Marine Areas 8-1 and 8-2
Mark-Selective Recreational Chinook Fishery,
November 1, 2007-April 30 2008

Post-season Report

REVISED DRAFT

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EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife (WDFW) implemented a winter mark-selective Chinook fishery (MSF) in Marine Areas 8-1 and 8-2 for the third time between November 1, 2007 and April 30, 2008. Consistent with the 2004 Puget Sound Chinook Harvest Management Plan (Puget Sound Indian Tribes and WDFW 2004) and the intent of previous Puget Sound/Strait of Juan de Fuca mark-selective Chinook fisheries, the primary goal for this fishery was to provide meaningful opportunity to the recreational angling public while minimally impacting ESA-listed Puget Sound Chinook salmon. WDFW's Puget Sound Sampling Unit (PSSU) implemented an intensive monitoring program in Areas 8-1 and 8-2 during the November-April season in order to collect the data needed to estimate key parameters characterizing the fishery and its impacts on unmarked salmon. Sampling activities included dockside creel sampling, test fishing, and on-the-water effort surveys. Among other parameters, 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 15 different access sites (9 in 8-1, 6 in 8-2; 2 total on any given sampling day) on 125 of the 182 days that Areas 8-1 and 8-2 were open to Chinook retention under mark-selective regulations. Samplers interviewed an estimated 28% and 49% of all anglers fishing in Areas 8-1 (n = 907 private, 6 charter) and 8-2 (n = 2,718 private, 61 charter), respectively. Additionally, they sampled 36% and 54% of all marked Chinook harvested in the two respective areas (n = 244 in 8-1, 469 in 8-2). Other PSSU staff conducted 42 on-the-water effort surveys (22 in 8-2, 20 in 8-2), and spent 245 days (1,279 hours) on the water pursuing Chinook using test fishing methods, in support of Areas 8-1 and 8-2 monitoring efforts.

Based on the combination of sampling activities, we estimated that nearly 9,000 angler trips (3,288 in 8-1, 5,678 in 8-2) were completed by private and charter anglers in the two combined areas between November and April. With a season-wide CPUE of 0.21 Chinook retained per angler trip in Area 8-1 and 0.16 in Area 8-2, these anglers harvested a grand total of 674 and 869 marked Chinook in the respective areas (1,543 total); they released an estimated 2,321 Chinook (1,441 marked, 881 unmarked) in Area 8-1 and 1,540 Chinook (1,056 marked, 484 unmarked) in Area 8-2 (i.e., 3,860 releases overall). Over the two areas, harvested Chinook averaged 64 cm (range: 45 to 91 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, 95 and 91% of legal size). Nearly two-thirds of all harvested individuals were 3-year olds (i.e., brood year 2004 for age-3 fish caught before [10%] and 2005 for fish caught on or after January 1, 2008 [56%]). In addition to taking length measurements and scale samples, ramp samplers recovered 56 CWTs from marked Chinook

[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.

harvested in the Areas 8-1 and 8-2 fishery. The majority of these tags (87.5%) were from Puget Sound (48.2% from north, 21.4% from central, and 17.9% from south Puget Sound facilities) and Hood Canal (10.7%) release sites.

During their six months of sampling in Areas 8-1 and 8-2 while it was open under mark-selective regulations, test fishers encountered 562 Chinook salmon, 73% (70% in 8-1, 79% in 8-2) of which were marked and 50% (54% in 8-1, 45% in 8-2) of which were of legal size. With a "CPUE" of 0.50 (legal-marked Chinook encounters / angler trip; 0.69 for 8-1, 0.35 for 8-2), test fishers encountered legal-marked Chinook at a higher rate than private fleet anglers but at a rate similar to that of charter anglers. With mean lengths of 56 cm (8-1 marked and unmarked mean) and 55 cm (8-2 marked and unmarked mean), the distribution of encountered Chinook lengths was centered about the legal size limit (56 cm) in both areas. Further, based the results of scale-reading efforts, brood year 2005 fish made up an overwhelming majority (80+%) of test fishery encounters. Throughout the six-month season, test fishery samples indicated that high mark rates and moderate legal-size fractions persisted during each month, with one in three Chinook encounters being legally harvestable (i.e., $\geq$22 in [56 cm] *and* marked) on average. In total, we estimated the season-wide size/mark-status composition at 37.8% legal-marked (LM), 16.2% legal-unmarked (LU), 31.8% sublegal-marked (SM), and 14.1% sublegal-unmarked (SU) in Area 8-1 and 36.2% LM, 8.3% LU, 42.8% SM, and 12.7% SU in Area 8-2. Finally, in addition to fishing in Areas 8-1 and 8-2 during its MSF season, test fishers sampled Chinook in both areas during the October 2008 closure in order to maintain a consistent time series of monitoring (i.e., it was open under MSF regulations during October 2005 and 2006). Results demonstrate that high mark rates existed in both areas before seasons opened and that the majority of Chinook present were sublegal in size (76% in 8-1, 91% in 8-2).

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 combined areas. In total, 5,428 Chinook were encountered (retained and released) during the combined Areas 8-1 and 8-2 fishery, with 1,642 of these being legal-marked, 505 legal-unmarked, 2,398 sublegal-marked, and 3,281 sublegal-unmarked individuals. Among released encounters, an estimated 31 legal-marked, 73 legal-unmarked, 457 sublegal-marked, and 176 sublegal-unmarked Chinook (737 overall, 60% in 8-1, 40% in 8-2) were estimated to have died due to handling and release effects. Thus, in total, 2,033 marked (77% due to direct harvest) and 271 unmarked Chinook mortalities occurred as a result of the Areas 8-1 and 8-2 fishery. Although estimated unmarked (legal and sublegal) and sublegal-marked Chinook impacts were considerably less than what was expected based on pre-season Fishery Regulation Assessment Model runs (model run 3907), the impact of the Areas 8-1 and 8-2 fishery on legal-sized, marked Chinook (i.e., modeled harvest) was similar to what was anticipated. Finally, regarding impacts of MSFs on the coded-wire tag (CWT) program, we estimated that 7 unmarked Chinook belonging to double-index tag (DIT) groups may have died due to the handling-and-release impacts of 2007-2008 Areas 8-1 and 8-2 fishery.

INTRODUCTION

In recent years, abundant runs of hatchery Chinook salmon (*Oncorhynchus tshawytscha*) have been mixed with depressed runs of wild Chinook salmon in the marine environments of the Puget Sound and Strait of Juan de Fuca. Providing recreational anglers with opportunities to harvest abundant hatchery stocks while simultaneously protecting weaker, wild stocks has proven to be a significant conservation and management challenge. The combination of large-scale hatchery marking (i.e., fin clipping) programs and mark-selective harvest regulations makes it possible for anglers to pursue and harvest hatchery Chinook salmon while minimally impacting wild salmon populations. In such "mark-selective fisheries" (MSFs), anglers are generally allowed to retain adipose-fin clipped ("marked") hatchery fish and are required to release unharmed any unclipped ("unmarked", predominantly wild) salmon encountered[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 2006-07 fishing season, pilot *summer* selective Chinook seasons have occurred in Areas 5 and 6 for five years (2003-2007; WDFW 2008a) and in Areas 9, 10, 11, and 13 for one year (2007; WDFW 2007a and 2007b); pilot *winter* selective Chinook fisheries have occurred in Areas 8-1 and 8-2 for two complete seasons (2005-06 and 2006-07; WDFW 2008b). From November 1, 2007 to April 30, 2008, the Washington Department of Fish and Wildlife (WDFW) implemented a winter mark-selective Chinook fishery in Areas 8-1 and 8-2 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 8-1 and 8-2 selective Chinook fishery, WDFW's Puget Sound Sampling Unit was tasked with implementing an intensive monitoring program during the entirety of its November-April 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 2007), we tailored our sampling so that we could reliably estimate: *i*) the mark rate of the targeted Chinook population, *ii*) the total number of Chinook salmon harvested (by size [legal or sublegal] and mark-status [marked or unmarked] group), *iii*) the total number of Chinook salmon released (by size and mark-status group), *iv*) the coded-wire tag- (CWT) and/or DNA-based stock composition of marked and

[2]The regulations specific to the 2007-8 Areas 8-1 and 8-2 mark-selective fishery allowed for the retention of up to two legal-sized ($\geq$22 inches [56 cm]) marked Chinook salmon per day and required the immediate release of all unmarked or sublegal Chinook. Additionally, anglers were: *i*) required to use single-point, barbless hooks while fishing for salmon, *ii*) held to a combined (all salmon species) two-fish daily limit during the Areas 8-1 and 8-2 mark-selective fishery, and *iii*) held to a handling rule that prevented them from bringing unmarked and/or sublegal Chinook aboard their vessels.

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

METHODS

Marine Catch Area Description

Area 8-1 includes the marine waters extending from Deception Pass southward through Skagit Bay and Saratoga Passage (south of Fidalgo Island) between Whidbey Island and Camano Island. Area 8-2 encompasses all marine waters from Port Susan south to Port Gardner, between Everett and Whidbey Island (**Figure 1**). During the 2007-8 season, fishing was permitted throughout both areas, excluding waters in and immediately adjacent to Tulalip Bay (Area 8-2). As in other winter salmon fisheries in Puget Sound, immature Chinook salmon ("blackmouth") were the predominant fish targeted and encountered in Areas 8-1 and 8-2 during the winter months.

Monitoring Program Overview

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

[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.

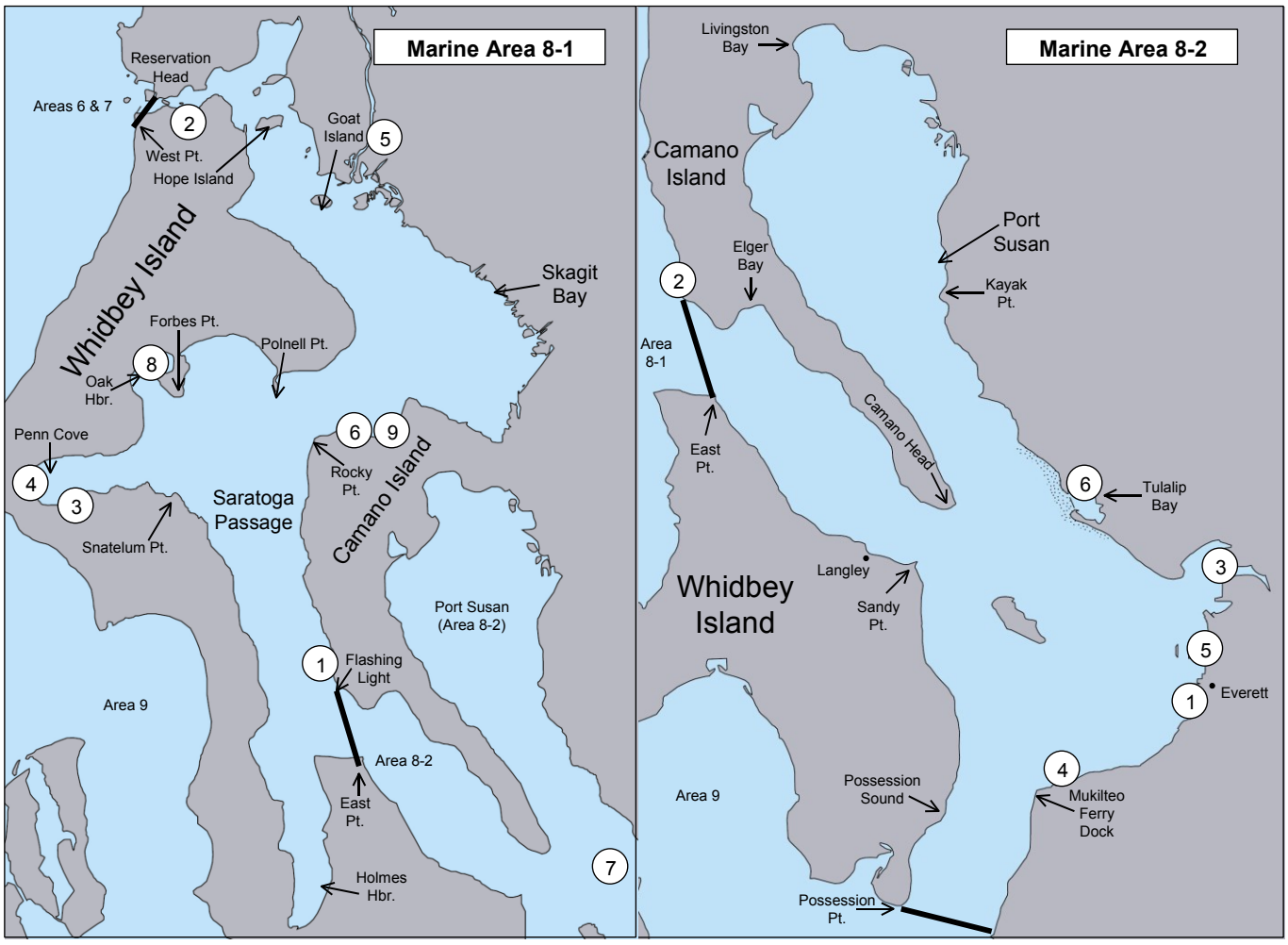

Figure 1. Map of Marine Catch Areas 8-1 (*left panel*) and 8-2 (*right panel*) in Puget Sound, where the third season of the pilot selective Chinook fishery occurred from November 2007-April 2008. Circled numbers correspond to access sites sampled during the 2007-2008 selective fishery (*Area 8-1*: 1 = Camano Island State Park, 2 = Cornet Bay State Park, 3 = Coupeville Ramp, 4 = Holmes Harbor [Freeland] Ramp, 5 = LaConner Marina, 6 = Maple Grove Ramp, 7 = Norton Street [Everett] Ramp, 8 = Oak Harbor Ramp, and 9 = Utsalady Ramp; *Area 8-2*: 1 = Bayside Marina, 2 = Camano Island State Park, 3 = Dagmar's Landing, 4 = Mukilteo State Park, 5 = Norton Street [Everett] Ramp, and 6 = Tulalip Marina).

