbia River (5%), and British Columbia (2%). As for individual hatcheries, tag recoveries from the Hoodsport Hatchery were most abundant (19% of fishery total), followed by Garrison Hatchery (12% of total) and Nisqually Hatchery (11% of total). Ten of the Area 9 CWT recoveries were from double index tag (DIT) releases.

Of the 48 CWTs recovered in the Area 10 selective Chinook fishery, over half (52%; 25 tags) originated from Central Puget Sound release sites (**Table 6-2**). The remaining 23 recoveries consisted of fish from South Puget Sound (29%), Hood Canal (15%), and North Puget Sound (4%) production facilities. Of the individual release sites, Grover's Creek tags had the greatest representation (23% of total). Finally, 16 of the 48 CWTs from the Area 10 fishery were associated with DIT releases. See **Appendix G-1 and G-2** for individual-level details on CWT recoveries.

Table 6-1. Summary of coded-wire tags recovered from Chinook salmon harvested during the Area 9 July 16-August 31, 2009 mark-selective Chinook fisheries. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups.

Release Region[1/]	Release Site	Rearing Location	CWTs Recovered	No. DITs
British Columbia, Lower Fraser River	Chilliwack River	Chilliwack River Hatchery	1 (1.8%)	1
Columbia River	Cowlitz River	Cowlitz Hatchery + Cowlitz Friends	1 (1.8%)	0
	Spring Creek	Spring Creek National Fish Hatchery	2 (3.5%)	1
Hood Canal	Purdy Creek	George Adams Hatchery	3 (5.3%)	1
	Finch Creek	Hoodsport Hatchery	11 (19.3%)	0
	John Creek + Hamma Hamma River	RFEG 6 Hood Canal	1 (1.8%)	0
	Skokomish River	Rick's Pond (LLTK)	2 (3.5%)	0
Puget Sound-Central	Cowskull Acclim Pond	Cowskull Acclim Pond	1 (1.8%)	0
	Grovers Creek	Grovers Creek Hatchery	4 (7.0%)	4
	Elliott Bay Tribal Net Pens	Keta Creek Hatchery	1 (1.8%)	0
	Green River	Icy Creek Hatchery	1 (1.8%)	0
		Unreported	2 (3.5%)	0
	Voights Creek	Voights Creek Hatchery	4 (7.0%)	0
Puget Sound-North	East Sound Bay	Glennwood Springs	1 (1.8%)	0
	Friday Creek	Samish Hatchery	2 (3.5%)	2
	Wallace River	Wallace R. Hatchery	4 (7.0%)	0
Puget Sound-South	Chambers Creek	Garrison Hatchery	7 (12.3%)	0
		Lakewood Hatchery	1 (1.8%)	0
	Kalama Creek	Kalama Creek Hatchery	1 (1.8%)	0
	Clear Creek	Nisqually Hatchery	6 (10.5%)	1
	Deschutes River	Tumwater Falls Hatchery	1 (1.8%)	0
TOTAL			**57**	**10**

[1/]Unofficial release regions. Puget Sound regions were designated based on the WDFW marine catch area containing the river/stream network where juvenile releases originated (i.e., Areas 11 and 13 = South; Areas 9 and 10 = Central; and Areas 7, 8-1, and 8-2 = North).

Table 6-2. Summary of coded-wire tags recovered from Chinook salmon harvested during the Area 10 July 16-August 31, 2009 mark-selective Chinook fisheries. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups.

Release Region[1/]	Release Site	Rearing Location	CWTs Recovered	No. DITs
Hood Canal	Purdy Creek	George Adams Hatchery	2 (4.2%)	2
	Finch Creek	Hoodsport Hatchery	4 (8.3%)	0
	John Creek + Hamma Hamma River	RFEG 6 Hood Canal	1 (2.1%)	0
Puget Sound-Central	Big Soos Creek	Soos Creek Hatchery	2 (4.2%)	2
	Cowskull Acclim Pond	Cowskull Acclim Pond	1 (2.1%)	0
	Grovers Creek	Grovers Creek Hatchery	11 (22.9%)	11
	Green River	Unreported	2 (4.2%)	0
	Issaquah Creek	Issaquah Hatchery	1 (2.1%)	0
	Voights Creek	Voights Creek Hatchery	8 (16.7%)	0
Puget Sound-North	Friday Creek	Samish Hatchery	1 (2.1%)	1
	Wallace River	Unreported	1 (2.1%)	0
Puget Sound-South	Chambers Creek	Garrison Hatchery	6 (12.5%)	0
		Lakewood Hatchery	2 (4.2%)	0
	Kalama Creek	Kalama Creek Hatchery	1 (2.1%)	0
	Clear Creek	Nisqually Hatchery	5 (10.4%)	0
TOTAL			**48**	**16**

[1/]Unofficial release regions. Puget Sound regions were designated based on the WDFW marine catch area containing the river/stream network where juvenile releases originated (i.e., Areas 11 and 13 = South; Areas 9 and 10 = Central; and Areas 7, 8-1, and 8-2 = North).

Test Fishing Results

Fishing Time and Gear Types

Test fishers were scheduled to fish in both Areas 9 and 10 for 33 out of the 47 days the fishery was open from July 16 through August 31, 2009. In total, they spent approximately 353 hours (173.4 in Area 9, 179.6 in Area 10) and 66 total test fishing days (33 in 9, 33 in 10) on the water pursuing Chinook salmon in the two areas (**Tables 7-1** and **7-2**). Based on dockside interview results for anglers reporting successful Chinook salmon encounters, gear schedules were prescribed to help ensure that samplers fished using the same methods in approximately the same proportions as the private fleet. During the 47 days that Areas 9 was open, test fishers trolled using downriggers 97.6% of the time and spent their remaining time (2.4%)

using mooching techniques (i.e., the "weight-and-bait" method). Similarly, their private fleet counterparts pursued Chinook mainly by trolling with downriggers (98.4% of respondents) and, to a lesser extent, by mooching (1.1%), fishing with divers (0.2%), or jigging (0.1%). Area 10 test fishers trolled with downriggers and mooched for 97.6% and 2.4% of their time, respectively, whereas 86.6%, 12.3%, 0.7% and 0.3% of private effort consisted of downrigger trolling, mooching, fishing with divers and jigging respectively.

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

During their respective mark-selective seasons, test fishers encountered 100 Chinook in Area 9 (22 legal-sized and marked [LM], 8 legal-sized and unmarked [LU], 52 sublegal-sized and marked [SM], and 18 sublegal-sized and unmarked [SU]; **Table 7-1**) and 54 Chinook in Area 10 (17 LM, 1 LU, 26 SM, and 10 SU; **Table 7-2**). In Area 9, 74% of all Chinook encountered were marked (73% for legal-sized fish only), whereas Area 10 Chinook had an 80% overall mark rate (94% for legal-sized fish only). Thus, mark rates were high overall and similar for the two areas. For both areas, test fisher "CPUE" (LM Chinook encountered per angler trip; 0.33 in Area 9, 0.26 in Area 10) was higher than that of the average private fleet angler.

Table 7-1. Chinook encounters by size/mark-status group for the July 16-August 31, 2009 Area 9 test fishery. Values in parentheses reflect the variance about proportional season-total contributions of a particular size/mark-status group to total Chinook encounters.

Stat Week	Fishing Effort		Legal-size		Sublegal-size		Total
	Days	Hours Fished	AD	UM	AD	UM	
29	2	10.9	4	0	3	0	**7**
30	5	24.4	4	2	7	2	**15**
31	5	26.7	1	2	5	3	**11**
32	6	29.3	5	3	14	3	**25**
33	4	21.6	1	0	3	1	**5**
34	5	29.8	3	1	13	3	**20**
35	5	27.4	4	0	7	6	**17**
36	1	3.3	0	0	0	0	**0**
Total	**33**	**173.4**	**22**	**8**	**52**	**18**	**100**
Size/mark-status composition:			0.220 (0.002)	0.080 (0.001)	0.520 (0.003)	0.180 (0.001)	
Legal size mark rate:			0.73 (0.007)				
Overall mark rate:			0.74 (0.002)				

Table 7-2. Chinook encounters by size/mark-status group for the July 16-August 31, 2009 Area 10 test fishery. Values in parentheses reflect the variance about proportional season-total contributions of a particular size/mark-status group to total Chinook encounters.

Stat Week	Fishing Effort		Legal-size		Sublegal-size		Total
	Days	Hours Fished	AD	UM	AD	UM	
29	2	11.5	1	0	0	1	**2**
30	5	29.0	2	0	4	2	**8**
31	5	29.0	1	0	5	3	**9**
32	5	30.0	5	0	5	1	**11**
33	5	25.0	4	1	4	0	**9**
34	5	27.0	3	0	6	1	**10**
35	5	23.6	1	0	2	2	**5**
36	1	4.5	0	0	0	0	**0**
Total	**33**	**179.6**	**17**	**1**	**26**	**10**	**54**
Size/mark-status composition:			0.315 (0.004)	0.019 (0.000)	0.481 (0.005)	0.185 (0.003)	
Legal size mark rate:			0.94 (0.003)				
Overall mark rate:			0.80 (0.003)				

In terms of within-season patterns, the mark rate of legal-sized Chinook remained high (>70% on average) between July 16th and August 31st but was somewhat variable on a weekly basis (due in part to small weekly sample sizes; **Tables 7-1 and 7-2**). Chinook encountered in the Area 9 test fishery (for all size classes combined) exhibited moderately variable weekly mark rates, with the highest value (100%) observed during the first week of the fishery and the lowest value (55%) observed during the third week (**Figure 7**). In Area 10, where weekly sample sizes were somewhat lower, the mark-rate pattern (all size classes combined) generally mirrored that of Area 9, with the exception of the first week of the fishery, when the mark rate value in the Area 10 test fishery was at its lowest (51%) in contrast to the 100% mark rate in Area 9. The Area 10 weekly mark rate increased to a high of 91% by the fourth week of the fishery and remained stable until it dropped slightly (60%) in the seventh week.

Mean total length of Chinook encountered by test fishers in each area appeared to follow similar overall trends and varied systematically from mid-July through the end of August in both areas (**Figure 7**, *lower panel*). In both areas, the size trend generally mirrored the seasonal mark-rate pattern, and was most similar to the Area 9 seasonal mark-rate trend. Combining length and mark-rate information, the legally harvestable fraction of encountered Chinook (i.e., marked and $\geq$22 in [56 cm]) averaged 0.24 (range: 0.15 - 0.57) in Area 9 and 0.32 (range: 0.11 -0.50) in Area 10, and varied over the season in a manner similar to the overall mark rate trend (**Figure 7**).