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 two temporal strata (weekday [Monday-Thursday], with $n = 2$ days sampled; weekend [Friday-Sunday], with $n = 3$ days sampled) during each week of the fishery. On each selected sample day, we selected two access points (i.e., public ramps, boathouses, etc.) from our Areas 8-1 and 8-2 sample frames for creel sampling. Access site (i.e., cluster) selection was achieved at the second stage using a probability-proportional-to-size (PPS) sampling algorithm (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 8-1 and 8-2 (*Area 8-1*: Camano Island State Park, Cornet Bay State Park, Coupeville Ramp, Holmes Harbor [Freeland] Ramp, LaConner Marina, Maple Grove Ramp, Norton Street [Everett] Ramp, Oak Harbor Ramp, and Utsalady Ramp; *Area 8-2*: Bayside Marina, Camano Island State Park, Dagmar's Landing, Mukilteo State Park, Norton Street [Everett] Ramp, and Tulalip Marina). Given that some effort was excluded from our sample frame (i.e., private and/or low-effort access sites), we also estimated the out-of-frame effort proportion from boat survey data and accounted for this quantity in estimates of fishery-wide totals (e.g., catch and effort).

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

By combining dockside interview data with estimated size measures, we generated daily estimates (and variances) of total fishing effort and landed Chinook catch (by mark-status group) for our sample frame using Murthy's population-total estimator (Murthy 1957, Cochran 1977, WDFW 2008b). We then expanded these estimates to account for the out-of-frame effort proportion and then again to obtain stratum-wide totals (**Table 1**). To minimize the influence of recall bias on our assessment, we estimated Chinook releases as the difference between retained catch (i.e., from the Murthy estimator, based on *observed* landings) and total Chinook encounters (i.e., releases = encounters – retained catch) generated using the bias-corrected Conrad and McHugh (2008) approach. Briefly, encounters were

[4] In a recent 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 8-1 and 8-2 fishery.

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 creel data for these anglers through a separate but comprehensive effort. We contacted all salmon charters known to be operating in Areas 8-1 and 8-2 during the winter months and coordinated with them so that they would complete and return creel information for all trips taken using supplied Voluntary Trip Report (VTR) forms. For these anglers, total salmon catch (kept and released) and fishing effort data were assumed to be the result of a complete census and therefore simply added to the survey-based estimates generated for the private fleet. Although they were not used in producing creel estimates, VTRs were also completed and returned by a subset of private fleet anglers.

Test Fishery Methods

In order to obtain accurate estimates (i.e., free from survey-based recall error) of the size (legal or sublegal) and mark-status (marked or unmarked) composition of the pool of Chinook salmon encountered by anglers participating in the fishery, we conducted a recreational test fishery during the entirety of the mark-selective Chinook season (**Table 1**). Our test boat crew consisted of two WDFW technicians, each fishing with a single rod for five days a week (Monday-Friday). Test fishers focused their efforts at locations that optimized their overall encounter rate and mirrored choices made by the at-large private fleet. Also, test fishers fished for Chinook using the same methods as the recreational fleet, as prescribed by supervisory staff based on dockside interview results for the preceding week. For each fish brought to boat, test fishers logged details on its identity (species), size (fork length and total length), and, if appropriate, mark status (marked or unmarked). For Chinook salmon encounters only, test fishers additionally collected scale and DNA samples (~1-cm^2 piece of dorsal tissue).

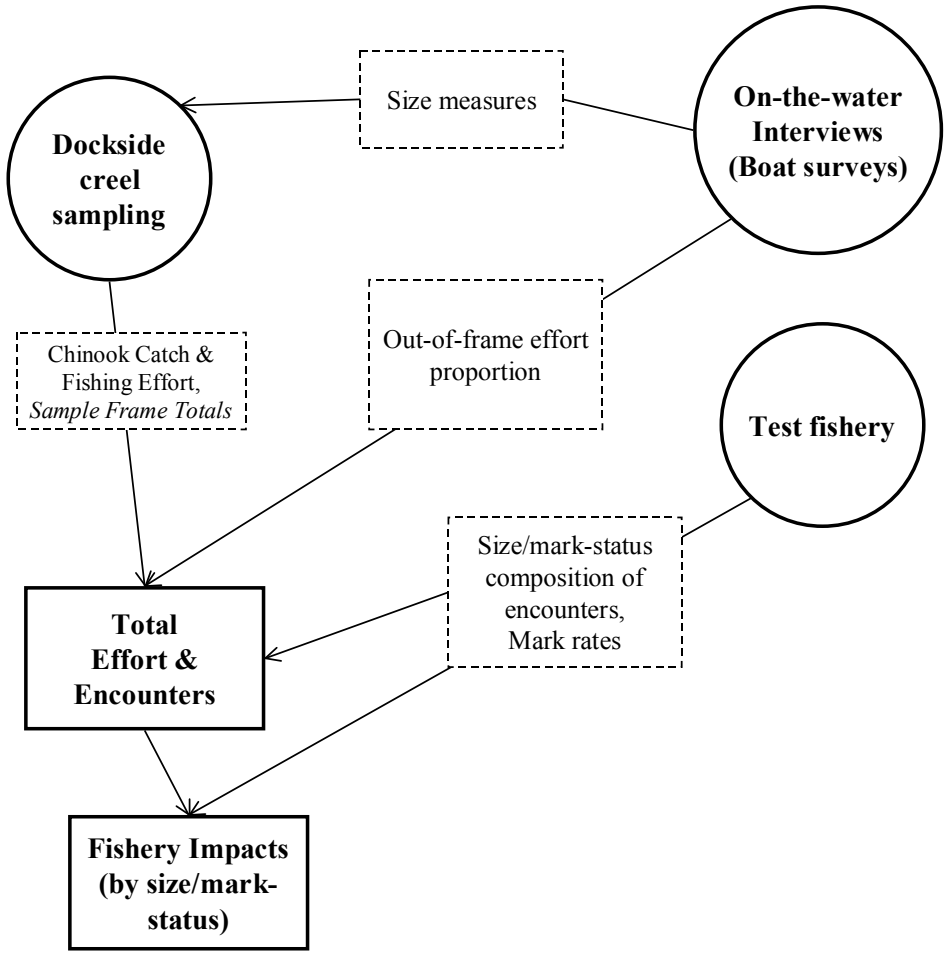

Figure 2. Conceptual diagram of the monitoring plan implemented in Areas 8-1 and 8-2 during the November 2007-April 2008 mark-selective Chinook season. Circles represent discrete sampling activities, dashed boxes represent parameters that are estimated using data from a given activity, and solid boxes depict key quantities estimated from the comprehensive plan. 'Encounters' includes both harvested and released Chinook salmon.

Estimating Fishery Impacts

Total Encounters and Mortalities

We characterized the overall impacts of the fishery in terms of grand-total estimates of encounters and mortalities and by using estimates specific to each of the four size/mark-status groups (i.e., legal-marked [LM], sublegal-marked [SM], legal-unmarked [LU], and sublegal-unmarked [SU]; **Table 1**). As indicated above and in contrast to previous post-season Areas 8-1 and 8-2 reports, 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. 3907) for each size and mark status category.

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

Activity	Focal Parameter(s)	Secondary Parameter(s)	Sample Unit(s)	Finest Estimation Time Step	Comments
Dockside Creel Sampling	Fishing effort (boat & angler trips); kept and released fish[1]	Catch rates (CPUE); length, age, and CWT composition of harvest[2]	Angler trip; kept fish; reported fish release	Week[1]	Within weeks, estimates are also produced by strata (weekday/weekend).
Test Fishing	Size (legal/sublegal) and mark-status composition (marked, unmarked) of encountered Chinook	Chinook length, age, and DNA-based[3] stock composition; species composition of non-Chinook encounters	Fish encounter	Month	Too few encounters occurred to assess mark rates on a finer time scale.
Overall Fishery Impacts Estimation	Total Chinook encounters and mortalities, by size/mark-status group	Ratios of encounters and mortalities per kept Chinook	N/A	Season (6 months)	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 (6 months)	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 8-1 and 8-2 fishery on the CWT program, we estimated the total number of unmarked-tagged Chinook mortalities that may have occurred during the course of its six-month, November-April, season. To do this, we acquired information for all marked CWT double index tag (DIT) groups present in landed catch from the Pacific States Marine Fisheries Commission's Regional Mark Information System (RMIS) and then applied the methods described by the Selective Fisheries Evaluation Committee – Analysis Work Group (SFEC-AWG 2002) to estimate the number of unmarked DIT fish encountered[5]. We subsequently estimated the number of these fish that may have died due to hook-and-release impacts using an *sfm* analogous that used in FRAM modeling. Given our interest in characterizing the impacts of mark-selective regulations on the CWT program and not recreational fishing in general, we used an *sfm* 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.

RESULTS & DISCUSSION

Summary of Sampling Efforts

Sampled Access Sites

Between November 1, 2007 and April 30, 2008, we sampled the recreational creel on a grand total of 125 days in Area 8-1 and Area 8-2, visiting nine and six different access sites in the two respective areas (**Table 2**). In Area 8-1, we visited Camano Island State Park (30% of sampled days) and Oak Harbor ramps (28% of sampled days) most frequently. The majority of remaining Area 8-1 sampling effort was spent at Maple Grove and Coupeville ramps. In Area 8-2, we sampled Norton Street Ramp on all sample days; Camano Island State Park and Bayside Marine comprised the majority of the sampling effort remainder. In both areas, we made minor alterations to our sample frame in response to in-season changes in size measures (i.e., from on-the-water surveys, described below) or due to logistical considerations (e.g., temporary ramp closures [Camano Island State Park, late November]).

[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.

In total, our Area 8-1 angler interview efforts allowed us to directly sample 907 completed angler trips and 407 completed boat trips. In Area 8-2, we collected data on a total of 2,718 angler trips and 1,381 boat trips. In addition to interviewing these anglers and sampling their catch, we also obtained samples from baseline recreational sampling activities that were ongoing during the Areas 8-1 and 8-2 season.

On-the-Water Survey Summary

During the 6-month period that Area 8-1 was open under mark-selective regulations, we conducted 525 on-the-water interviews (i.e., total anglers intercepted [n = 263 boats]) over a total of 22 boat surveys (**Table 3**; **Appendix D-1**). In Area 8-2, we conducted 20 total surveys and intercepted 647 anglers (n = 352 boats; **Table 3**; **Appendix D-2**). These surveys yielded quantitative details about the set of sites anglers used to access Areas 8-1 and 8-2 and thus allowed us to estimate the proportion of effort originating at each of our sample-frame sites (i.e., size measures; **Appendix E-1**). As suggested in **Table 2**, Camano Island State Park was the site anglers most frequently reported using to access Area 8-1, followed closely by Oak Harbor and Maple Grove ramps. Pooled over all surveys, 14% of all anglers interviewed during Area 8-1 boat surveys indicated that their trip would end at either a private or never-sampled launch site (**Appendix F-1**). In Area 8-2, half of all anglers interviewed reported using Everett (Norton Street) Ramp to access the fishery (**Appendix F-2**); one in five anglers reported using private and/or never-sampled access sites. Boat surveys revealed a modest level of short-term and seasonal variability in the relative "size" of sampled access sites (i.e., in the 8-1/8-2 sample frames; **Appendix E**). We incorporated this variation into our PPS site-selection framework.

Table 2. List of sites sampled, with number of sampling events, during the Areas 8-1 and 8-2, 2007-2008 mark-selective Chinook fishery.

Area 8-1 Sampled Sites	Sample days per month						Total sample days	% of total	Season-total site size[1]
	NOV	DEC	JAN	FEB	MAR	APR			
Camano Island State Park Public Ramp	12	8	11	13	11	14	69	**27.6%**	**30.2%**
Coronet Bay Public Ramp	2						2	**0.8%**	**0.4%**
Coupeville Public Ramp	2	3	8	6	4	4	27	**10.8%**	**6.8%**
Holmes Harbor Public Ramp					3	1	4	**1.6%**	**2.9%**
LaConner Marina/Sling				2			2	**0.8%**	**2.0%**
Maple Grove Ramp, Camano Is	7	6	7	7	10	9	46	**18.4%**	**21.1%**
Norton Street (Everett) Ramp						7	7	**2.8%**	**12.8%**
Oak Harbor Marina & Public Ramp	17	14	14	10	12	9	76	**30.4%**	**19.8%**
Utsalady Ramp, Camano Is	4	7	6				17	**6.8%**	**4.0%**
TOTAL	44	38	46	38	40	44	250		

Area 8-2 Sampled Sites	Sample days per month						Total sample days	% of total	Season-total site size[1]
	NOV	DEC	JAN	FEB	MAR	APR			
Bayside Marine	4	2	1	4	1	5	17	**9.6%**	**10.7%**
Camano Island State Park Public Ramp	4	4	5	3	5	4	25	**14.0%**	**14.5%**
Dagmar's Landing, Forklift Launch	1	1	4		2		8	**4.5%**	**7.2%**
Mukiteo State Park Public Ramp	1	1					2	**1.1%**	**0.9%**
Norton Street (Everett) Ramp	22	19	23	19	20	22	125	**70.2%**	**65.9%**
Tulalip Marina & Ramp				1			1	**0.6%**	**0.8%**
TOTAL	32	27	33	27	28	31	178		

[1] Estimated from on-the-water boat surveys; value is relative to sites included in sample frame only (See **Appendices D** and **E** for unadjusted values).