Based on VTRs returned by private anglers fishing in Areas 9 (n = 73 VTRs with 201 encounters) and 10 (n = 29 VTRs with 60 encounters) during the July 16-August 31 season, comparisons of the size/mark-status composition between the test fishery and fleet were equivocal (**Table 8**). In Area 9, there were differences in the overall size/mark-status

composition (χ^2 = 35.1, df = 3, *P* <0.0001; **Table 7-1** vs. **Table 8**) between the two angler groups. Although, in a similar four-group size/mark-status test for Area 10, there were no apparent significant differences (χ^2 = 7.5, df = 3, *P* < 0.058).

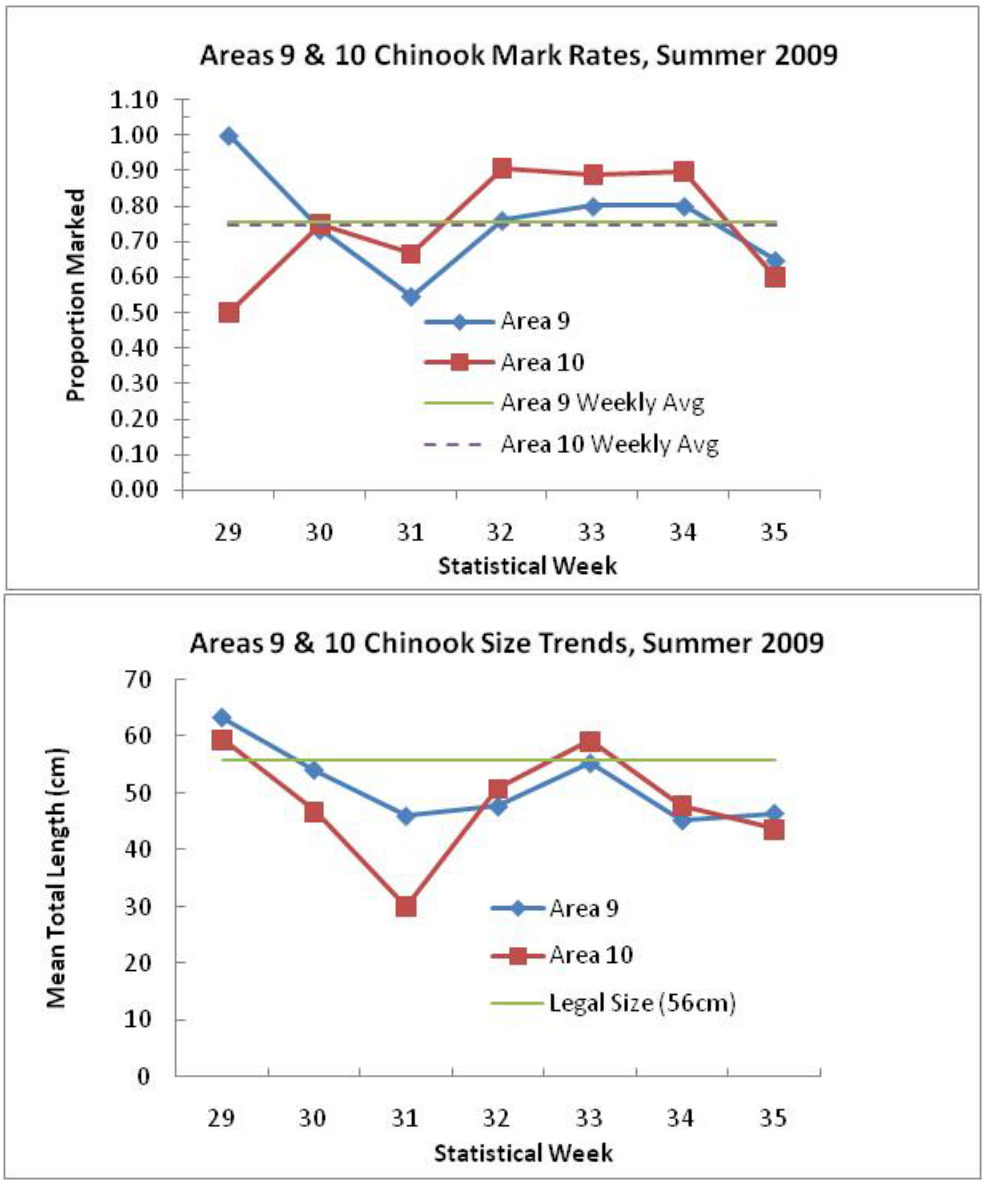

Figure 7. Trends in Chinook mark rates (all size classes, *upper panel*) and average total lengths (marked fish only, *lower panel*) encountered by test fishers during the Areas 9 and 10 July 16-August 31, 2009 mark-selective Chinook fishery. The horizontal solid and dashed lines in the upper panel correspond to the average weekly mark rates for Areas 9 and 10, respectively. The solid horizontal line in the lower panel corresponds to the legal size limit (22 in [56 cm]). (Note: The Areas 9 and 10 MSFs did not begin until Thursday, July 16th [statistical week 29]. On the last day in each fishery [August 31st; statistical week 36], the test fishers caught zero Chinook in both Areas 9 and 10; thus the test fishery-based mark rate and size trend data are not available for week 36.)

Table 8. Total Chinook encountered (retained and released) by private anglers logging their trips on voluntary trip reports (VTRs), with estimates of legal, sublegal, and overall mark rates, Areas 9 and 10 summer mark-selective Chinook fisheries, July 16-August 31, 2009.

Marine Area	Month	Stat Week	VTRs (*n*)	Angler Trips	Chinook Encounters						Legal Mark Rate	Overall Mark Rate
					LM Kept	LM Rel'd	LU	SM	SU	TOTAL		
Area 9	July	29	19	41	32	3	5	12	3	55	87.5%	85.5%
		30	26	52	40	10	9	16	3	78	84.7%	84.6%
		31	16	30	13	1	4	11	5	34	77.8%	73.5%
	August	32	8	18	7	0	3	8	5	23	70.0%	65.2%
		33	2	4	2	0	1	5	1	9	66.7%	77.8%
		34	1	2	0	0	1	0	0	1	0.0%	0.0%
		35	1	2	1	0	0	0	0	1	100.0%	100.0%
		36	0	0	0	0	0	0	0	0	0.0%	0.0%
	Season Total		**73**	**149**	**95**	**14**	**23**	**52**	**17**	**201**	**82.6%**	**80.1%**
	Encounter Rates (LM, LU, SM, SU):				**54.2%**		**11.4%**	**25.9%**	**8.5%**	**100%**		
Area 10	July	29	7	11	7	1	2	6	5	21	80.0%	66.7%
		30	1	2	0	0	0	0	1	1	0.0%	0.0%
		31	5	7	2	0	1	1	5	9	66.7%	33.3%
	August	32	1	2	1	0	0	1	1	3	100.0%	66.7%
		33	1	2	1	0	0	0	0	1	100.0%	100.0%
		34	11	23	11	0	0	2	5	18	100.0%	72.2%
		35	3	8	1	0	1	5	0	7	50.0%	85.7%
		36	0	0	0	0	0	0	0	0	0.0%	0.0%
	Season Total		**29**	**55**	**23**	**1**	**4**	**15**	**17**	**60**	**85.7%**	**65.0%**
	Encounter Rates (LM, LU, SM, SU):				**40.0%**		**6.7%**	**25.0%**	**28.3%**	**100%**		

Chinook Size and Age

During the period that mark-selective Chinook fisheries were open, marked and unmarked Chinook salmon sampled by test fishers in Areas 9 and 10 exhibited disjunct, trimodal size distributions. Three separate size classes of fish—one ranging ~10-40 cm, one ranging ~40-60 cm, and the other ~60+ cm in total length—appeared to have been caught in recreational test fisheries; this pattern was especially obvious for marked Chinook and more striking in Area 9 than in Area 10 (**Figure 8**). In Area 9, Chinook (marked and unmarked combined) averaged 49 cm (SD = 15 cm) and ranged from 15-93 cm in total length (TL), whereas in Area 10 they averaged 47 cm TL (SD = 17 cm; range: 15-100 cm). Thus, there was little difference in the average size of Chinook caught in the two areas, with Area 9 Chinook encounters being slightly larger than Area 10 Chinook encounters.

Of the 154 Chinook encountered and sampled by test fishers during the Areas 9 and 10 fisheries, 131 (82 [60 AD, 21 UM, 1 UD] in Area 9; 49 [39 AD, 10 UM]) in Area 10 had scales that were successfully read. As the length-frequency data suggest (**Figure 8**), marked and unmarked Chinook salmon encountered by test fishers exhibited somewhat different age

structures for Area 10, with age-1 (brood year 2008) individuals comprising a larger fraction of the unmarked (60%) than the marked (18%) group (**Appendix F**). Between areas (pooled over mark-status groups), size differences between Chinook encounters in Area 9 and Area 10 were minimal. Brood-year 2007 (i.e., age-2) fish had the strongest representation of any single brood (65% in Area 9, 45% in Area 10) for test fishery encounters (ad-marked and unmarked combined). Further, age data from the test fishery showed that approximately 95% of all Chinook sampled by test fishers were sub-yearling outmigrants.

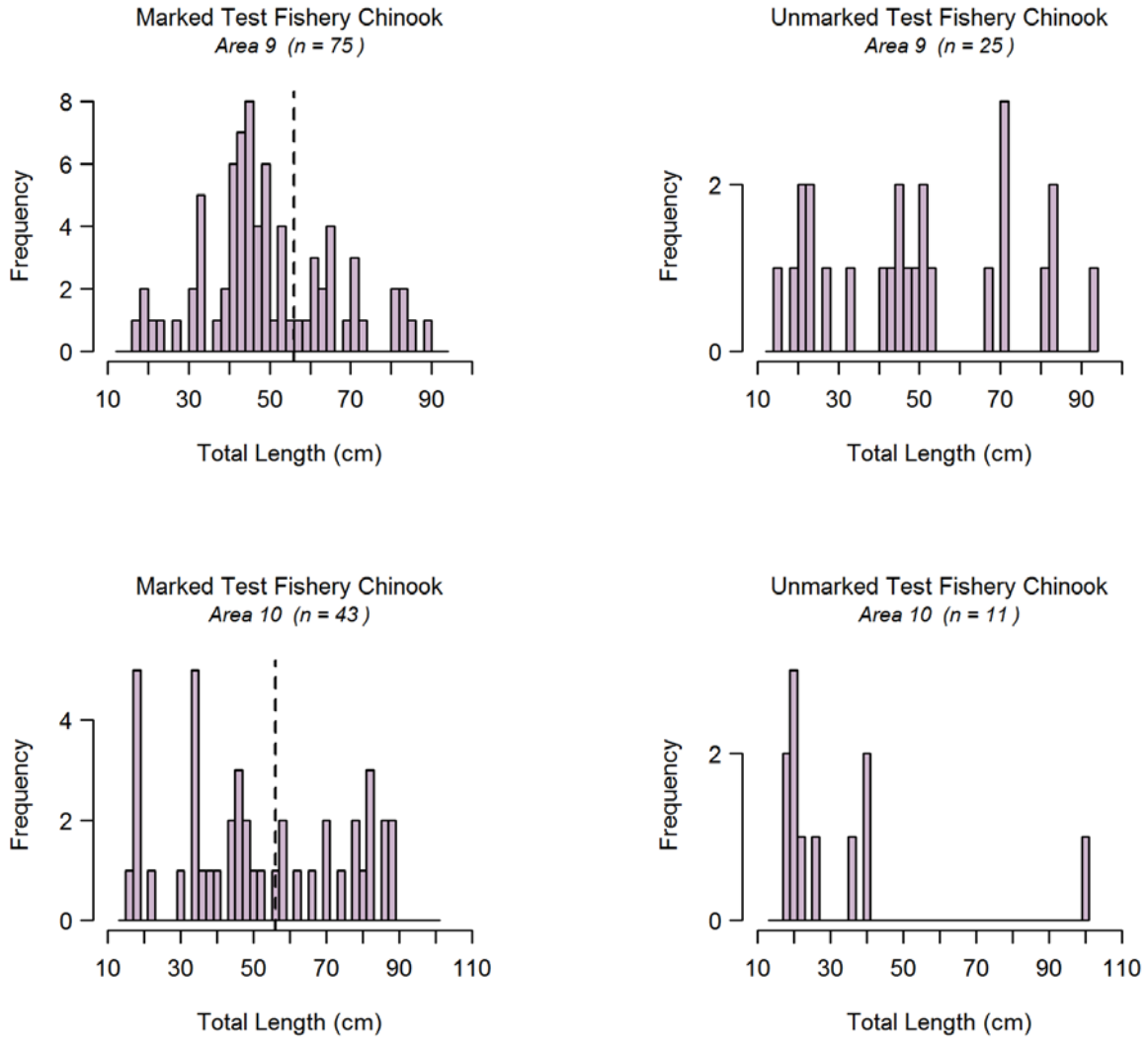

Figure 8. Length-frequency distributions of marked (*left column*) and unmarked (*right column*) Chinook encountered by test fishers during the Areas 9 (*upper row*) and 10 (*lower row*) July 16-August 31, 2009 mark-selective Chinook fishery. The dashed vertical line in the length-frequency histograms for marked Chinook corresponds to the legal size limit (22 in or 56 cm). *Note*: *y* axis ranges differ between panels.

Other Fish Species Encountered

Though they fished exclusively for Chinook, test fishers encountered 302 fish (155 in Area 9, 147 in Area 10) belonging to eleven other species groups during their Areas 9 and 10, summer 2009 sampling efforts. Over the two areas combined, Pacific sanddab (27 in Area 9, 82 in Area 10), pink salmon (40 in Area 9, 9 in Area 10), dogfish shark (23 in Area 9, 21 in Area 10), Pacific cod (33 in Area 9, 10 in Area 10), and coho (24 in Area 9, 14 in Area 10), ranked greatest to least for non-Chinook test fishery encounters (**Table 9**).

Table 9. Test fishery catches of species other than Chinook salmon during the Areas 9 and 10 summer 2009 mark-selective Chinook fisheries.

Species Common Name	Species Scientific Name	Area 9 Total Number	Area 10 Total Number
Brown rockfish	*Sebastes auriculatus*	0	2
Canary rockfish	*Sebastes pinniger*	1	0
Coho salmon	*Oncorhynchus kisutch*	24	14
Copper rockfish	*Sebastes caurinus*	2	3
Dogfish shark	*Squalus acanthias*	23	21
Lingcod	*Ophiodon elongatus*	3	0
Pacific cod	*Gadus macrocephalus*	33	10
Pacific sanddab	*Citharichthys sordidus*	27	82
Pink salmon	*Oncorhynchus gorbuscha*	40	9
Quillback rockfish	*Sebastes maliger*	1	6
Redstripe rockfish	*Sebastes proriger*	1	0
Total		**155**	**147**

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., size/mark-status group-specific harvest estimates derived from data in **Tables 4-1**, **4-2**, and **5** (see **Appendix A** for computational details) and test fishery size/mark-status composition data (**Tables 7-1**, **7-2**). In total, we estimated that private boat anglers fishing in Area 9 encountered 3,551 LM, 1,291 LU, 8,393 SM, and 2,905 SU Chinook, while charter anglers encountered 1 LM, 0 LU, 2 SM, and 0 SU Chinook, yielding a total of 16,143 Chinook encountered in Area 9 from July 16 through August 31, 2009 (**Tables 10-1** and **11**). For Area 10, we estimated private boat encounters at 1,690 LM, 99 LU, 2,584 SM, and 994 SU and charter angler encounters at 35 LM, 5 LU, 20 SM, and 23 SU (5,450 total; **Tables 10-2** and **11**). Given estimates of harvest and the assumed selective fishing mortality (*sfm*) mortality rates of 0.15 for legal-sized and 0.20 for

sublegal-sized Chinook, these encounters translated into 5,741 (Area 9) and 2,389 (Area 10) estimated mortalities for the two areas (**Tables 10-1, 10-2,** and **12**). Fifty-four and 63% of estimated mortality was due to the direct harvest of legal-marked Chinook harvest in the two respective areas. Unmarked Chinook mortality totaled 1,028 fish (791 in Area 9, 237 in Area 10) over the two areas, which corresponds to 0.26 (Area 9) and 0.16 (Area 10) unmarked mortalities per legal-marked Chinook kept. In addition, given the 100 (22 LM, 8 LU, 52 SM, 18 SU) and 54 (17 LM, 1 LU, 26 SM, 10 SU) Chinook caught and released in the respective Areas 9 and 10 test fisheries during their respective fisheries, an estimated 29 (19 in Area 9 and 10 in Area 10) Chinook may have died as a result of our sampling activities.

Table 10-1. Summary of season-wide fishery impact estimates for the Area 9 mark-selective Chinook fishery, July 16-August 31, 2009. Values may not add up perfectly due to rounding error.

Area 9

Total Encounters (E): **16,143** (Creel estimates: 3,228 Marked Retained + 20 Unmarked Retained + 12,893 Released; Charters: 1 Marked Retained + 0 Unmarked Retained + 2 Released)

V(E): **12,972,085**

Size/mark group	Encounters	No. Retained	No. Rel'd	Rel. Mort. Rate	Rel. Mort.	Total Mortality	Var	SE	95% CI	CV (%)
Legal marked	3,552	3,090	462	0.15	69	3,159	160,243	400	2375 - 3944	13
Legal unmarked	1,291	20	1,272	0.15	191	210	6,107	78	57 - 364	37
Sublegal marked	8,395	139	8,256	0.20	1,651	1,790	166,245	408	991 - 2589	23
Sublegal unmarked	2,905	0	2,905	0.20	581	581	31,573	178	233 - 929	31
All groups combined	**16,143**	**3,248**	**12,895**		**2,492**	**5,741**	**364,168**	**603**	**4558 - 6923**	**11**

Table 10-2. Summary of season-wide fishery impact estimates for the Area 10 mark-selective Chinook fishery, July 16-August 31, 2009. Values may not add up perfectly due to rounding error.

Area 10

Total Encounters (E): **5,450** (Creel estimates: 1,585 Marked Retained + 22 Unmarked Retained + 3,760 Released; Charters: 36 Marked Retained + 0 Unmarked Retained + 47 Released)

V(E): **1,325,420**

Size/mark group	Encounters	No. Retained	No. Rel'd	Rel. Mort. Rate	Rel. Mort.	Total Mortality	Var	SE	95% CI	CV (%)
Legal marked	1,725	1,505	220	0.15	33	1,538	16,413	128	1287 - 1789	8
Legal unmarked	104	22	82	0.15	12	34	244	16	4 - 65	45
Sublegal marked	2,604	116	2,488	0.20	498	613	17,896	134	351 - 876	22
Sublegal unmarked	1,017	0	1,017	0.20	203	203	4,947	70	66 - 341	35
All groups combined	**5,450**	**1,643**	**3,807**		**746**	**2,389**	**39,500**	**199**	**1999 - 2779**	**8**

Table 11. Comparison of modeled (i.e., using FRAM, model run 2309) and estimated total Chinook encounters for the Areas 9 and 10 July 16-August 31, 2009 mark-selective Chinook fisheries.

Marine Area	Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
9	FRAM Encounters	Unmark.	8,469	3,334	5,135	67
		Mark.	27,022	10,097	16,925	8,784
		Total	35,491	13,431	22,060	8,851
		% Mark.	76	75	77	99
	Estimated (Creel) Encounters	Unmark.	4,196	1,291	2,905	20
		Mark.	11,946	3,552	8,395	3,229
		Total	16,143	4,843	11,300	3,248
		% Mark.	74	73	74	99
10	FRAM Encounters	Unmark.	3,334	1,264	2,070	25
		Mark.	8,436	3,331	5,105	2,898
		Total	11,770	4,595	7,175	2,923
		% Mark.	72	73	71	99
	Estimated (Creel) Encounters	Unmark.	1,121	104	1,017	22
		Mark.	4,329	1,725	2,604	1,621
		Total	5,450	1,829	3,621	1,643
		% Mark.	79	94	72	99

FRAM versus Creel Comparison

Relative to field data, pre-season Fishery Regulation Assessment Model (FRAM, model run 2309) runs provided an overestimate of fishery impacts—measured as encounters or mortalities—for both Area 9 and Area 10. For instance, FRAM predictions of total and legal-marked Chinook encounters and mortalities were over two-fold higher than field estimates of these parameters (**Tables 11** and **12**, **Figures 10-1** and **10-2**). Further, FRAM predicted that the Areas 9 and 10 mark-selective Chinook fisheries would have a substantially greater impact (i.e., mortalities) on both marked and unmarked Chinook than field data indicate actually occurred during the 47-day season (**Table 12**, **Figures 10-1** and **10-2**). Compared to field estimates, FRAM most over-predicted the mortalities of legal-marked releases (i.e., 137-fold higher in Area 9; 94-fold higher in Area 10); whereas, at the other extreme, FRAM most accurately predicted the number of unmarked landed Chinook in both areas **Figures 10-1** and **10-2**).