Table 3. Monthly summary of boat surveys conducted during the Areas 8-1 and 8-2 2007-2008 mark-selective Chinook fishery.

Boat survey schedule: Areas 8-1 & 8-2		
Month	**Area 8-1**	**Area 8-2**
November	1st, 3rd, 6th, 17th	1st, 3rd, 19th, 24th
December	5th, 9th, 10th, 29th	9th, 21st, 22nd
January	13th, 18th, 19th, 23rd	16th, 19th, 24th, 26th
February	14th, 16th, 21st, 23rd	2nd, 14th, 16th, 22nd
March	6th, 9th, 29th, 30th	7th, 16th, 22nd, 31st
April	3rd, 5th	2nd
Total Number	**22**[a]	**20**

[a] An additional 2 surveys were initiated but called off due to unsafe conditions.

Fishery Characteristics

Estimates of Fishing Effort and Chinook Catch

Charter and private anglers completed an estimated total of nearly 9,000 angler trips and 4,500 boat trips during the six-month combined Areas 8-1 and 8-2 mark-selective blackmouth fishery. As in previous seasons, approximately one-third of this effort occurred in Area 8-1 and two-thirds in Area 8-2 (**Table 4-1** and **4-2**). Charter anglers made up a minor portion of total angling effort (1% or less) in both areas. Further, both areas exhibited similar month-to-month patterns in angling effort over the course of the season (**Figure 3**). November was the most active (38% of 8-1 total, 26% of 8-2 total; due largely to the co-occurrence of fair weather and a recreational crab opening on Thanksgiving weekend) and December the lease active (8% of 8-1 total, 5% of 8-2 total) month of fishing during the six-month season.

Chinook salmon catch rates (CPUE, charter and private combined) averaged 0.21 and 0.16 landed Chinook per angler trip in Areas 8-1 and 8-2, respectively, but varied considerably from month to month. In both areas, CPUE peaked at ~0.3 (0.31 in 8-1 [Jan.] and 0.34 in 8-2 [Dec.]) landed Chinook per angler trip during the December–January period and then steadily declined to an all-season low in April (0.07 CPUE in 8-1 and 8-2; **Figure 4**). Pooled over areas, charter angler CPUE (0.63 landed Chinook per angler trip) was 3.7 times higher than private angler CPUE (0.17 landed Chinook per angler trip).

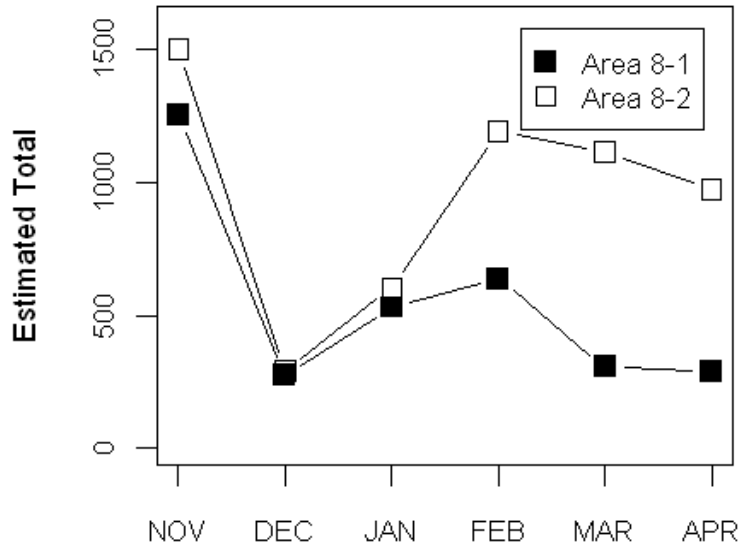

Figure 3. Temporal patterns in fishing effort during the Areas 8-1 and 8-2, November 2007-April 2008, mark-selective Chinook fishery.

Table 4-1. Estimates of total fishing effort and the total number of salmon kept and released during the November 2007-April 2008 Area 8-1 selective fishery. Values may not add exactly due to rounding error.

Month	Date Range	Angler Category	Effort[1]		Retained Chinook[1]		Released Chinook[2]		Chinook Encounters Total
			Boats	Anglers	AD	UM	AD	UM	
NOV	11/1-12/2	Private	612	1,255	267	0	1,159	628	2,054
		Charter	0	0	0	0	0	0	0
DEC	12/3-12/31	Private	153	274	32	0	29	35	96
		Charter	0	0	0	0	0	0	0
JAN	1/1-2/3	Private	325	529	164	0	148	100	412
		Charter	0	0	0	0	0	0	0
FEB	2/4-3/2	Private	307	633	137	0	49	60	245
		Charter	2	6	1	0	0	2	3
MAR	3/3-3/30	Private	158	305	55	5	47	42	148
		Charter	0	0	0	0	0	0	0
APR	3/31-4/30	Private	144	286	20	0	8	13	41
		Charter	0	0	0	0	0	0	0
Private subtotal:			1,700	3,282	673	5	1,441	879	2,997
Charter subtotal:			2	6	1	0	0	2	3
Grand Total:			1,702	3,288	674	5	1,441	881	3,000
Standard Error:			142	317	82	4	511	242	888
CV (%):			8%	10%	12%	86%	35%	27%	30%
95% CI:			1,423-1,981	2,667-3,910	513-836	1-12	439-2,442	407-1,354	1,259-4,741

[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.

Table 4-2. Estimates of total fishing effort and the total number of salmon kept and released during the November 2007-April 2008 Area 8-2 selective fishery. Values may not add exactly due to rounding error.

Month	Date Range	Angler Category	Effort		Retained Chinook		Released Chinook		Chinook Encounters Total
			Boats	Anglers	AD	UM	AD	UM	
NOV	11/1-12/2	Private	764	1,501	155	0	314	108	577
		Charter	0	0	0	0	0	0	0
DEC	12/3-12/31	Private	151	280	84	4	167	43	298
		Charter	3	11	10	0	15	6	31
JAN	1/1-2/3	Private	314	587	148	1	198	99	446
		Charter	5	18	16	0	13	4	33
FEB	2/4-3/2	Private	608	1,183	136	7	181	72	396
		Charter	3	9	6	0	4	2	12
MAR	3/3-3/30	Private	531	1,093	239	5	146	110	499
		Charter	9	23	9	0	11	3	23
APR	3/31-4/30	Private	512	973	66	0	8	37	112
		Charter	0	0	0	0	0	0	0
Private subtotal:			2,879	5,617	828	18	1,013	469	2,329
Charter subtotal:			20	61	41	0	43	15	99
Grand Total:			2,899	5,678	869	18	1,056	484	2,428
Standard Error:			97	192	49	7	166	90	308
CV (%):			3%	3%	6%	39%	17%	17%	13%
95% CI:			2,709-3,089	5,301-6,054	774-964	4-32	711-1,401	319-650	1,824-3,031

[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.

Given observed patterns in effort and catch rates, we estimated that anglers harvested a grand total of 1,566 Chinook salmon in the combined Area 8-1/8-2 fishery (679 in Area 8-1, 887 in Area 8-2; **Tables 4-1** and **4-2**). Of these fish, 1,543 were marked (679 in Area 8-1 and 887 in Area 8-2) and 23 (1.5% of harvest total) were unmarked (5 in Area 8-1 and 18 in Area 8-2). Monthly harvest totals averaged 112 and ranged from 20 (April) to 267 (November) in Area 8-1; Area 8-2 monthly totals averaged 145 (range: 66 [April] to 248 [March]). See **Figure 5** for a graphical display of month-to-month harvest patterns.

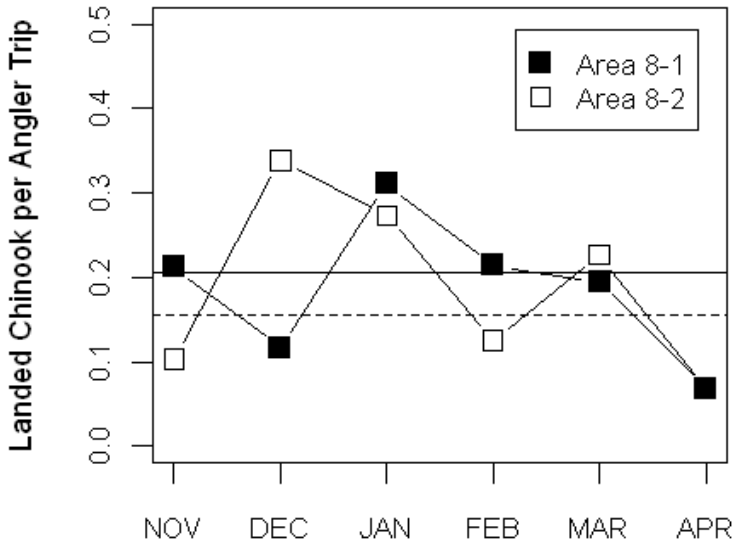

Figure 4. Temporal patterns in CPUE (landed Chinook per angler trip) during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery. The horizontal solid and dashed lines correspond to the season-wide CPUE for Areas 8-1 and 8-2, respectively.

In addition to harvesting 1,566 Chinook salmon, we estimated that anglers participating in the Areas 8-1 and 8-2 MSF caught and released an additional 2,497 marked (1,441 in Area 8-1 and 1,056 in Area 8-2) and 1,385 unmarked Chinook salmon (881 in Area 8-1 and 484 in Area 8-2; **Tables 4-1** and **4-2**)[6]. On a season-total level, anglers released an estimated 2.1 marked and 1.3 unmarked Chinook per harvested fish in Area 8-1; in Area 8-2, they released an estimated 1.2 marked and 0.6 unmarked Chinook per landed fish. For both areas, the greatest number of releases occurred during November (77% [Area 8-1] and 27% [Area 8-2] of season total), whereas the fewest occurred during April (1% [Area 8-1] and 3% [Area 8-2] of season total; **Figure 5**). Thus, release rates (Chinook releases per angler trip) were higher during the earlier compared to the latter portion of the season.

Combining harvest and release estimates, we estimate that anglers encountered a grand total of 3,000 and 2,428 Chinook in Area 8-1 and 8-2, respectively, during the six-month mark-

[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**.

selective season (**Table 4-1**, **4-2**). For additional discussion of fishery impacts from a total encounters perspective, see the subsequent section titled *Overall Fishery Impacts*.

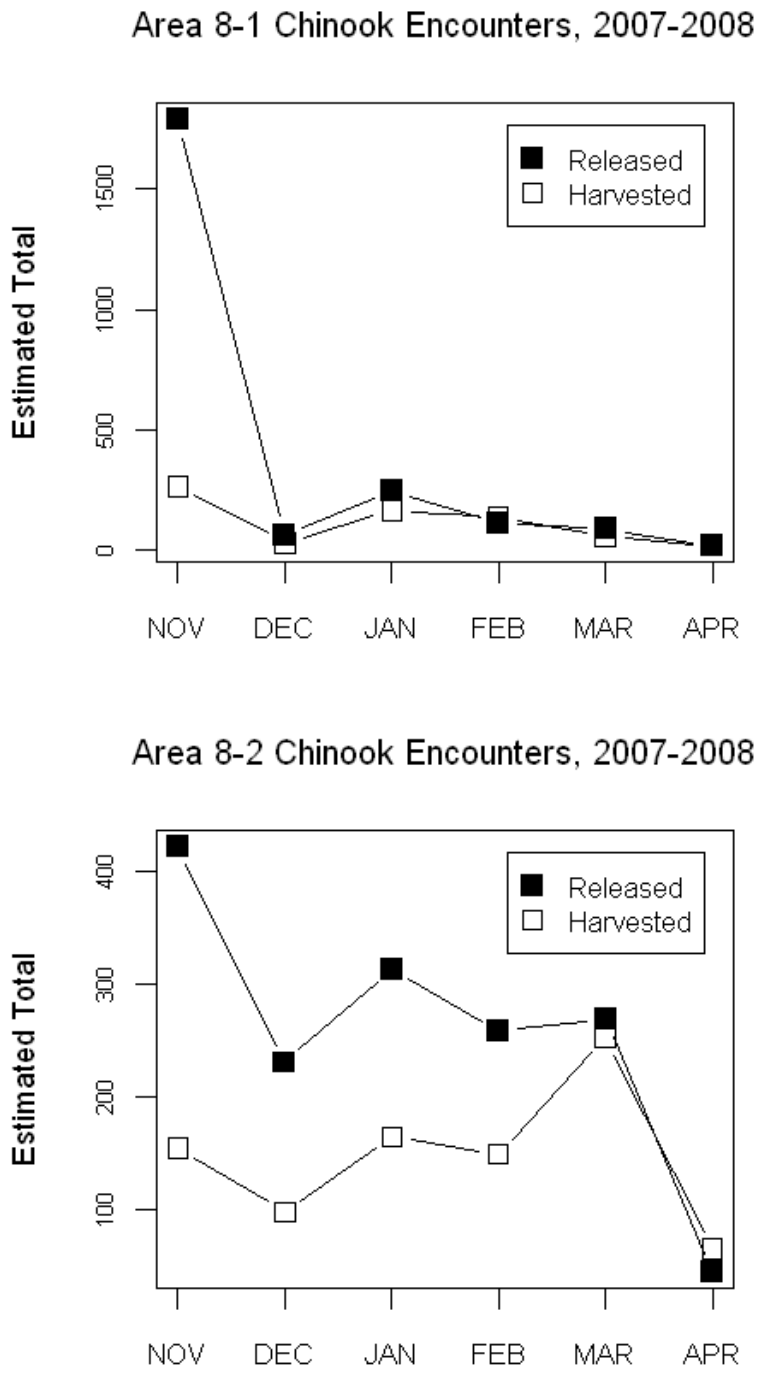

Figure 5. Temporal patterns in total Chinook harvest and releases during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) November 2007-April 2008 mark-selective Chinook fishery.

Characteristics of Harvested Chinook

Length and Age.—During the combined Areas 8-1 and 8-2 mark-selective fishery, 722 (247 in Area 8-1 and 475 in Area 8-2) retained Chinook were sampled at dockside. All of these fish were measured and examined for the presence of a CWT. Marked Chinook harvested from Area 8-1 averaged 65.4 cm TL (range: 45.1-82.5, SD = 7.2) and were slightly longer than those caught in Area 8-2 (average: 63.0 cm TL [range: 49.5-90.5, SD = 6.4]; **Figure 6**). Legally harvestable (≥ 22 in [56 cm] *and* marked) Chinook comprised 90 and 94% 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 8-1 and 8-2, November 2007-April 2008. *Note*: one legal-size fish of undetermined mark status was sampled in Area 8-1.

Marine Area	Mark Type	Number Sampled		
		Legal-size	Sublegal-size	Total
Area 8-1	Marked	231	13	244
	Unmarked	2	0	2
	Total	**233**	**13**	**246**
Area 8-2	Marked	427	42	469
	Unmarked	5	1	6
	Total	**432**	**43**	**475**

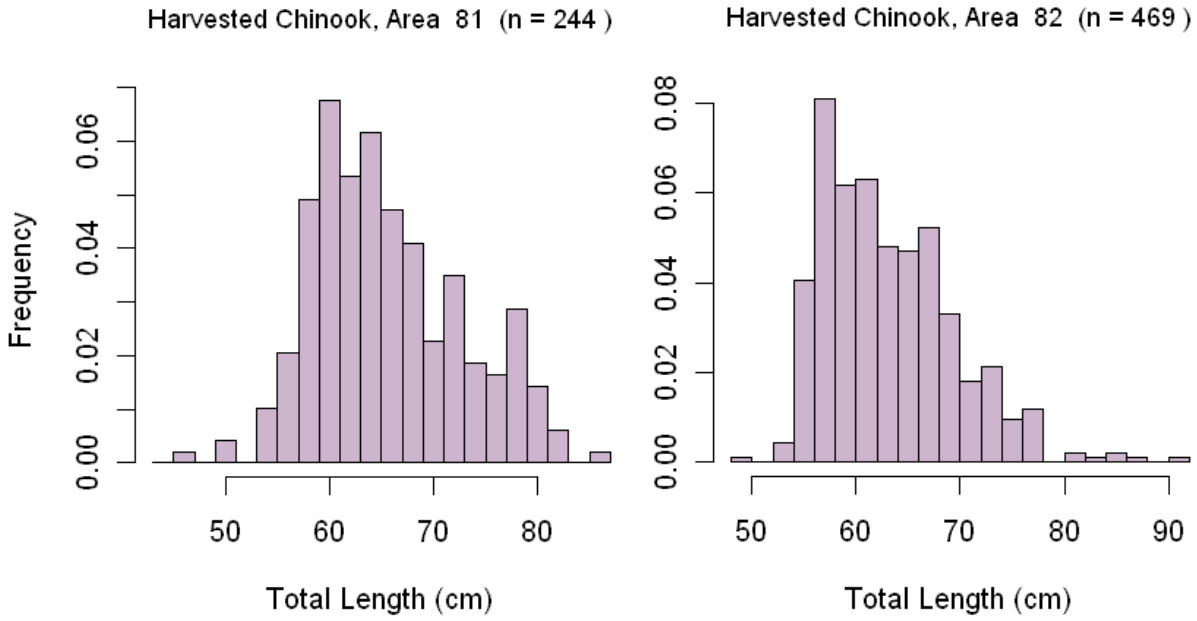

Figure 6. Length-frequency distributions of retained marked Chinook sampled at dockside during the Areas 8-1 (*left panel*) and 8-2 (*right panel*) November 2007-April 2008 mark-selective Chinook fishery.

Though scales were collected from all of the 713 marked Chinook sampled at dockside, only 681 (n = 229 in Area 8-1 and n = 452 in Area 8-2) of these could be successfully aged. Based on these scales, we found that the age composition of Chinook harvest was similar for both areas 8-1 and 8-2 (**Appendix F**). The majority of the retained Chinook were age-3 individuals (60-70%); age-2 and age-4 fish each constituted 15-25% of the harvest total for both areas. Further, approximately one in five retained Chinook were yearling outmigrants.

Table 6. Summary of coded-wire tags recovered from Chinook salmon harvested during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery. The field "No. DITs" corresponds to the number of tags that belonged to double-index tag groups.

Release Region	Release Site	Rearing Location	CWTs Recovered	No. DITs
British Columbia-Fraser River	Chilliwack River	Chilliwack R. Hatch.	1 (1.8%)	1
Hood Canal	Finch Creek	Hoodsport Hatchery	2 (3.6%)	
	Skokomish River	Ricks Pond	4 (7.1%)	
Puget Sound-Central	Big Soos Creek	Unreported	1 (1.8%)	1
	Gorst Creek	Gorst Cr. Pond	1 (1.8%)	
	Green River	Icy Creek Hatchery	1 (1.8%)	
	Grovers Creek	Grovers Creek Hatchery	7 (12.5%)	7
	Grovers Creek Hatchery	Grovers Creek Hatchery	1 (1.8%)	1
	Issaquah Creek	Issaquah Hatchery	1 (1.8%)	
Puget Sound-North	Cascade River	Marblemount Hatchery	9 (16.1%)	7
	Friday Creek	Samish Hatchery	3 (5.4%)	3
	N.F. Nooksack River	Kendall Creek Hatchery	1 (1.8%)	1
	Tulalip Creek	Bernie Gobin Hatchery	3 (5.4%)	
	Wallace River	Wallace River Hatchery	10 (17.9%)	1
	Whitehorse Springs	Whitehorse Pond	1 (1.8%)	
Puget Sound-South	Chambers Creek	Chambers Cr. & Garrison Hatchery	1 (1.8%)	
		Garrison Hatchery	1 (1.8%)	
		Lakewood Hatchery	3 (5.4%)	
	Clear Creek	Nisqually Hatchery	2 (3.6%)	2
	Deschutes River	Tumwater Hatch.	1 (1.8%)	
	Kalama Creek	Kalama Cr. Hatchery	1 (1.8%)	
	Minter Creek	Minter Hatchery	1 (1.8%)	
		Grand Total	56	24

[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).

CWT Samples.—In total, 56 (20 in Area 8-1, 36 in Area 8-2) coded-wire tags were recovered from the Areas 8-1 and 8-2 fishery (**Table 6**). At 48% of the total, CWTs from north Puget Sound release sites (i.e., sites in river basins draining to Areas 8-1, 8-2, or 7) dominated our sample. The remaining 29 tags, ranked from greatest to least, were of central Puget Sound (n = 12), south Puget Sound (n = 10), Hood Canal (n = 6), and Canadian (Fraser Basin) origin (n = 1). Finally, nearly half of all CWTs were associated with a double-index tag group. See **Appendix G** for complete details on individual CWT recoveries.

Test Fishing Results

Fishing Time and Gear Types

Test fishers were scheduled to fish five days per week during the six-month November-April season, weather permitting. Additionally, in order to maintain a time series of test fishery data that would be comparable to the 2005-2006 and 2006-2007 seasons (both ran from October 1-April 30), test fishers also fished during the October 2007 Area 8-1 and 8-2 MSF closure. In total, they spent over 1,200 hours (550 in 8-1, 730 in 8-2) and nearly 250 days (109 in 8-1, 136 in 8-2) on the water pursuing and sampling Chinook in the two areas (**Tables 7, 8-1**, and **8-2**). They fished for an average of 91 hours and 18 days per month. As was the case for the private recreational fleet, bad weather conditions precluded test fishers from fishing on several scheduled sample days during the season, particularly during December. All other losses in test fishing time were due to test fishers' participation in regularly scheduled boat surveys (n = 4 per month, test fishers conducted all of them) or a result of boat maintenance issues (e.g., the Area 8-1 boat was out of the water for repairs during November).

Based on the results from interviews of anglers that reported successfully encountering (retained or released) Chinook salmon (n = 359 in 8-1 and 562 in 8-2 with responses to our fishing methods question), test fishers angled for Chinook using the same methods and in the same proportions as did the private fleet in both areas (χ^2 test of test fishery vs. fleet methods-frequency comparison, $P \geq 0.70$). Thus, during the six months that the fishery was open, test fishers fished primarily by trolling lures and/or bait with downriggers (96.7 in Area 8-1, 98.6 % in Area 8-2; **Table 7**). In Area 8-1, they spent 14.6 out of 440.9 hours (Nov.-Apr. time only) using other methods (i.e., using the "mooching" or "weight-and-bait" technique); in Area 8-2, they spent 7.6 out of 534.1 hours using other methods (6.6 weight and bait; 1.0 jigging).

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

During the open fishery period (Nov.-Apr.), test fishers encountered 333 Chinook total (126 legal-sized and marked [LM], 54 legal-sized and unmarked [LU], 106 sublegal-sized and marked [SM], and 47 sublegal-sized and unmarked [SU]; **Table 8-1**) in Area 8-1 and 229 Chinook total (83 LM, 19 LU, 98 SM, and 29 SU; **Table 8-2**) in Area 8-2. In Area 8-1, 70% of all Chinook encountered between November 1st and April 30th were marked (70% for legal-sized fish only); 54% of all Area 8-1 test fishery encounters were of legal size ($\geq$22 in [56 cm]). During this same period, 79% of all Chinook encounters were marked (81% for legal-sized fish only) and 45% of all encounters were of legal size in Area 8-2. Thus, mark rates were high overall, similar for legal and sublegal fish, and slightly higher (11%) in Area 8-2 than Area 8-1.

In terms of within-season patterns, the mark rate of legal-sized Chinook remained high (>60%) and varied little from month to month (**Figure 7**). In contrast, the proportion of test fishery encounters that were legal in size increased steadily between November (21% of 8-1 total, 31% of 8-2 total) and April (79% of 8-1 total, 90% of 8-2 total). Thus, the ratio of legally harvestable (i.e., LM fish) to non-harvestable fish (i.e., LU, SM, and SU) seen in the test fishery increased markedly over the season (0.2 to 1.1 in Area 8-1, 0.4-1.6 in Area 8-2). Overall, legal-size, marked individuals comprised 38% and 37% of all Chinook encountered in Areas 8-1 and 8-2, respectively, during the six-month season. See **Tables 8-1** and **8-2** for a complete account of Area 8-1 and 8-2 test fishery encounters.

Based on voluntary trip reports (VTRs) returned by private anglers fishing in Areas 8-1 (n = 15 VTRs with 47 encounters) and 8-2 (n = 5 VTRs with 12 encounters) during the November-April MSF period, test fishers and private fleet encounters had similar mark rates and size-class fractions. In Area 8-1, where an adequate number of VTR encounters were available for comparison[7], there were no statistical differences in either the size/mark-status composition ($\chi^2 = 5.3$, df = 3, $P = 0.150$; **Table 9**) or the overall mark rate (test fishery, 70% vs. fleet, 79%; $\chi^2 = 0.01$, df = 1, $P = 0.89$; **Table 9**). Though too few encounters were reported on VTRs to facilitate a similar statistical comparison for Area 8-2, available data indicate that private fleet anglers, like test fishers, experienced a high Chinook mark rate.

Finally, test fishers sampled both areas 8-1 and 8-2 for 18 days each during a pre-season, October fishing period. In addition to the 562 Chinook encountered during the six-month season, they caught and sampled 139 and 76 Chinook in the two respective areas during this month. Similar to what was observed during the season, overall mark rates (legal- and sublegal-sized fish combined) were high in both areas (75% in 8-1 and 76% in 8-2) before the season opened. However, the majority of Chinook encountered were sublegal in size (76% in 8-1, 91% in 8-2; marked and unmarked included). Thus, the majority of fish encountered during October were sublegal in size and marked (58% in 8-1 and 71% in 8-2).

[7] Because Area 8-2 VTRs covered trips that occurred during November, February, and March only, we used only test fishery data from these months for test fishery vs. fleet comparisons.

Table 7. Fishing methods employed by private recreational anglers (from dockside interviews, based on number of boat trips sampled) and test fishers (based on hours fished,) during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery.