Finally, in Area 9, observed mark rates were comparable to those modeled in FRAM, while for Area 10, modeled values were comparable for overall and sublegal-sized Chinook, but not legal-sized Chinook (i.e., FRAM predicted mark rate values that were substantially lower than what was observed; **Table 11**).

Table 12. Comparison of modeled (i.e., using FRAM, model run 2309) and estimated total Chinook mortalities for Areas 9 and 10 July 16-August 31, 2009 mark-selective Chinook fishery.

Marine Area	Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
		Unmark	Mark	Total	Unmark	Mark	Total
9	Total (Landed + Released)	1,655	21,589	23,244	791	4,949	5,741
	Released Legal	561	9,420	9,981	191	69	260
	Released Sublegal	1,027	3,385	4,412	581	1,651	2,232
	Landed Only	67	8,784	8,851	20	3,229	3,248
10	Total (Landed + Released)	651	7,027	7,678	238	2,151	2,389
	Released Legal	212	3,108	3,320	12	33	45
	Released Sublegal	414	1,021	1,435	203	498	701
	Landed Only	25	2,898	2,923	22	1,621	1,643

Estimated CWT-DIT Impacts

Of the 57 coded-wire tags recovered during the summer 2009 Area 9 mark-selective Chinook fishery, 10 belonged to double-index tag (DIT) release groups (**Table 13-1**). Based on the release details associated with these tags and their unmarked sister groups, we obtained an estimate of the unmarked-to-marked ratio (λ) at juvenile release for each applicable hatchery of origin and brood year, and we used this value to estimate total unmarked DIT encounters for the entirety of the Area 9 fishery. In total, we estimated that 50 unmarked-DIT Chinook were encountered during the fishery. Given an assumed *sfm* rate of 0.10 for the estimated unmarked DIT fish that were encountered and released, and applying a 100% mortality rate to the one unmarked retained DIT fish from Spring Creek National Fish Hatchery (brood year 2007; CWT code 053768), we estimate that 10 unmarked DIT fish may have died as a result of the Area 9 fishery. Similarly, based on the 16 DIT CWTs recovered in Area 10 during its MSF season, we estimated that 56 unmarked-DIT Chinook were encountered during the fishery, of which 6 may have died as a result of handling-and-release impacts associated with this fishery (**Table 13-2**).

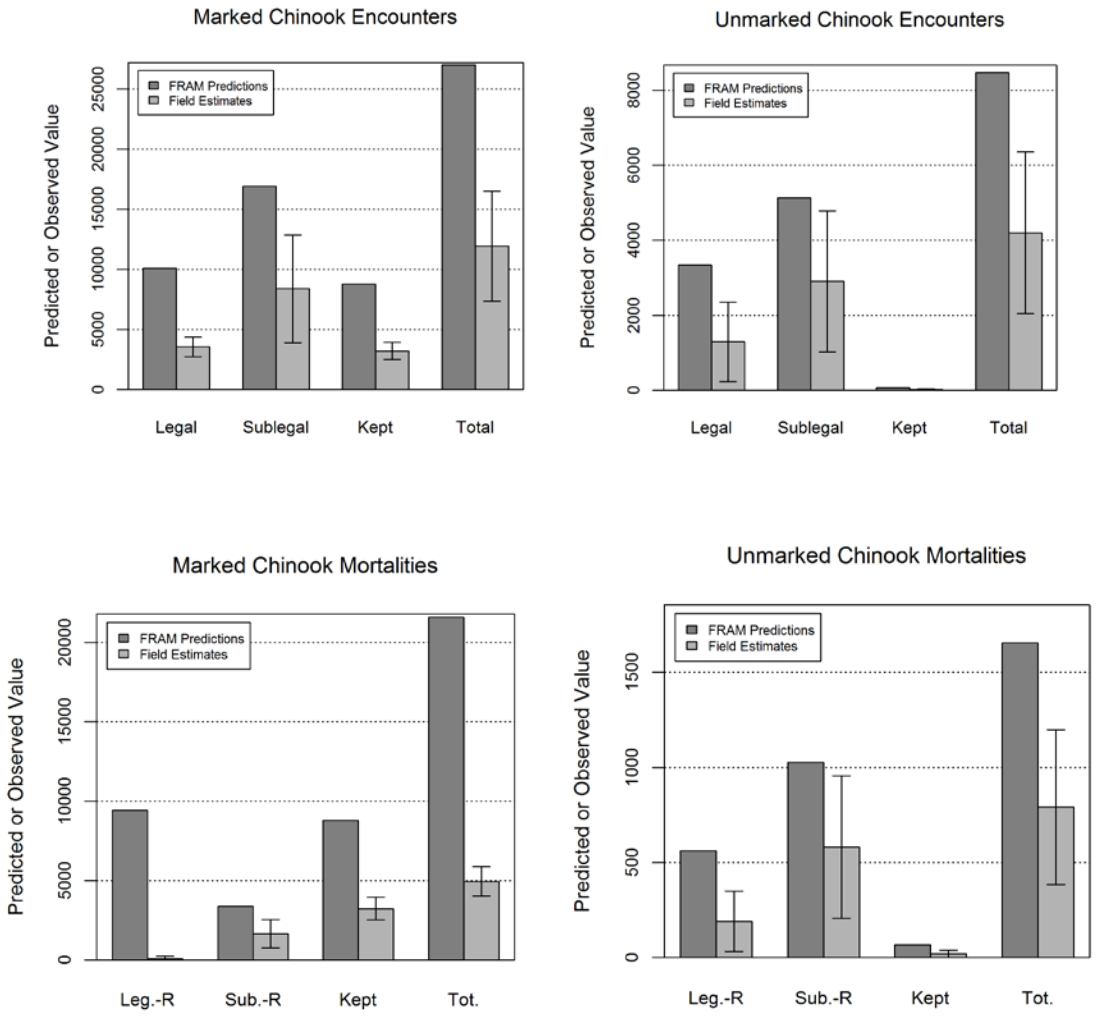

Figure 10-1. Comparison of modeled (i.e., using FRAM, model run 2309) and estimated total Chinook encounters and mortalities for the Area 9 July 16-August 31, 2009 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates.

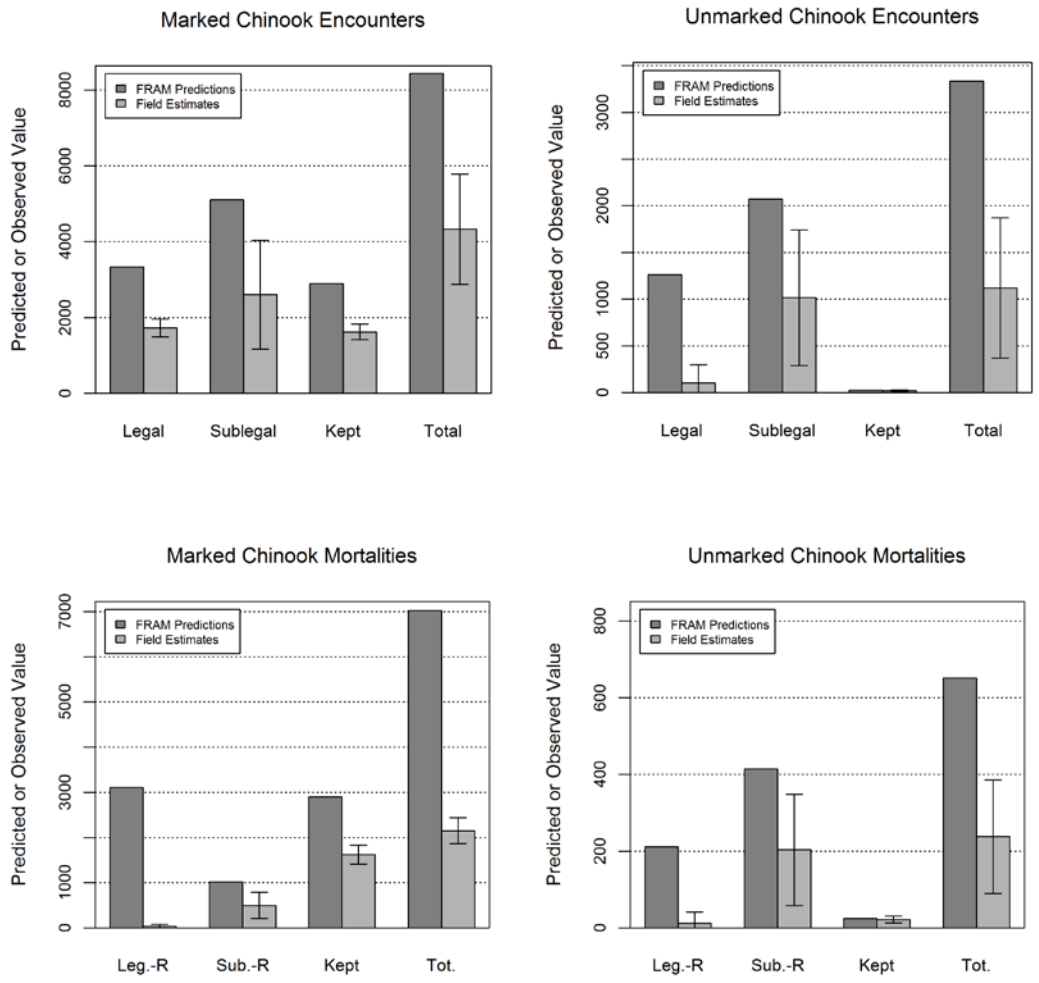

Figure 10-2. Comparison of modeled (i.e., using FRAM, model run 2309) and estimated total Chinook encounters and mortalities for the Area 10 July 16-August 31, 2009 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates.

Table 13-1. 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 Area 9 July 16-August 31, 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.)
George Adams Hatchery	2007	1	4.4	14.6	4.4	0.4	0.1	0.4
Grovers Creek Hatchery	2005	3	14.1	52.8	18.4	1.8	0.9	1.6
	2006	1	4.4	14.6	4.3	0.4	0.1	0.4
Chilliwack River Hatchery	2005	1	4.4	14.6	4.4	0.4	0.2	0.4
Nisqually Hatchery	2005	1	4.4	14.6	4.6	0.5	0.2	0.4
Samish River Hatchery	2005	2	8.7	29.2	7.9	0.8	0.2	0.7
Spring Creek NFH [1/]	2007	1	0.0	0.0	5.4	5.4	23.6	4.9
TOTAL		**10**	**40.2**	**140.5**	**49.5**	**9.8**	**25.4**	**8.7**

[1/] The DIT recovery that originated from Spring Creek National Fish Hatchery (brood year 2007; CWT code 053768) was an unmarked retained Chinook harvested in the Area 9 fishery; thus, a 100% mortality rate was applied to this DIT recovery.

Table 13-2. 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 Area 10 July 16-August 31, 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.)
George Adams Hatchery	2006	1	3.5	8.9	3.9	0.4	0.1	0.3
	2007	1	3.0	5.8	3.0	0.3	0.1	0.2
Grovers Creek Hatchery	2005	3	9.4	20.5	12.3	1.2	0.3	1.0
	2006	8	26.5	62.0	26.4	2.6	0.6	2.2
Samish River Hatchery	2006	1	3.5	8.9	3.5	0.4	0.1	0.3
Soos Creek Hatchery	2005	1	3.5	8.9	3.6	0.4	0.1	0.3
	2006	1	3.5	8.9	3.5	0.4	0.1	0.3
TOTAL		**16**	**53.0**	**123.9**	**56.3**	**5.6**	**1.4**	**4.7**

ACKNOWLEDGEMENTS

This review of the summer 2009 Areas 9 and 10 mark-selective Chinook fisheries is a result of the dedicated efforts of several individuals. Slim Simpson (Central Sound Sampling Supervisor) and his sampling crew collected creel survey, test-fishery, and on-the-water survey data throughout the season in Areas 9 and 10. Larry Bennett (Peninsula Sampling Supervisor) and his sampling staff conducted creel surveys in northern Area 9. In addition, Steve Axtell (Northern Sampling Supervisor) and his staff conducted on-the-water surveys in northeastern Area 9. Toby Black and Jonathan Potts conducted test fishing throughout Area 9 as well as on-the-water surveys in the southern portion of Area 9. Jim Pykonen and Mike Petronelli conducted test fishing and boat survey activities in Area 10. Additionally, Scott Walker and Mike Elam conducted on-the-water surveys in the northwestern portion of Area 9 and the western portion of Area 10.

Dockside samplers stationed in southern Area 9 included Sue Kraemer (lead sampler at Everett Ramp), Amy Willoughby, Aaron Park, April Bosley, and Shelly Schubert. In northern Area 9, dockside samplers included Marcus Thompson and Ken Wall. Dockside samplers stationed on the eastern side of Area 10 included Courtney Adkins, Fiona Taylor, and Andrea Henton, while Cara Crowley and Karen Peabody sampled on the Kitsap side of Area 10.

Additionally, Central Sound staff Slim Simpson, Jeff McKee, and Kathy Young-Berg greatly assisted in the summarization and error checking of data, and on many other aspects of Areas 9 and 10 sampling. Larry Bennett, Connie Warren, and Marcus Thompson provided timely summarization and error checking of northern Area 9 data.

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. Mark Baltzell provided timely in-season creel estimates for Areas 9 and 10 and scheduled all boat surveys. 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, Steve Caromile, Karen Kloempken, and Laurie Peterson prepared this post-season report.

Finally, we would like to thank Area 9 and Area 10 charter operators for their cooperation with our charter census activities.

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.

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.

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.

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.

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.

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.

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.

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.

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.

Washington Department of Fish and Wildlife (WDFW). 2009e. Marine Area 7 Mark-Selective Recreational Chinook Fishery, February 1-29, 2008: Post-season Report. Revised Draft Report: February 20, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 47 pp. http://wdfw.wa.gov/fish/salmon/suggested_reading.htm.

Washington Department of Fish and Wildlife (WDFW). 2009f. Marine Areas 8-1 and 8-2 Mark-Selective Recreational Chinook Fishery, January 1-April 30, 2009, Post-season Report. Draft Report: October 12, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 61 pp.

Washington Department of Fish and Wildlife (WDFW). 2009g. Marine Area 9 Mark-Selective Recreational Chinook Fishery, November 1-30, 2008 and January 16-April 15, 2009, Post-season Report. Draft Report: October 30, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 47 pp.

Washington Department of Fish and Wildlife (WDFW). 2009h. Marine Area 10 Mark-Selective Recreational Chinook Fishery, December 1, 2008–January 31, 2009, Post-season Report. Draft Report: October 6, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 49 pp.

Washington Department of Fish and Wildlife (WDFW). 2009i. Marine Area 7 Mark-Selective Recreational Chinook Fishery, February 1–April 15, 2009, Post-season Report. Draft Report: November 5, 2009. Washington Department of Fish and Wildlife. Olympia, Washington. 49 pp.

Washington Department of Fish and Wildlife (WDFW) and Northwest Indian Fisheries Commission (NWIFC). 2009. 2009-10 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[7] estimators of encounters-by-class (i.e., the four size [legal, sublegal] × mark-status [marked, unmarked] groups) to season-wide impact estimates.

A. Total and Class-specific Encounters Estimation

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

Monthly Encounters

$\widehat{E}_i$ = Total Chinook encounters for month *i*, which is estimated by combining creel estimates of legal-marked Chinook harvest ($\hat{K}_{LM\,i}$, defined on subsequent page) with a test fishery-based estimate of the proportion of the fishable Chinook population that is of legal size and marked ($\hat{p}_{LM\,i}$,defined on subsequent page). Given the potential for negative bias in $\widehat{E}_i$ if anglers release any of the legal-marked Chinook that they encounter, the $\widehat{E}_i$ estimator also includes a "correction" to account for this phenomenon (i.e., 1-$p_{\text{LM-R}}$, where $p_{\text{LM-R}}$ is the estimated legal-marked Chinook release rate)[8]. $\widehat{E}_i$ and its variance are estimated as:

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

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

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

[8] 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 $p_{\text{LM-R}}$ (combined intentional and unintentional LM Chinook release rate) applied in the bias-corrected $\widehat{E}_i$ estimator is 0.13. See Conrad and McHugh (2008) for further detail.

Test-fishery Encounter Composition

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

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

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

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

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

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

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

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

Encounters by Size/Mark-status Class

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

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

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

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

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

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

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

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

Before total mortality can be estimated for each class (LM, SM, LU, SU), class-specific encounters must be separated into retention and release categories. First, given that harvest is estimated only to mark-status class for creel survey purposes (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*[9] dockside observations of marked Chinook (as is $\hat{d}_{SMK}$)

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

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

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

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

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

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

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

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

Apportioned Estimates of Retention to Size Classes

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

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

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

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

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

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

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

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

[9] 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 $\hat{d}_{XYK}$.

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

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

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

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

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

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

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

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

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

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

Assumed Mortality Rates for Retained and Released Chinook

m_K = retention mortality rate, 100% for all retained Chinook (reincarnation is rare among fishes)
sfm_L = release mortality rate for legal (*L*) Chinook, assumed to be a constant 15%
sfm_S = release mortality rate for sublegal (*S*) Chinook, assumed to be a constant 20%

Retention-mortality Estimates

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

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

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

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

Release-mortality Estimates

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

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

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

Season-wide Total and Class-specific Mortality Estimation

$\hat{M}_{total}$ = total season-wide Chinook salmon mortality; this parameter and its variance [$\text{var}(\hat{M}_{total})$] are computed as the sum of all monthly retention and release mortality estimates [i.e., $\hat{M}_{total} = \sum_{i=1}^{\max i}(\hat{M}_{XYKi} + \hat{M}_{XYRi})$] 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) $SE(\hat{\theta}) = \sqrt{\text{var}(\hat{\theta})}$

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

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

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

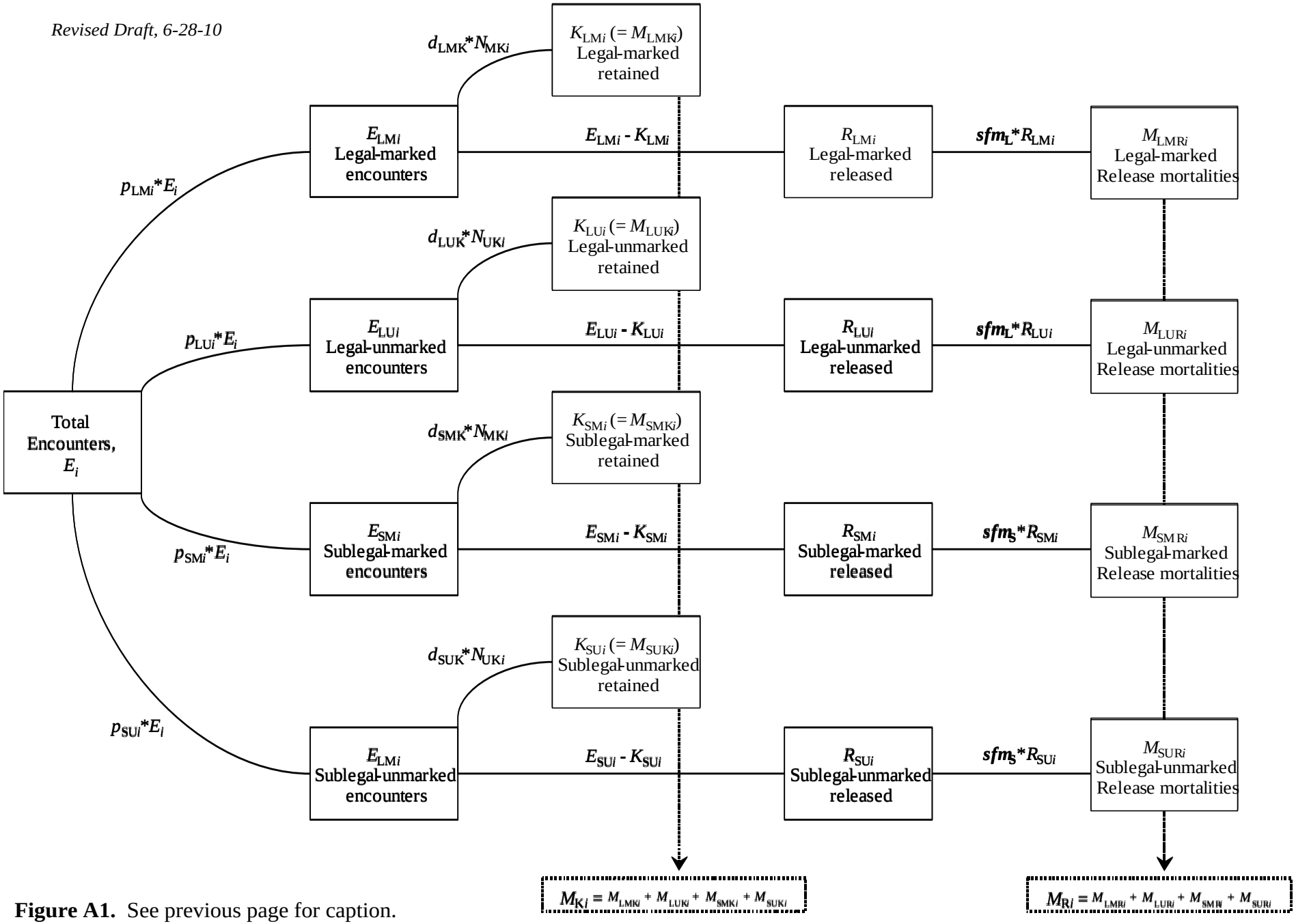

Figure A1. See previous page for caption.