Area	Source	Month[1]	Method				
			Downrigger Trolling	Weight & Bait	Diver Trolling	Jigging	Other
Area 8-1	Creel	October (*closed*)	NA	NA	NA	NA	NA
		November (*n* = 107)	99.1%	0.9%	0.0%	0.0%	0.0%
		December (*n* = 35)	94.3%	5.7%	0.0%	0.0%	0.0%
		January (*n* = 47)	100.0%	0.0%	0.0%	0.0%	0.0%
		February (*n* = 73)	95.9%	4.1%	0.0%	0.0%	0.0%
		March (*n* = 56)	96.4%	3.6%	0.0%	0.0%	0.0%
		April (*n* = 41)	82.9%	17.1%	0.0%	0.0%	0.0%
		Total (*n* = 359)	95.8%	4.2%	0.0%	0.0%	0.0%
	Test Fishery	October (*n* = 109.1)	100.0%	0.0%	0.0%	0.0%	0.0%
		November (*n* = 53.3)	98.6%	1.4%	0.0%	0.0%	0.0%
		December (*n* = 45.4)	100.0%	0.0%	0.0%	0.0%	0.0%
		January (*n* = 80.5)	91.7%	8.3%	0.0%	0.0%	0.0%
		February (*n* = 72.0)	98.1%	1.9%	0.0%	0.0%	0.0%
		March (*n* = 80.1)	96.5%	3.5%	0.0%	0.0%	0.0%
		April (*n* = 109.6)	97.3%	2.7%	0.0%	0.0%	0.0%
		Total[2] (*n* = 440.9)	96.7%	3.3%	0.0%	0.0%	0.0%
Area 8-2	Creel	October (*closed*)	NA	NA	NA	NA	NA
		November (*n* = 121)	97.5%	1.7%	0.8%	0.0%	0.0%
		December (*n* = 38)	97.4%	0.0%	0.0%	0.0%	2.6%
		January (*n* = 80)	100.0%	0.0%	0.0%	0.0%	0.0%
		February (*n* = 116)	99.1%	0.0%	0.0%	0.9%	0.0%
		March (*n* = 141)	99.3%	0.7%	0.0%	0.0%	0.0%
		April (*n* = 66)	93.9%	4.5%	0.0%	1.5%	0.0%
		Total (*n* = 562)	98.2%	1.1%	0.2%	0.4%	0.2%
	Test Fishery	October (*n* = 97.8)	100.0%	0.0%	0.0%	0.0%	0.0%
		November (*n* = 57.1)	100.0%	0.0%	0.0%	0.0%	0.0%
		December (*n* = 66.8)	100.0%	0.0%	0.0%	0.0%	0.0%
		January (*n* = 115.0)	100.0%	0.0%	0.0%	0.0%	0.0%
		February (*n* = 85.4)	97.7%	1.2%	0.0%	1.2%	0.0%
		March (n = 102.9)	100.0%	0.0%	0.0%	0.0%	0.0%
		April (*n* = 107.0)	94.8%	5.2%	0.0%	0.0%	0.0%
		Total[2] (*n* = 534.1)	98.6%	1.2%	0.0%	0.2%	0.0%

[1]*n* for Creel corresponds to interviews; for test fishery, *n* correspond to hours fished.
[2]To facilitate direct comparison with creel numbers, the test fishery total is based on Nov.-Apr. only.

Table 8-1. Chinook encounters by size/mark-status group for the November 2007-April 2008 Area 8-1 test fishery. Values in parentheses reflect the proportional monthly or season-total (bottom line, Nov.-Apr. only) contribution of a particular size/mark-status group to total Chinook encounters.

Time period			Fishing Effort		Legal		Sub-legal		
Month	**SW**	**Dates**	**Hours**	**Days**	**M**	**UM**	**M**	**UM**	**Total**
OCT[1]	40	10/1-10/7	17.2	3	1	0	14	2	17
	41	10/8-10/14	30.5	5	7	2	21	5	35
	42	10/15-10/21	5.3	1	0	1	3	3	7
	43	10/22-10/28	25.6	4	8	3	23	9	43
	44	10/26-10/31	30.6	5	7	4	20	6	37
October Total:			109.1	18	23 (16.5%)	10 (7.2%)	81 (58.3%)	25 (18.0%)	139
NOV	44-45	11/1-11/11	26.9	4	11	4	31	18	64
	46	11/12-11/18	4.5	1	0	0	0	0	0
	47	11/19-11/25	0.0	0	0	0	0	0	0
	48	11/26-12/2	21.9	4	1	2	16	2	21
November Total:			53.3	9	12 (14.1%)	6 (7.1%)	47 (55.3%)	20 (23.5%)	85
DEC	49	12/3-12-9	3.0	1	1	0	3	0	4
	50	12/10-12/16	22.6	5	8	3	5	6	22
	51	12/17-12/23	13.6	4	8	2	3	6	19
	52	12/24-12/30	6.3	2	0	0	2	0	2
	53	12/31-12/31	0.0	0	0	0	0	0	0
December Total:			45.4	12	17 (36.2%)	5 (10.6%)	13 (27.7%)	12 (25.5%)	47
JAN	1	1/1-1/6	0.0	0	0	0	0	0	0
	2	1/7-1/13	24.8	4	4	0	6	1	11
	3	1/14-1/20	16.3	4	2	2	6	2	12
	4	1/21-1/27	27.4	4	9	5	3	1	18
	5	1/28-2/3	12.0	3	5	0	0	0	5
January Total:			80.5	15	20 (43.5%)	7 (15.2%)	15 (32.6%)	4 (8.7%)	46
FEB	6	2/4-2/10	9.4	2	3	0	0	1	4
	7	2/11-2/17	12.3	4	4	3	1	0	8
	8	2/18-2/24	23.7	4	5	0	1	1	7
	9	2/25-3/2	26.6	5	12	4	4	1	21
February Total:			72.0	15	24 (60.0%)	7 (17.5%)	6 (15.0%)	3 (7.5%)	40
MAR	10	3/3-3/9	23.0	5	5	3	10	0	18
	11	3/10-3/16	15.9	3	10	5	4	1	20
	12	3/17-3/23	20.9	5	3	0	2	3	8
	13	3/24-3/30	20.3	6	5	5	0	1	11
March Total:			80.1	19	23 (40.4%)	13 (22.8%)	16 (28.1%)	5 (8.8%)	57
APR	14	3/31-4/6	26.5	5	9	8	1	1	19
	15	4/7-4/13	21.9	4	8	1	6	1	16
	16	4/14-4/20	26.2	5	6	5	1	1	13
	17	4/21-4/27	23.7	5	7	2	1	0	10
	18	4/28-4/30	11.3	2	0	0	0	0	0
April Total:			109.6	21	30 (51.7%)	16 (27.6%)	9 (15.5%)	3 (5.2%)	58
Season Total[2]:			**440.9**	**91**	**126 (37.8%)**	**54 (16.2%)**	**106 (31.8%)**	**47 (14.1%)**	**333**

[1] The Area 8-1 and 8-2 recreational fishery was closed during the month of October.
[2] Totals and size/mark-status percentages are for the open (Nov.-Apr.) period only.

Table 8-2. Chinook encounters by size/mark-status group for the November 2007-April 2008 Area 8-2 test fishery. Values in parentheses reflect the proportional monthly or season-total (bottom line, Nov.-Apr. only) contribution of a particular size/mark-status group to total Chinook encounters.

Time period			Fishing Effort		Legal		Sub-legal		
Month	**SW**	**Dates**	**Hours**	**Days**	**M**	**UM**	**M**	**UM**	**Total**
OCT[1]	40	10/1-10/7	19.6	3	0	1	9	5	15
	41	10/8-10/14	18.4	4	1	1	5	4	11
	42	10/15-10/21	11.5	2	0	0	6	1	7
	43	10/22-10/28	23.5	4	2	0	20	4	26
	44	10/26-10/31	24.8	5	1	1	14	1	17
October Total:			97.8	18	4 (5.3%)	3 (3.9%)	54 (71.1%)	15 (19.7%)	76
NOV	44-45	11/1-11/11	21.3	4	9	1	16	6	32
	46	11/12-11/18	11.3	2	6	0	4	2	12
	47	11/19-11/25	12.7	3	2	0	10	1	13
	48	11/26-12/2	11.8	3	1	1	4	1	7
November Total:			154.8	30	18 (28.1%)	2 (3.1%)	34 (53.1%)	10 (15.6%)	64
DEC	49	12/3-12-9	0.0	0	0	0	0	0	0
	50	12/10-12/16	27.5	5	6	4	11	2	23
	51	12/17-12/23	22.5	4	5	0	7	1	13
	52	12/24-12/30	16.8	3	2	0	6	0	8
	53	12/31-12/31	0.0	0	0	0	0	0	0
December Total:			66.8	12	13 (29.5%)	4 (9.1%)	24 (54.5%)	3 (6.8%)	44
JAN	1	1/1-1/6	15.2	3	5	0	6	2	13
	2	1/7-1/13	29.7	5	6	1	7	3	17
	3	1/14-1/20	29.3	6	2	1	5	2	10
	4	1/21-1/27	18.3	3	3	0	1	1	5
	5	1/28-2/3	15.7	3	1	0	2	1	4
January Total:			108.2	20	17 (34.7%)	2 (4.1%)	21 (42.9%)	9 (18.4%)	49
FEB	6	2/4-2/10	15.0	3	1	1	2	0	4
	7	2/11-2/17	26.6	5	3	0	5	1	9
	8	2/18-2/24	22.8	4	0	0	2	0	2
	9	2/25-3/2	27.8	5	5	1	2	2	10
February Total:			92.2	17	9 (36.0%)	2 (8.0%)	11 (44.0%)	3 (12.0%)	25
MAR	10	3/3-3/9	22.8	4	4	1	4	0	9
	11	3/10-3/16	21.3	4	6	1	1	2	10
	12	3/17-3/23	26.6	5	3	1	1	1	6
	13	3/24-3/30	32.2	5	0	0	1	0	1
March Total:			102.9	18	13 (50.0%)	3 (11.5%)	7 (26.9%)	3 (11.5%)	26
APR	14	3/31-4/6	28.9	5	7	2	0	1	10
	15	4/7-4/13	22.4	4	1	1	0	0	2
	16	4/14-4/20	18.1	4	3	1	1	0	5
	17	4/21-4/27	25.9	5	2	1	0	0	3
	18	4/28-4/30	11.7	3	0	1	0	0	1
April Total:			107.0	21	13 (61.9%)	6 (28.6%)	1 (4.8%)	1 (4.8%)	21
Season Total[2]:			**631.8**	**118**	**83 (36.2%)**	**19 (8.3%)**	**98 (42.8%)**	**29 (12.7%)**	**229**

[1] The Area 8-1 and 8-2 recreational fishery was closed during the month of October.
[2] Totals and size/mark-status percentages are for the open (Nov.-Apr.) period only.

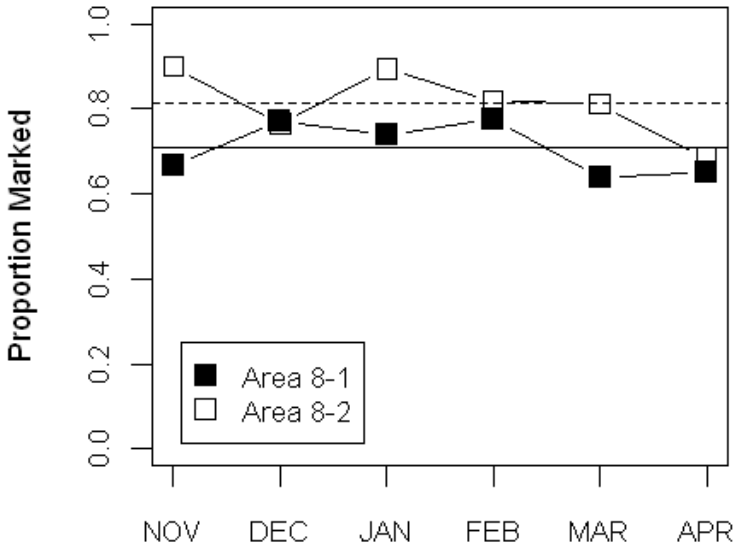

Figure 7. Trends in mark rates (% adipose clipped) for legal-sized Chinook encountered by test fishers during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery. The horizontal solid and dashed lines correspond to the average monthly mark rate for Areas 8-1 and 8-2, respectively.

Table 9. Total Chinook encountered (retained and released) by private anglers logging their trips on voluntary trip reports (VTRs), with estimates of legal, sublegal, and overall mark rates.

Area	Size Class	Mark Status	Nov	Dec	Jan	Feb	Mar	Apr	Total	% Marked
Area 8-1	Legal	Marked	1	0	0	8	8	0	17	77.3%
(*n* = 15)		Unmarked	1	0	0	0	4	0	5	
	Sublegal	Marked	15	0	0	1	4	0	20	80.0%
		Unmarked	4	0	0	1	0	0	5	
	Total Encounters		21	0	0	10	16	0	47	78.7%
Area 8-2	Legal	Marked	0	0	3	0	1	0	4	100.0%
(*n* = 6)		Unmarked	0	0	0	0	0	0	0	
	Sublegal	Marked	4	0	4	0	0	0	8	100.0%
		Unmarked	0	0	0	0	0	0	0	
	Total Encounters		4	0	7	0	1	0	12	100.0%

Chinook Size and Age

During the period that the Area 8-1 and 8-2 fishery was open (i.e., for November-April test fishery samples only), marked and unmarked Chinook sampled by test fishers exhibited a unimodal size distribution centered about the legal size limit (i.e., 22 inches [56 cm]). In Area 8-1, Chinook (marked and unmarked combined) averaged 56 (SD = 12 cm) and ranged from 24-84 cm in total length (TL), whereas in Area 8-2 they averaged 55 cm TL (SD = 11 cm; range: 30-85 cm; **Figure 8**). Thus, there was little difference in the size of Chinook caught in the two areas (two-sample *t*-test: $t = 0.9$, df = 547, $P = 0.2$).