Appendix B. Statistical week calendar for 2009. Note that weeks shaded in gray correspond to those during which Areas 9 and 10 were open under mark-selective harvest regulations.

STAT MONTH	WEEK NO.	START DATE	END DATE	STAT MONTH	WEEK NO.	START DATE	END DATE
1	1	01-Jan	04-Jan	7	27	29-Jun	05-Jul
	2	05-Jan	11-Jan		28	06-Jul	12-Jul
	3	12-Jan	18-Jan		29	13-Jul	19-Jul
	4	19-Jan	25-Jan		30	20-Jul	26-Jul
	5	26-Jan	01-Feb		31	27-Jul	02-Aug
2	6	02-Feb	08-Feb	8	32	03-Aug	09-Aug
	7	09-Feb	15-Feb		33	10-Aug	16-Aug
	8	16-Feb	22-Feb		34	17-Aug	23-Aug
	9	23-Feb	01-Mar		35	24-Aug	30-Aug
3	10	02-Mar	08-Mar	9	36	31-Aug	06-Sep
	11	09-Mar	15-Mar		37	07-Sep	13-Sep
	12	16-Mar	22-Mar		38	14-Sep	20-Sep
	13	23-Mar	29-Mar		39	21-Sep	27-Sep
4	14	30-Mar	05-Apr	10	40	28-Sep	04-Oct
	15	06-Apr	12-Apr		41	05-Oct	11-Oct
	16	13-Apr	19-Apr		42	12-Oct	18-Oct
	17	20-Apr	26-Apr		43	19-Oct	25-Oct
	18	27-Apr	03-May		44	26-Oct	01-Nov
5	19	04-May	10-May	11	45	02-Nov	08-Nov
	20	11-May	17-May		46	09-Nov	15-Nov
	21	18-May	24-May		47	16-Nov	22-Nov
	22	25-May	31-May		48	23-Nov	29-Nov
6	23	01-Jun	07-Jun	12	49	30-Nov	06-Dec
	24	08-Jun	14-Jun		50	07-Dec	13-Dec
	25	15-Jun	21-Jun		51	14-Dec	20-Dec
	26	22-Jun	28-Jun		52	21-Dec	27-Dec
					53	28-Dec	31-Dec

Appendix C. Sample rates (Retained Ad-marked Chinook Sampled/Total Estimated Retained Ad-marked Chinook) for the Areas 9 and 10 July 16-August 31, 2009 selective Chinook fisheries. Note: sample counts and totals are for adipose-clipped (i.e., marked) Chinook only.

Marine Area	Sample Month	Stat. Weeks	Date Range	No. AD Chinook Sampled [1/]	Estimated Chinook Retained	Sample Rate
Area 9	July	29-31	July 16 - Aug 2	526	2,291	23.0%
	August	32-36	Aug 3 - 31	174	937	18.6%
			Season Total	**700**	**3,228**	**21.7%**
Area 10	July	29-31	July 16 - Aug 2	211	625	33.8%
	August	32-36	Aug 3 - 31	272	959	28.4%
			Season Total	**483**	**1,584**	**30.5%**

[1/] Of the 526 ad-marked retained Chinook observed by dockside samplers in the Area 9 MSF during July, 455 were sampled for lengths and scales; the remaining 71 Chinook were observed as retained catch but not sampled for lengths and scales.

Appendix D-1. Total number of anglers intercepted in Area 9 during on-the-water surveys conducted between July 16 and August 31, 2009. (Dark gray shaded sites were included in the dockside sample frame.[1/])

Site Name	Weekday Anglers	Weekday Total (unadjusted) size measure	Weekend Anglers	Weekend Total (unadjusted) size measure
Armeni Ramp	2	0.003	0	0.000
Bayside	9	0.014	6	0.005
Beach Launch	9	0.014	11	0.009
Beckett point	0	0.000	4	0.003
Brownsville	0	0.000	5	0.004
Brownsville Marina	5	0.008	0	0.000
Bush Point (Prvt)	0	0.000	8	0.007
Camano Is St PK	2	0.003	5	0.004
Cape George Ramp	0	0.000	2	0.002
Cultus Bay	4	0.006	0	0.000
Dagmars Landing[1/]	15	0.023	6	0.005
Driftwood Key Marina	5	0.008	36	0.030
Driftwood Key Ramp	3	0.005	0	0.000
Edmonds Marina Dry Storage[1/]	23	0.035	54	0.045
Edmonds Marina Moorage	56	0.085	70	0.058
Edmonds Marina Sling	34	0.051	53	0.044
Eglon	10	0.015	18	0.015
Elliott Bay Marina	3	0.005	7	0.006
Everett Marina	14	0.021	35	0.029
Everett Public Ramp (Norton)[1/]	112	0.169	243	0.200
Fisherman's Terminal	1	0.002	0	0.000
Fort Flagler	1	0.002	17	0.014
Fort Casey/Keystone[1/]	44	0.067	108	0.089
Fort Warden	29	0.044	27	0.022
Hat Island	3	0.005	0	0.000
Hudson Point	5	0.008	7	0.006
John Wayne Marina	0	0.000	2	0.002
Kingston Ramp[1/]	24	0.036	30	0.025
Kingston Marina	11	0.017	11	0.009
Lagoon Point	17	0.026	60	0.049
Langley Ramp	0	0.000	3	0.002
Langus Ramp (Snohomish River)	0	0.000	4	0.003
Marysville Slough	3	0.005	1	0.001
Mats Mats Bay	1	0.002	5	0.004
Max Welton (Whidbey)	2	0.003	1	0.001
Miller Bay	0	0.000	2	0.002
Mukilteo State Park Ramp[1/]	43	0.065	88	0.073
Mutiny Bay	1	0.002	26	0.021
Oak Bay (Prvt)	3	0.005	6	0.005
Pleasant Harbor	0	0.000	3	0.002

Continued, next page

Site Name	Weekday Anglers	Weekday Total (unadjusted) size measure	Weekend Anglers	Weekend Total (unadjusted) size measure
Port Hadlock Marina (Moorage)	3	0.005	7	0.006
Port Hadlock Ramp	9	0.014	9	0.007
Port Ludlow	7	0.011	5	0.004
Port Madison	2	0.003	0	0.000
Port Townsed Moorage	16	0.024	7	0.006
Port Townsend Boat Haven Ramp[1/]	59	0.089	97	0.080
Possession Ramp	7	0.011	9	0.007
Private Buoy/moorage/launch	20	0.030	34	0.028
Salmon Bay	5	0.008	0	0.000
Salisbury Ramp	19	0.029	44	0.036
Sandy Hook (Prvt)	5	0.008	3	0.002
Shilshole Ramp	7	0.011	25	0.021
Shilshole Marina (Prvt)	6	0.009	6	0.005
Sequim Bay State Park	2	0.003	0	0.000
Tulalip Ramp	0	0.000	3	0.002
Total Anglers	**661**	**1.000**	**1,213**	**1.000**

[1/]Dark gray shaded rows are sites that we included in the sampling site frame. Light gray shaded rows are sites we considered to include in the sampling site frame, but ultimately we did not include these sites because they represented a relatively low proportion of the overall angler effort in the fishery.

Appendix D-2. Total number of anglers intercepted in Area 10 during on-the-water surveys conducted between July 16 and August 31, 2009. (Dark gray shaded sites were included in the dockside sample frame.[1/])

Site Name	Weekday Anglers	Weekday Total (unadjusted) size measure	Weekend Anglers	Weekend Total (unadjusted) size measure
Armeni Ramp[1/]	31	0.071	50	0.074
Bainbridge Ramp	0	0.000	3	0.004
Bayside Drystack	2	0.005	2	0.003
Brownsville Marina	2	0.005	4	0.006
Brownsville Ramp	29	0.067	36	0.053
Dagmars Landing	0	0.000	4	0.006
Des Moines Marina	0	0.000	5	0.007
Duwamish	0	0.000	3	0.004
Eagle Harbor	15	0.035	6	0.009
Eagle Harbor Moorage	0	0.000	15	0.022
Edmonds Marina Dry Storage[1/]	13	0.030	12	0.018
Edmonds Marina Moorage	39	0.090	85	0.126
Edmonds Marina Sling	11	0.025	64	0.095
Elliott Bay Marina	8	0.018	8	0.012
Evergreen Park	0	0.000	4	0.006
Everett Public Ramp (Norton)	6	0.014	6	0.009
First Ave So Ramp	0	0.000	4	0.006
Golden Gardens	0	0.000	1	0.001
Harbor Island	2	0.005	0	0.000
Jim Clark Marina	0	0.000	1	0.001
Keyport Marina	0	0.000	4	0.006
Kingston Ramp[1/]	24	0.055	91	0.134
Kingston Marina	16	0.037	0	0.000
Liberty Bay	0	0.000	2	0.003
Manchester Ramp[1/]	31	0.071	54	0.080
Miller Bay	4	0.009	0	0.000
Newport	0	0.000	4	0.006
Port Orchard Ramp[1/]	2	0.005	8	0.012
Port Madison	1	0.002	2	0.003
Private Launch/Moorage	38	0.088	15	0.022
Redondo	0	0.000	8	0.012
Salmon Bay	0	0.000	6	0.009
Shilshole Marina (Prvt)	20	0.046	25	0.037
Shilshole Ramp[1/]	140	0.323	145	0.214
Total Anglers	**434**	**1.000**	**677**	**1.000**

[1/]Dark gray shaded rows are sites that we included in the sampling site frame. Light gray shaded rows are sites we considered to include in the sampling site frame, but ultimately we did not include these sites because they represented a relatively low proportion of the overall angler effort in the fishery.

Appendix E-1. Size measures of sites sampled during the Area 9 July 16-August 31, 2009 creel survey, by statistical week. WD and WE correspond to weekday and weekend strata, respectively.

Stat Week	Day Type	Prop'n Effort In Sample Frame	Area 9 Sampled Sites and Size Measures			
			Norton St. (Everett) Ramp	Fort Casey SP Ramp	Mukilteo SP Ramp	Port Townsend Boat Haven
29	WD	0.51	0.484	0.058	0.191	0.196
	WE	0.49	0.430	0.102	0.070	0.148
30	WD	0.51	0.484	0.058	0.191	0.196
	WE	0.47	0.530	0.139	0.193	0.139
31	WD	0.34	0.316	0.329	0.066	0.289
	WE	0.47	0.530	0.139	0.193	0.139
32	WD	0.34	0.316	0.329	0.066	0.289
	WE	0.42	0.308	0.256	0.164	0.272
33	WD	0.42	0.438	0.113	0.150	0.300
	WE	0.42	0.308	0.256	0.164	0.272
34	WD	0.41	0.520	0.171	0.167	0.229
	WE	0.44	0.543	0.200	0.137	0.120
35	WD	0.41	0.520	0.171	0.167	0.229
	WE	0.44	0.543	0.200	0.137	0.120
Season Mean	**WD mean**	0.422	0.440	0.175	0.142	0.247
	WD SD	0.070	0.089	0.115	0.054	0.045
	WE mean	0.450	0.456	0.185	0.151	0.173
	WE SD	0.026	0.109	0.060	0.042	0.069

Appendix E-2. Size measures of sites sampled during the Area 10 July 16-August 31, 2009 creel survey, by statistical week. WD and WE correspond to weekday and weekend strata, respectively.

Stat Week	Day Type	Prop'n Effort In Sample Frame	Area 10 Sampled Sites and Size Measures			
			Armeni Ramp	Kingston Ramp	Manchester Ramp	Shilshole Ramp
29	WD	0.41	0.089	0.304	0.000	0.607
	WE	0.49	0.077	0.231	0.209	0.484
30	WD	0.41	0.089	0.304	0.000	0.607
	WE	0.48	0.162	0.288	0.126	0.423
31	WD	0.54	0.125	0.205	0.045	0.625
	WE	0.48	0.162	0.288	0.126	0.423
32	WD	0.54	0.125	0.205	0.045	0.625
	WE	0.48	0.162	0.288	0.126	0.423
33	WD	0.63	0.170	0.092	0.135	0.603
	WE	0.48	0.162	0.288	0.126	0.423
34	WD	0.43	0.082	0.129	0.141	0.647
	WE	0.55	0.119	0.229	0.220	0.432
35	WD	0.43	0.082	0.129	0.141	0.647
	WE	0.55	0.119	0.229	0.220	0.432
Season Mean	**WD mean**	0.485	0.109	0.196	0.072	0.623
	WD SD	0.086	0.033	0.085	0.065	0.019
	WE mean	0.501	0.138	0.263	0.165	0.435
	WE SD	0.033	0.034	0.031	0.048	0.022

Appendix F. Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon, Areas 9 and 10 mark-selective Chinook fishery, July 16-August 31, 2009. AD = marked or adipose-fin clipped Chinook, UM = unmarked (unclipped) Chinook, UD = undetermined mark status.

Area	Source	Mark-status group	Period	Age Composition[1] 1.1	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	Total
9	Dockside	AD	Season	1	52	1	241	31	228	15	1	1	571
			(%)	0%	9%	0%	42%	5%	40%	3%	0%	0%	
		UM	Season	0	1	0	1	1	1	0	0	0	4
			(%)	0%	25%	0%	25%	25%	25%	0%	0%	0%	
	Test Fishing	AD	Season	5	40	2	13	0	0	0	0	0	60
			(%)	8%	67%	3%	22%	0%	0%	0%	0%	0%	
		UD	Season	0	1	0	0	0	0	0	0	0	1
			(%)	0%	100%	0%	0%	0%	0%	0%	0%	0%	
		UM	Season	5	10	0	2	0	3	1	0	0	21
			(%)	24%	48%	0%	10%	0%	14%	5%	0%	0%	
10	Dockside	AD	Season	0	56	0	193	16	162	4	1	0	432
			(%)	0%	13%	0%	45%	4%	38%	1%	0%	0%	
		UM	Season	0	3	0	1	0	0	0	0	0	4
			(%)	0%	75%	0%	25%	0%	0%	0%	0%	0%	
	Test Fishing	AD	Season	7	16	3	7	0	6	0	0	0	39
			(%)	18%	41%	8%	18%	0%	15%	0%	0%	0%	
		UM	Season	6	3	0	0	0	1	0	0	0	10
			(%)	60%	30%	0%	0%	0%	10%	0%	0%	0%	

[1]Gilbert-Rich age notation, "Total Age". "Age at outmigration", inclusive of time spent in incubation.

Appendix G-1. CWTs recovered from Chinook salmon during the Area 9 July 16-August 31, 2009 mark-selective Chinook fishery.

Area	Recov. Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel. Agency	DIT codes	FKL cm	Label	Mark
9	16-Jul-09	633966	2006	WALLACE R 07.0940		WDFW		64	57427	AD Fin Clp
9	16-Jul-09	633286	2005	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ	210681	90	14001	AD Fin Clp
9	16-Jul-09	633369	2005	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW	633368	80	14658	AD Fin Clp
9	16-Jul-09	633468	2005	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW		67	49774	AD Fin Clp
9	16-Jul-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		74	49773	AD Fin Clp
9	16-Jul-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		70	54930	AD Fin Clp
9	16-Jul-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		65	49772	AD Fin Clp
9	16-Jul-09	633471	2005	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		75	14653	AD Fin Clp
9	16-Jul-09	633494	2006	DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW		53	14810	AD Fin Clp
9	16-Jul-09	633886	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		65	14657	AD Fin Clp
9	16-Jul-09	633886	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		68	54931	AD Fin Clp
9	16-Jul-09	633964	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		61	54932	AD Fin Clp
9	16-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		64	14659	AD Fin Clp
9	16-Jul-09	633887	2006	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW		65	57442	AD Fin Clp
9	16-Jul-09	633967	2006	GREEN R 09.0001		WDFW		58	57426	AD Fin Clp
9	16-Jul-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		55	57443	AD Fin Clp
9	17-Jul-09	210688	2006	COWSKULL ACCLIM POND	COWSKULL ACCLIM POND	PUYA		68	57444	Unkn Marks
9	17-Jul-09	632979	2005	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		81	14811	AD Fin Clp
9	17-Jul-09	633369	2005	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW	633368	75	49775	AD Fin Clp
9	17-Jul-09	633482	2006	JOHN CR + HAMMA R	RFEG 6 HOOD CANAL	WDFW		63	57295	AD Fin Clp
9	17-Jul-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	79	14722	AD Fin Clp
9	17-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		65	14721	AD Fin Clp
9	17-Jul-09	633971	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		64	32621	AD Fin Clp
9	17-Jul-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		81	54213	AD Fin Clp
9	17-Jul-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		68	57138	AD Fin Clp
9	17-Jul-09	633375	2005	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		80	54933	AD Fin Clp
9	18-Jul-09	633969	2006	CHAMBERS CR 12.0007	LAKEWOOD HATCHERY	WDFW		57	57445	AD Fin Clp
9	18-Jul-09	632874	2004	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		77	32623	AD Fin Clp
9	18-Jul-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		67	32622	AD Fin Clp
9	18-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		79	57413	AD Fin Clp
9	18-Jul-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	83	57428	AD Fin Clp
9	19-Jul-09	633375	2005	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		88	49777	AD Fin Clp
9	19-Jul-09	633382	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		76	49776	AD Fin Clp
9	19-Jul-09	634271	2007	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW	634270,634272	57	57446	AD Fin Clp
9	22-Jul-09	633366	2005	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW		71	57414	AD Fin Clp
9	23-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		63	54631	AD Fin Clp
9	24-Jul-09	185240	2005	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	185238,185030	78	32624	AD Fin Clp
9	24-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		72	57415	AD Fin Clp
9	25-Jul-09	633382	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		72	28702	AD Fin Clp
9	25-Jul-09	633967	2006	GREEN R 09.0001		WDFW		58	32617	AD Fin Clp
9	25-Jul-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		66	54934	AD Fin Clp
9	26-Jul-09	633366	2005	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW		78	54217	AD Fin Clp
9	26-Jul-09	633467	2005	GREEN R 09.0001	ICY CR HATCHERY	WDFW		78	28701	AD Fin Clp
9	29-Jul-09	210788	2007	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		49	28703	AD Fin Clp
9	31-Jul-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	77	54935	AD Fin Clp
9	6-Aug-09	633886	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		75	57418	AD Fin Clp
9	7-Aug-09	054318	2006	SPRING CR 29.0159	SPRING CR NFH	FWS		79	28704	AD Fin Clp
9	7-Aug-09	634080	2006	EAST SOUND BAY (SAN)	GLENWOOD SPRINGS	WDFW		70	49779	AD Fin Clp
9	7-Aug-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		54	57145	AD Fin Clp
9	8-Aug-09	633473	2006	COWLITZ R 26.0002	COWL SALM + COWL FRIENDS	WDFW		64	49780	AD Fin Clp

Area	Recov. Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel. Agency	DIT codes	FKL cm	Label	Mark
9	9-Aug-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	71	54937	AD Fin Clp
9	9-Aug-09	633966	2006	WALLACE R 07.0940		WDFW		59	60251	AD Fin Clp
9	15-Aug-09	210720	2006	ELLIOTT BAY TRIBAL NP	KETA CREEK HATCHERY	MUCK		66	57359	AD Fin Clp
9	15-Aug-09	210744	2006	KALAMA CR 11.0017	KALAMA CR HATCHERY	NISQ		61	57448	AD Fin Clp
9	16-Aug-09	632964	2004	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		83	57054	AD Fin Clp
9	22-Aug-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		57	28705	AD Fin Clp
9	26-Aug-09	053768	2007	SPRING CR 29.0159	SPRING CR NFH	FWS	052978	56	54945	Unmarked

Appendix G-2. CWTs recovered from Chinook salmon during the Area 10 July 16-August 31, 2009 mark-selective Chinook fishery.