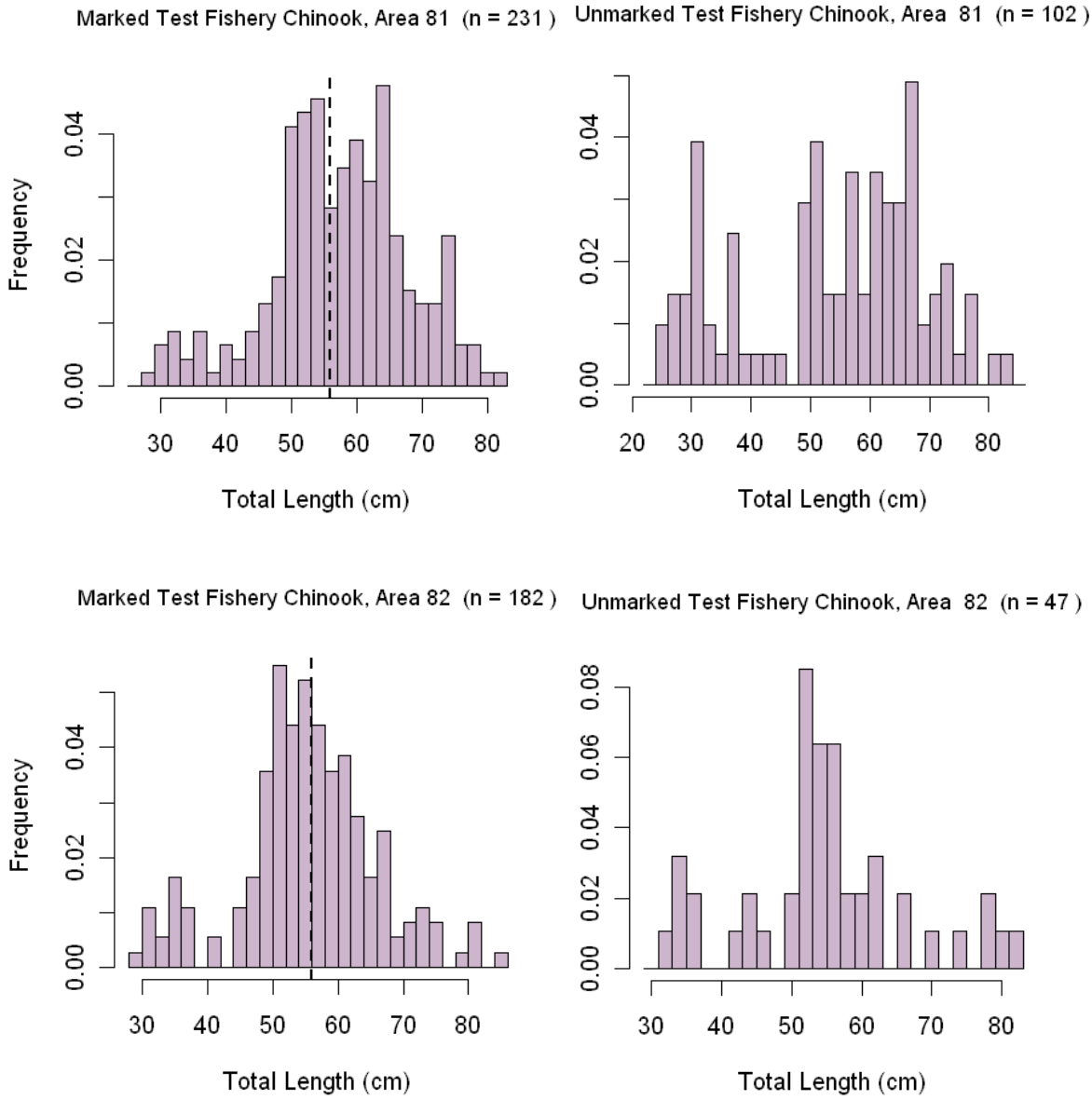

Figure 8. Length-frequency distributions of marked (*left column*) and unmarked (*right column*) Chinook encountered by test fishers during the Areas 8-1 (*upper row*) and 8-2 (*lower row*) November 2007-April 2008 mark-selective Chinook fishery. The dashed vertical line in the length-frequency histograms for marked Chinook corresponds to the legal size limit (22 in or 56 cm). *Note*: *x* and *y* axis ranges differ between panels.

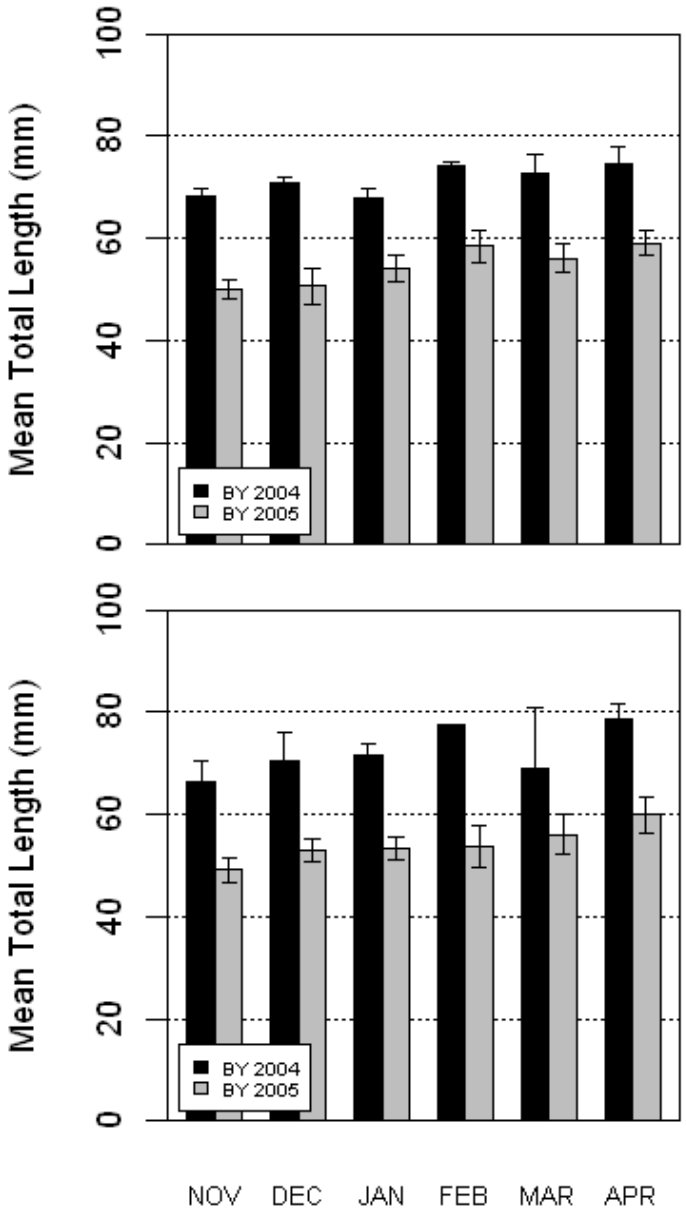

Figure 9. Monthly mean total length (+/- 95% CIs) of Chinook (marked and unmarked combined) sampled by test fishers during the Areas 8-1 (*upper panel*) and 8-2 (*lower panel*) November 2007-April 2008 mark-selective Chinook fishery, by brood year.

Within areas, marked Chinook were on average 3 cm larger than unmarked Chinook in Area 8-1 (two-sample *t*-test: $t = 1.95$, df = 147, $P = 0.03$); both marked and unmarked Chinook averaged 55 cm TL in Area 8-2 (two-sample *t*-test: $t = 0.34$, df = 34, $P = 0.37$). Further, as suggested by the trends in LM Chinook fractions reviewed above (See *Encounters, Mark Rates, and Size/Mark-status Composition*), test fishery TL data clearly demonstrate a trend towards larger Chinook sizes from the start to the close of the fishery (i.e., positive growth; **Figure 9**). In the two areas, the average size of 2004- and 2005-brood (based on scales,

described below) Chinook increased by ~10 cm between November 1, 2007 and April 30, 2008. Although 2004-brood Chinook were on average of legal size at the start of the fishery, 2005-brood Chinook did not average ≥56 cm (22 in) until February and March in Area 8-1 and Area 8-2, respectively.

Of the 562 Chinook encountered and sampled by test fishers during the six-month Areas 8-1 and 8-2 fishery, 475 (258 [181 AD, 77 UM] in 8-1; 217 in 8-2 [175 AD, 42 UM]) had scales that were successfully read. Within areas, marked and unmarked individuals had a similar age structure (Area 8-1: $\chi^2 = 1.7$, df = 2, $P = 0.432$, **Appendix F-1**: Area 8-2, $\chi^2 = 3.3$, df = 2, $P = 0.180$; **Appendix F-2**), with age-3 (3.1 and 3.2) individuals comprising the majority (54% on average) of samples from both areas and for both marked and unmarked groups. Additionally, 2005 brood year-origin fish (i.e., age-2 fish in 2007 and age-3 fish in 2008) comprised 80-85% of all Chinook encounters. Between areas, there was a tendency towards lower age-1 or -2 abundance and greater age-4+ abundance in Area 8-1 compared to Area 8-2 scale samples ($\chi^2 = 5.4$, df = 2, $P = 0.059$).

Other Fish Species Encountered

Though they fished exclusively for Chinook, test fishers encountered eight other species of fish during their areas 8-1 and 8-2, November-April sampling efforts (**Table 10**). Over the two areas combined, Pacific sandab, copper rockfish, and spiny dogfish, ranked greatest to least, dominated non-Chinook test fishery encounters. Additionally, during their one-month pre-season (October) sampling period, test fishers encountered seven coho salmon (*O. kisutch*), one copper rockfish, 26 spiny dogfish, one lingcod, and 54 Pacific sandab.

Table 10. Test fishery catches of species other than Chinook salmon during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery.

Common and scientific name	**Area 8-1**	**Area 8-2**
Rock sole (*Lepidopsetta bilineata*)	2	2
Pacific sanddab (*Citharichthys sordidus*)	8	56
Pacific herring (*Clupea harengus*)	0	2
Lingcod (*Ophiodon elongatus*)	0	1
Greenstriped rockfish (*Sebastes elongatus*)	0	3
Copper rockfish (*Sebastes caurinus*)	1	16
Spiny dogfish (*Squalus acanthias*)	12	14
Pacific staghorn sculpin (*Leptocottus armatus*)	2	0
Grand Total (n = 8 species)	**25**	**94**

Overall Fishery Impacts

Total Encounters and Mortalities

We derived size/mark-status group-specific estimates of Chinook encounters from a combination of dockside sampling results (i.e., legal-marked Chinook harvest estimates derived from data in Tables **4-1**, **4-2**, and **5**; see **Appendix A** for computational details), test fishery size/mark-status composition data (**Table 8-1**, **8-2**), and charter VTR data (**Tables 4-1**, **4-2**). In total, we estimated that anglers fishing in Area 8-1 encountered a total of 734 LM, 308 LU, 1,381 SM, and 577 SU Chinook (3,000 total) between November and April (**Table 11**). For Area 8-2, we estimated encounters at 909 LM, 197, LU, 1,017 SM, and 306 SU (2,428 total; **Table 11**). Given our 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 1,123 (Area 8-1) and 1,180 (Area 8-2) mortalities for the two areas (**Table 11**). Fifty-seven and 77% of estimated mortality was due to the direct harvest of legal-marked Chinook harvest in the two respective areas. Unmarked Chinook mortality totaled 271 fish (165 in Area 8-1, 106 in Area 8-2) over the two areas, which corresponds to 0.2 unmarked mortalities per legal-marked Chinook kept. In addition, given the 333 (126 LM, 54 LU, 106 SM, 47 SU) and 229 (83 LM, 19 LU, 98 SM, 29 SU) Chinook caught and released in the respective Areas 8-1 and 8-2 test fisheries between November and April, an estimated 99 (58 in Area 8-1 and 41 in Area 8-2) Chinook may have died as a result of our sampling activities.

FRAM versus Creel Comparison

Pre-season Fishery Regulation Assessment Model (FRAM, model run 3907) planning efforts suggested that the combined Areas 8-1 and 8-2 fishery would have a substantially greater impact on marked and unmarked Chinook than field data indicate actually occurred during its six-month season. With the exception of legal-marked Chinook harvest, which was accurately predicted, FRAM encounters (**Table 12**, **Figure 10**) and mortalities (**Table 13**, **Figure 10**) predictions were anywhere from 2 (total marked encounters) to 9 (unmarked harvest) times greater than what was estimated through intensive field sampling efforts. Additionally, observed mark rates (combined 8-1/8-2 mark rate: 74%) were substantially lower than what was expected based on pre-season modeling (i.e., 48%; **Table 12**).

Estimated CWT-DIT Impacts

Of the 56 coded-wire tags recovered during the Areas 8-1 and 8-2 mark-selective Chinook fishery, 24 belonged to double-index tag (DIT) release groups (**Table 14**). Based on the release details associated with these tags and their unmarked sister groups, we obtained an estimate of the unmarked-to-marked ratio (λ) at juvenile release for each applicable hatchery of origin and brood year, and we used this value to estimate total unmarked DIT encounters for the entirety of the Areas 8-1 and 8-2 fishery. In total, we estimated that 58 unmarked-DIT Chinook were caught and released during the fishery, nearly a third of which were of Marblemount Hatchery origin (brood year 2004) and one fourth of which were of Grovers

Creek Hatchery origin (brood year 2005). Given an *sfm* rate of 0.10, we estimate that six of these unmarked-DIT Chinook may have died as a result of the six-month Areas 8-1 and 8-2 mark-selective fishery.

Table 11. Summary of season-wide fishery impact estimates for the Areas 8-1 and 8-2 mark-selective Chinook fishery, November 2007-April 2008. Values may not add up perfectly due to rounding error.