Area	Recov. Date	Tag Code	Brood Year	Release Site	Rearing Hatchery	Rel. Agency	DIT codes	FKLcm	Label	Mark
10	17-Jul-09	633885	2006	ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW		68	57834	AD Fin Clp
10	17-Jul-09	633482	2006	JOHN CR + HAMMA R	RFEG 6 HOOD CANAL	WDFW		65	56652	AD Fin Clp
10	19-Jul-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	73	57388	AD Fin Clp
10	23-Jul-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	84	57390	AD Fin Clp
10	23-Jul-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	72	57389	AD Fin Clp
10	25-Jul-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	91	57417	AD Fin Clp
10	25-Jul-09	210801	2007	KALAMA CR 11.0017	KALAMA CR HATCHERY	NISQ			57393	AD Fin Clp
10	25-Jul-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	65	57416	AD Fin Clp
10	25-Jul-09	633375	2005	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		83	57392	AD Fin Clp
10	26-Jul-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		72	54216	AD Fin Clp
10	26-Jul-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		58	57303	AD Fin Clp
10	27-Jul-09	634271	2007	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW	634270,634272	54	57308	AD Fin Clp
10	29-Jul-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		61	57352	AD Fin Clp
10	31-Jul-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		69	57394	AD Fin Clp
10	1-Aug-09	633886	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		73	57141	AD Fin Clp
10	1-Aug-09	633375	2005	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		89	57140	AD Fin Clp
10	1-Aug-09	633472	2005	CHAMBERS CR 12.0007	LAKEWOOD HATCHERY	WDFW		60	57142	AD Fin Clp
10	2-Aug-09	633469	2005	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		80	57143	AD Fin Clp
10	2-Aug-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	68	54936	AD Fin Clp
10	2-Aug-09	632979	2005	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		71	57395	AD Fin Clp
10	3-Aug-09	633372	2005	BIG SOOS CR 09.0072	SOOS CREEK HATCHERY	WDFW	633371	81	57396	AD Fin Clp
10	3-Aug-09	633967	2006	GREEN R 09.0001		WDFW		52	54984	AD Fin Clp
10	6-Aug-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		71	57147	AD Fin Clp
10	6-Aug-09	633971	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		78	57399	AD Fin Clp
10	7-Aug-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		75	54989	AD Fin Clp
10	7-Aug-09	633969	2006	CHAMBERS CR 12.0007	LAKEWOOD HATCHERY	WDFW		68	57402	AD Fin Clp
10	8-Aug-09	633875	2006	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW	633876	65	57405	AD Fin Clp
10	8-Aug-09	633966	2006	WALLACE R 07.0940		WDFW		59	57403	AD Fin Clp
10	8-Aug-09	633285	2005	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210682	73	57326	AD Fin Clp
10	9-Aug-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		67	57242	AD Fin Clp
10	11-Aug-09	633964	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		68	57407	AD Fin Clp
10	11-Aug-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	73	57150	AD Fin Clp
10	11-Aug-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		67	57408	AD Fin Clp
10	13-Aug-09	633389	2006	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW	633390	72	42843	AD Fin Clp
10	14-Aug-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	72	57357	AD Fin Clp
10	14-Aug-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		75	57356	AD Fin Clp
10	15-Aug-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	62	58003	AD Fin Clp
10	15-Aug-09	633967	2006	GREEN R 09.0001		WDFW		61	54040	AD Fin Clp
10	15-Aug-09	210688	2006	COWSKULL ACCLIM POND	COWSKULL ACCLIM POND	PUYA		65	57245	AD Fin Clp
10	15-Aug-09	633882	2006	BIG SOOS CR 09.0072	SOOS CREEK HATCHERY	WDFW	633883	56	58002	AD Fin Clp
10	15-Aug-09	633886	2006	FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW		76	57410	AD Fin Clp
10	17-Aug-09	633889	2006	VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW		53	58006	AD Fin Clp
10	17-Aug-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		65	57257	AD Fin Clp
10	19-Aug-09	633391	2006	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		71	57219	AD Fin Clp
10	20-Aug-09	633579	2006	GROVERS CR 15.0299	GROVERS CR HATCHERY	SUQ	210737	77	58008	AD Fin Clp
10	21-Aug-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		68	57361	AD Fin Clp
10	29-Aug-09	633968	2006	CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW		50	57222	AD Fin Clp
10	30-Aug-09	210788	2007	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ		50	57224	AD Fin Clp

Appendix H-1. Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the Area 9 July 16-August 31, 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.

				Est. Effort		Est. Retained Chinook		Est. Other Sp. Retained					Est. Released Chinook			Est. Other Sp. Released				
Month	**Stat. Week**	**Start Date**	**End Date**	**Boats**	**Anglers**	**AD**	**UM**	**AD Coho**	**UM Coho**	**Pink**	**Sockeye**	**Chum**	**AD**	**UM**	**UNK**	**AD Coho**	**UM Coho**	**Unk Coho**	**Pink**	**Unk Salmon**
July	29	16-Jul	19-Jul	2,499	5,365	1,092	2	53	51	0	0	0	545	452	530	16	16	74	20	58
	30	20-Jul	26-Jul	2,280	4,844	613	0	40	40	28	3	0	230	321	388	17	57	62	13	160
	31	27-Jul	02-Aug	2,771	5,750	586	10	42	44	193	0	3	301	439	459	51	73	82	59	257
August	32	03-Aug	09-Aug	2,563	5,636	408	0	38	66	1,431	0	0	257	357	546	27	41	69	174	403
	33	10-Aug	16-Aug	2,852	6,271	260	0	110	121	4,702	0	0	246	227	301	10	34	41	579	182
	34	17-Aug	23-Aug	2,768	6,522	149	0	165	124	9,982	0	0	166	187	175	3	9	16	475	104
	35	24-Aug	30-Aug	3,102	7,032	102	6	309	485	12,908	0	0	79	176	131	0	25	29	1,061	39
	36	31-Aug	31-Aug	384	798	18	2	36	59	1,482	0	0	13	26	12	0	2	3	133	2
Total Private Boat Estimates:				19,219	42,219	3,228	20	794	991	30,726	3	3	1,836	2,185	2,543	124	257	376	2,514	1,204
Total from Charters (Count):				2	6	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Season Total (Private + Charter):				19,221	42,225	3,229	20	794	991	30,726	3	3	1,838	2,185	2,543	124	257	376	2,514	1,204
Variance				1,384,152	7,016,778	144,967	96	4,389	10,765	9,722,829	1	1	20,371	27,674	47,598	1,258	1,750	2,024	70,755	31,934
Standard Error:				1,176	2,649	381	10	66	104	3,118	1	1	143	166	218	35	42	45	266	179
CV (%):				6%	6%	12%	50%	8%	10%	10%	46%	47%	8%	8%	9%	29%	16%	12%	11%	15%
95% CI:				16,913-21,524	37,027-47,410	2,481-3,974	3-39	664-924	788-1,194	24,615-36,838	1-5	1-5	1,557-2,116	1,859-2,511	2,115-2,971	54-193	175-339	288-464	1,993-3,035	854-1,555

Appendix H-2. Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the Area 10 July 16-August 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.

				Est. Effort		Est. Retained Chinook		Est. Other Sp. Retained			Est. Released Chinook			Est. Other Sp. Released					
Month	Stat. Week	Start Date	End Date	Boats	Anglers	AD	UM	AD Coho	UM Coho	Pink	AD	UM	UNK	AD Coho	UM Coho	Unk Coho	Pink	Chum	Unk Salmon
July	29	16-Jul	19-Jul	1,128	2,308	133	3	85	64	3	77	51	230	33	34	108	3	0	239
	30	20-Jul	26-Jul	1,820	3,570	266	0	95	109	34	187	168	530	28	32	348	23	0	597
	31	27-Jul	02-Aug	1,365	2,734	227	2	67	71	116	200	217	694	35	37	346	53	0	754
August	32	03-Aug	09-Aug	1,690	3,252	368	12	101	75	727	134	185	689	60	48	251	286	6	552
	33	10-Aug	16-Aug	1,273	2,537	251	3	81	107	1,115	115	95	231	28	6	92	505	3	581
	34	17-Aug	23-Aug	1,891	3,789	225	0	180	102	2,307	130	155	392	8	20	47	577	0	647
	35	24-Aug	30-Aug	2,344	4,451	104	2	436	316	3,102	142	202	630	19	30	171	988	0	792
	36	31-Aug	31-Aug	295	537	11	0	55	40	369	19	30	48	3	4	23	125	0	94
Total Private Boat Estimates:				11,805	23,179	1,585	22	1,100	884	7,773	1,005	1,104	3,444	212	212	1,385	2,559	8	4,254
Total From Charters (Count):				22	76	36	0	0	0	0	19	28	0	0	0	0	0	0	0
Season Total (Private + Charter):				11,827	23,255	1,621	22	1,100	884	7,773	1,024	1,132	3,444	212	212	1,385	2,559	8	4,254
Variance				134,709	528,815	12,033	21	5,356	2,861	374,127	4,488	4,927	45,004	597	347	11,988	60,166	24	76,873
Standard Error:				367	727	110	5	73	53	612	67	70	212	24	19	109	245	5	277
CV (%):				3.1%	3.1%	6.9%	20.7%	6.7%	6.0%	7.9%	6.7%	6.4%	6.2%	11.5%	8.8%	7.9%	9.6%	58.3%	6.5%
95% CI:				11,086-12,524	21,753-24,604	1,370-1,800	13 - 31	957-1,244	779-989	6,574-8,972	1-5	1-5	3,028-3,859	164 - 260	175 - 248	1,171-1,600	2,079-3,040	1-18	3,711 -4,798

Appendix I. Season-total estimates of Chinook encounters by size/mark status, and total estimates of angler effort, summarized for the previous and current seasons of the Areas 9 and 10 summer mark-selective Chinook fisheries.

Area	Season Dates	Year	Effort (Angler-trips)	Retained Chinook				Released Chinook				Total Encounters
				LM	LU	SM	SU	LM	LU	SM	SU	
9	July 16 - July 31	2007	18,160	5,094	13	146	20	711	1,111	1,286	317	8,697
9	July 16 - Aug 15	2008	20,399	4,035	3	10	0	597	1,608	3,212	3,826	13,290
9	July 16 - Aug 31	2009	42,219	3,090	20	139	0	462	1,272	8,256	2,905	16,143
10	July 16 - July 28	2007	8,374	1,469	30	70	8	209	497	3,101	723	6,107
10	July 16 - Aug 15	2008	13,808	1,027	3	4	0	128	510	189	385	2,246
10	July 16 - Aug 31	2009	23,179	1,505	22	116	0	220	82	2,488	1,017	5,450