Area 8-1	**Encounters (E):**	**3,000**	(Creel estimates: 673 Marked Retained + 5 Unmarked Retained + 2319 Released; Charters: 1 Marked Retained + 0 Unmarked Retained + 2 Released)							
	V(E):	**788,909**								
Size/mark group	**Encounters**	**No. Retained**	**No. Rel'd**	**Rel. Mort. Rate**	**Rel. Mort.**	**Total Mortality**	**Var**	**SE**	**95% CI**	**CV (%)**
Legal marked	734	638	95	0.15	14	653	6,409	80	496 - 810	12
Legal unmarked	308	5	304	0.15	46	50	194	14	23 - 77	28
Sublegal marked	1,381	36	1,345	0.20	269	305	9,920	100	110 - 500	33
Sublegal unmarked	577	0	577	0.20	115	115	2,017	45	27 - 203	39
All groups combined	**3,000**	**679**	**2,321**		**444**	**1,123**	**18,539**	**136**	**856 – 1,390**	**12**

Area 8-2	**Encounters (E):**	**2,428**	(Creel estimates: 828 Marked Retained + 18 Unmarked Retained + 1482 Released Charters: 41 Marked Retained + 0 Unmarked Retained + 58 Released)							
	V(E):	**94,701**								
Size/mark group	**Encounters**	**No. Retained**	**No. Rel'd**	**Rel. Mort. Rate**	**Rel. Mort.**	**Total Mortality**	**Var**	**SE**	**95% CI**	**CV (%)**
Legal marked	909	795	114	0.15	17	812	2,086	46	722 - 901	6
Legal unmarked	197	15	181	0.15	27	42	94	10	23 - 61	23
Sublegal marked	1,017	74	942	0.20	188	263	1,095	33	198 - 328	13
Sublegal unmarked	306	3	303	0.20	61	64	186	14	37 - 90	21
All groups combined	**2,428**	**887**	**1,540**		**293**	**1,180**	**3,461**	**59**	**1065 – 1,296**	**5**

Table 12. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook encounters for the combined Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	Unmark.	7706	2551	5155	204
	Mark.	7217	1742	5475	1638
	Total	14923	4293	10630	1842
	% Mark.	48	41	52	89
Estimated (Creel) Encounters	Unmark.	1388	505	883	23
	Mark.	4040	1642	2398	1543
	Total	5428	2147	3281	1566
	% Mark.	74	77	73	99

Table 13. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook mortalities for the combined Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery.

	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
Mortality Category	Unmark.	Mark.	Total	Unmark.	Mark.	Total
Total (Landed + Released	1598	2830	4428	271	2032	2304
Released Legal	363	97	460	73	31	104
Released Sublegal	1031	1095	2126	176	458	634
Landed Only	204	1638	1842	23	1543	1566

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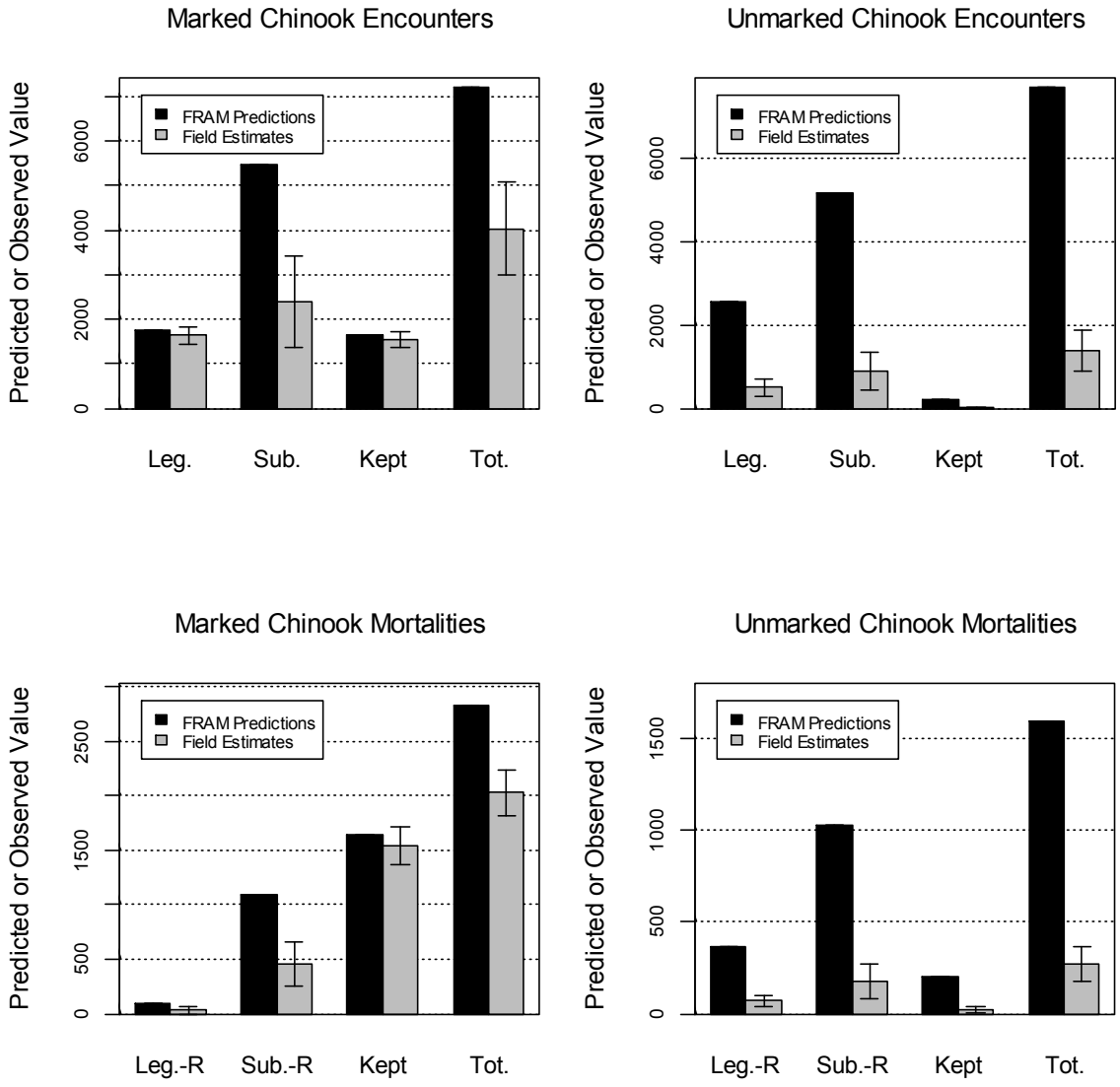

Figure 10. Comparison of modeled (i.e., using FRAM, model run 3907) and estimated total Chinook encounters and mortalities for the combined Areas 8-1 and 8-2 November 1, 2007-April 30, 2008 mark-selective Chinook fishery. Error bars represent approximate 95% confidence intervals for field estimates.

Table 14. Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Areas 8-1 and 8-2 November 2007-April 2008 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.)
Grovers Creek Hatchery	2004	1	1.5	0.68	1.66	0.17	0.01	0.09
	2005	7	19.8	39.92	15.20	1.52	0.23	1.18
H-Chilliwack R. Hatchery	2005	1	2.1	2.36	2.15	0.21	0.02	0.16
Kendall Creek Hatchery	2005	1	1.6	0.98	1.62	0.16	0.01	0.10
Marblemount Hatchery	2004	7	19.2	39.45	18.86	1.89	0.38	1.49
Nisqually Hatchery	2004	1	4.2	13.23	4.22	0.42	0.14	0.37
	2005	1	2.1	2.23	2.34	0.23	0.03	0.17
Samish River Hatchery	2004	1	1.6	0.98	1.70	0.17	0.01	0.10
	2005	2	5.8	14.22	5.26	0.53	0.12	0.42
Unreported (Big Soos Creek Release Site)	2005	1	2.4	3.56	2.47	0.25	0.04	0.19
Wallace R. Hatchery	2004	1	2.9	5.40	2.87	0.29	0.05	0.23
TOTAL		**24**	**63.1**	**123.02**	**58.33**	**5.83**	**1.04**	**4.51**

ACKNOWLEDGEMENTS

This review of the winter 2007-2008 Areas 8-1 and 8-2 mark-selective Chinook fishery is a result of the dedicated efforts of several individuals. Steve Axtell (Area 8-1 Sampling Supervisor), Slim Simpson (Area 8-2 Sampling Supervisor), and their sampling crews collected creel, test-fishery, and on-the-water survey data throughout the season. Dockside samplers included Patrick Morrison and Nathan Layman in Area 8-1, and Sue Kraemer and Amy Willoughby in Area 8-2. Central Sound staff Slim Simpson, Jeff McKee, and Kathy Young-Berg greatly assisted in the summarization and error checking of data, and on other aspects of Area 8-2 sampling. Steve Axtell provided similar support for Area 8-1. Chad Paul and Toby Black conducted Area 8-1 test fishing and on-the-water survey activities throughout the fishery. Jim Pykonen and Peter Sergeef conducted Area 8-2 test fishing and boat survey activities. At the Olympia Headquarters office, Lee Dyer provided substantial help with personnel logistics and support services for the project, Karen Kloempken managed the WDFW sampling databases and provided finalized post-season data, and biologists Mark Baltzell, Peter McHugh, and Laurie Peterson prepared this post-season report. Finally, we would like to thank Area 8-1 and Area 8-2 charter operators for their cooperation with our charter census activities.

Finally, this document benefitted greatly from the thorough reviews of Bob Conrad at the Northwest Indian Fisheries Commission and WDFW staff. Their collective critiques helped us to improve the quality of this final draft.

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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[8] estimators of encounters-by-class (i.e., the four size [legal, sublegal] × mark-status [marked, unmarked] groups) to season-wide impact estimates. Where appropriate, the encounters (kept and released) for charter, derby, and/or other fishery components assessed via a complete census (i.e., totals without variance) are simply added to relevant total private-fleet estimates.

A. Total and Class-specific Encounters Estimation

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

Monthly Encounters

$\hat{E}_i$ = Total Chinook encounters for month *i*, which is estimated by combining creel estimates of legal-marked Chinook harvest ($\hat{K}_{LM\,i}$, 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 $\hat{E}_i$ if anglers release any of the legal-marked Chinook that they encounter, the $\hat{E}_i$ estimator also includes a "correction" to account for this phenomenon (i.e., 1-$p_{\text{LM-R}}$, where $p_{\text{LM-R}}$ is the estimated legal-marked Chinook release rate)[9]. $\hat{E}_i$ and its variance are estimated as:

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

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

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

[9] 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 $\hat{E}_i$ estimator is 0.13. See Conrad and McHugh (2008) for further detail.

Test-fishery Encounter Composition

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

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

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

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

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

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

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

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

Encounters by Size/Mark-status Class

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

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

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

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

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

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

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

Since the $\hat{E}_{LMi}$ estimate derived according to Eqn. 5 above is equivalent to that obtained by expanding $\hat{K}_{LMi}$ by the constant 1 - $p_{\text{LM-R}}$, its variance is estimated as:

(7) $\text{var}(\hat{E}_{LMi}) = \text{var}(\hat{K}_{LMi})/(1 - \hat{p}_{LM=R})^2$

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*[10] 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:

$$(8) \qquad \hat{d}_{XMK} = n_{XMK} / n_{MK}$$

$$(9) \qquad \mathrm{var}(\hat{d}_{XMK}) = [\hat{d}_{XMK} * (1 - \hat{d}_{XMK})] / (n_{MK} - 1),$$

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

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

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

The proportions of retained, unmarked fish belonging to legal and sublegal size classes and their respective variances are estimated as above (Eqns. 8 and 9) 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:

$$(10) \qquad \hat{K}_{XM\,i} = \hat{d}_{XMK} * \hat{N}_{MK\,i}$$

$$(11) \qquad \mathrm{var}(\hat{K}_{XM\,i}) = \mathrm{var}(\hat{K}_{XM\,i}) * \hat{d}_{XMK}{}^2 + \hat{N}_{MK_i}{}^2 * \mathrm{var}(\hat{d}_{XMK}) - \mathrm{var}(\hat{N}_{MK\,i}) * \mathrm{var}(\hat{d}_{XMK})$$

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

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

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

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

The number of retained, unmarked fish belonging to legal and sublegal size classes is estimated according to Eqns. 10 and 11 above but using unmarked fish proportions and monthly retention estimates.

Estimating Release Numbers by Class

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

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

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

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

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

$$\hat{R}_{XYi} = \hat{E}_{XYi} - \hat{K}_{XYi} \quad (12)$$

$$\mathrm{var}(\hat{R}_{XYi}) = \mathrm{var}(\hat{E}_{XYi}) + \mathrm{var}(\hat{K}_{XYi}) \quad (13)$$

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

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

Assumed Mortality Rates for Retained and Released Chinook

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

Retention-mortality Estimates

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

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

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

Release-mortality Estimates

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

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

(14) $\hat{M}_{XYR_i} = \hat{R}_{XY_i} * sfm_Y$

(15) $\text{var}(\hat{M}_{XYR_i}) = \text{var}(\hat{R}_{XY_i}) * sfm_Y^{\,2}$

Season-wide Total and Class-specific Mortality Estimation

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

D. Characterizing Precision of Estimates

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

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

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

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

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

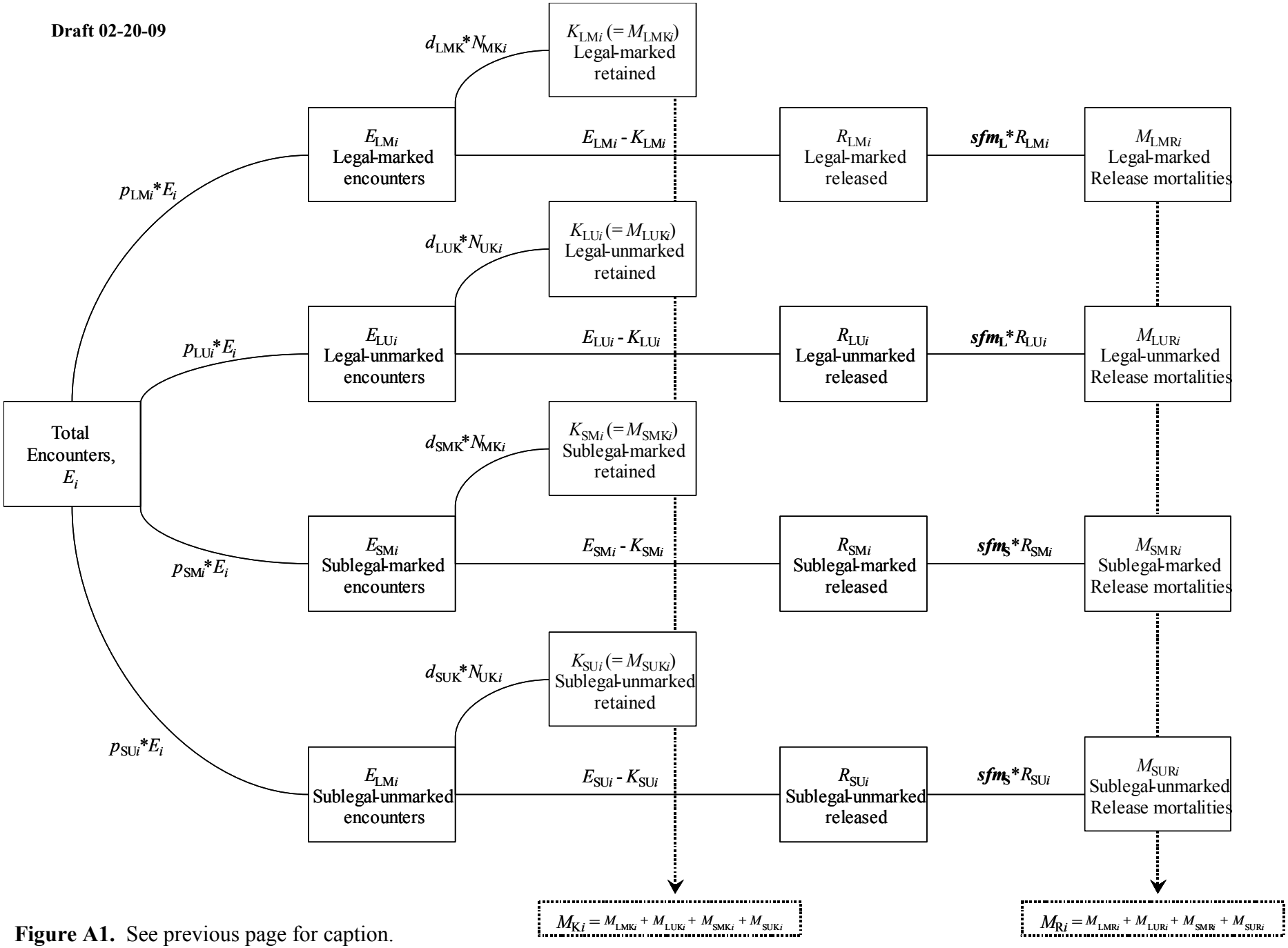

Figure A1. See previous page for caption.

Appendix B. Statistical week calendar for the period during which the Areas 8-1 and 8-2 mark-selective fishery was open, November 1, 2007-April 30, 2008.

Year	Stat Month	Week #	Start Date	End Date
2007	11	44	29-Oct	04-Nov
		45	05-Nov	11-Nov
		46	12-Nov	18-Nov
		47	19-Nov	25-Nov
		48	26-Nov	02-Dec
	12	49	03-Dec	09-Dec
		50	10-Dec	16-Dec
		51	17-Dec	23-Dec
		52	24-Dec	30-Dec
		53	31-Dec	31-Dec
2008	1	1	01-Jan	06-Jan
		2	07-Jan	13-Jan
		3	14-Jan	20-Jan
		4	21-Jan	27-Jan
		5	28-Jan	03-Feb
	2	6	04-Feb	10-Feb
		7	11-Feb	17-Feb
		8	18-Feb	24-Feb
		9	25-Feb	02-Mar
	3	10	03-Mar	09-Mar
		11	10-Mar	16-Mar
		12	17-Mar	23-Mar
		13	24-Mar	30-Mar
	4	14	31-Mar	06-Apr
		15	07-Apr	13-Apr
		16	14-Apr	20-Apr
		17	21-Apr	27-Apr
		18	28-Apr	4-May

Appendix C. Sample rates for the Areas 8-1 and 8-2 (November 2007-April 2008) selective Chinook fishery. Note: sample counts and totals are for adipose-clipped (i.e., marked) Chinook only.

Month	Area 8-1			Area 8-2		
	Number of Chinook Sampled	Estimated Chinook Retained	Sample Rate	Number of Chinook Sampled	Estimated Chinook Retained	Sample Rate
November	64	267	24.0%	67	155	43.2%
December	13	32	40.7%	38	94	40.3%
January	57	164	34.8%	79	164	48.2%
February	70	138	50.9%	86	142	60.4%
March	26	55	47.3%	154	248	62.2%
April	14	20	71.6%	45	66	68.2%
Total	**244**	**674**	**36.2%**	**469**	**869**	**54.0%**

Appendix D-1. Summary of the total number of anglers intercepted in Area 8-1 during on-the-water surveys between November 2007 and April 2008. Grayed cells represent sites included in the dockside sample frame.

	Area 8-1	
Site Name	**Anglers**	**Season-total (unadjusted) size measure**
Camano Island State Park	137	0.261
Bayside Dry Storage	5	0.010
Cornet Bay Ramp	2	0.004
Coupeville Ramp	31	0.059
Dagmars Landing	11	0.021
Everett Marina	9	0.017
Holmes Harbor Ramp (Freeland)	13	0.025
LaConner Ramp	9	0.017
Maple Grove Ramp	96	0.183
Misc. Private Launch	39	0.074
Monroes Landing	1	0.002
Mukilteo	3	0.006
Norton Street (Everett) Ramp	58	0.110
Oak Harbor Public	90	0.171
Tulalip Ramp	3	0.006
Utsalady Ramp	18	0.034
Grand Total	**525**	**1.00**

Appendix D-2. Summary of the total number of anglers intercepted in Area 8-2 during on-the-water surveys between November 2007 and April 2008. Grayed cells represent sites included in the dockside sample frame.

	Area 8-2	
Site Name	**Anglers**	**Season-total (unadjusted) size measure**
Bayside Marina	57	0.088
Camano Island State Park	77	0.119
Cavalero County Park	1	0.002
Clinton Ramp	0	0.000
Dagmars Landing	38	0.059
Ebey Waterfront Park	4	0.006
Edmonds Marina	2	0.003
Edmonds Dry Storage	4	0.006
Edmonds Sling	4	0.006
Everett Marina	71	0.110
Everett YC	0	0.000
Hat Island Marina	0	0.000
Holmes Harbor (Freeland)	4	0.006
Jetty Island	0	0.000
Kingston Marina	0	0.000
Langley Marina	1	0.002
Langley Ramp	6	0.009
Marysville Ramp	3	0.005
Misc. Private Launch	14	0.022
Mukilteo Public Ramp	5	0.008
Norton Street (Everett) Ramp	350	0.541
Oak Harbor	2	0.003
Possesion Pt	0	0.000
Sandy Hook Marina	0	0.000
Seattle Marina (Lk Union)	0	0.000
Shilshole Ramp	0	0.000
Tulalip Marina	0	0.000
Tulalip Ramp	4	0.006
Grand Total	**647**	**1.000**

Appendix E-1. Size measures of sites sampled during the Areas 8-1 2007-08 creel survey, by statistical week. Grayed cells represent when a particular site was not included in the sample frame for site selection or estimation in a particular statistical week.

Month	Stat Week	Prop'n Effort In Sample Frame	Area 8-1 Sampled Sites and Size Measures								
			Camano Island SP	Cornet Bay SP	Coupeville	Holmes Harbor	LaConner Marina	Maple Grove Ramp	Norton St (Everett) Ramp	Oak Harbor Ramp	Utsalady Ramp
NOV	44	0.73	0.252	0.126	0.049		0.010	0.165		0.087	0.039
	45	0.47	0.247		0.056		0.011			0.079	0.079
	46	0.58	0.192		0.010		0.010	0.087		0.221	0.058
	47 (19-24 Nov)	0.58	0.192		0.010		0.010	0.087		0.221	0.058
	47 (25 Nov)[a]	0.58			0.014		0.014	0.130		0.332	0.087
	48[a]	0.60			0.034		0.000	0.090		0.370	0.101
DEC	49	0.60	0.157		0.025		0.000	0.066		0.273	0.074
	50	0.61	0.152		0.048		0.000	0.064		0.272	0.072
	51	0.63	0.159		0.062		0.000	0.069		0.255	0.083
	52	0.63	0.159		0.062		0.000	0.069		0.255	0.083
JAN	1	0.63	0.159		0.062		0.000	0.069		0.255	0.083
	2	0.65	0.158		0.089		0.000	0.095		0.234	0.076
	3	0.65	0.158		0.089		0.000	0.095		0.234	0.076
	4	0.68	0.185		0.070		0.015	0.100		0.245	0.060
	5	0.72	0.190		0.069		0.014	0.144		0.259	0.042
FEB	6	0.78	0.210		0.094		0.028	0.149		0.271	0.033
	7	0.78	0.210		0.094		0.028	0.149		0.271	0.033
	8	0.79	0.204		0.105		0.026	0.147		0.267	0.037
	9	0.81	0.269		0.086		0.027	0.204		0.210	0.016
MAR	10	0.82	0.286		0.085	0.045		0.201		0.205	
	11	0.79	0.276		0.078	0.041		0.185		0.206	
	12	0.78	0.313		0.065	0.047		0.182		0.173	
	13	0.78	0.313		0.065	0.047		0.182		0.173	
APR	14	0.78	0.313		0.065	0.047		0.182		0.173	
	15	0.78	0.304		0.060			0.175	0.115	0.124	
	16	0.81	0.316		0.053			0.228	0.102	0.109	
	17	0.81	0.316		0.053			0.228	0.102	0.109	
	18	0.81	0.316		0.053			0.228	0.102	0.109	
	Mean	0.701	0.231	0.126	0.061	0.045	0.010	0.140	0.105	0.214	0.063
	SD	0.099	0.063	NA	0.025	0.002	0.011	0.056	0.007	0.073	0.023

[a]Camano Island SP Ramp was closed for repairs from 25 November – 2 December 2008.

Appendix E-2. Size measures of sites sampled during the Areas 8-2 2007-08 creel survey, by statistical week. Grayed cells represent when a particular site was not included in the sample frame for site selection or estimation in a particular statistical week.

Month	Stat Week	Prop'n Effort In Sample Frame	Area 8-2 Sampled Sites and Size Measures					
			Bayside Marina	Camano Island SP	Dagmar's Landing	Mukilteo SP	Norton Street (Everett) Ramp	Tulalip Marina
NOV	44	0.77	0.022	0.192	0.026	0.057	0.467	0.009
	45	0.77	0.022	0.192	0.026	0.057	0.467	0.009
	46	0.81	0.100	0.170	0.055	0.025	0.460	
	47 (19-24 Nov)	0.81	0.100	0.170	0.055	0.025	0.460	
	47 (25 Nov)[a]	0.77	0.120		0.066	0.030	0.554	
	48[a]	0.74	0.160		0.047	0.009	0.519	
DEC	49	0.74	0.079	0.116	0.056	0.028	0.460	
	50	0.74	0.079	0.116	0.056	0.028	0.460	
	51	0.75	0.072	0.105	0.072	0.025	0.473	
	52	0.75	0.072	0.105	0.072	0.025	0.473	
JAN	1	0.74	0.060	0.083	0.064	0.023	0.514	
	2	0.74	0.060	0.083	0.064	0.023	0.514	
	3	0.74	0.060	0.083	0.064	0.023	0.514	
	4	0.74	0.060	0.083	0.064	0.023	0.514	
	5	0.78	0.059	0.083	0.055	0.020	0.561	
FEB	6	0.77	0.071	0.085	0.058	0.017	0.537	
	7	0.77	0.068	0.094	0.055	0.016	0.537	
	8	0.87	0.096	0.080	0.074		0.601	0.016
	9	0.87	0.096	0.080	0.074		0.601	0.016
MAR	10	0.86	0.096	0.076	0.076		0.601	0.015
	11	0.86	0.096	0.076	0.076		0.601	0.015
	12	0.86	0.096	0.076	0.076		0.601	0.015
	13	0.86	0.116	0.131	0.052		0.549	0.009
APR	14	0.85	0.101	0.123	0.058		0.563	0.010
	15	0.84	0.104	0.156	0.043		0.532	0.004
	16	0.85	0.105	0.178	0.040		0.522	0.004
	17	0.85	0.105	0.178	0.040		0.522	0.004
	18	0.85	0.105	0.178	0.040		0.522	0.004
	Mean	0.799	0.085	0.119	0.057	0.027	0.525	0.010
	SD	0.051	0.029	0.043	0.014	0.012	0.048	0.005

[a]Camano Island SP Ramp was closed for repairs from 25 November – 2 December 2008.

Appendix F-1. Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon, Area 8-1 November 2007-April 2008.

			Age[1] Composition									
Data Source	**Mark-status group**	**Month**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**	**5.2**	**Total**
Dockside Samples	AD	Nov.	0	31	0	7	18	0	1	0	0	57
		Dec	0	6	0	2	4	0	0	0	0	12
		Jan	0	0	0	34	0	7	12	0	0	53
		Feb	0	0	0	44	0	10	14	0	0	68
		Mar	0	0	0	21	0	1	3	0	0	25
		Apr	0	0	0	9	0	0	5	0	0	14
		Total	0	37	0	117	22	18	35	0	0	229
		%	0.0	16.2	0.0	51.1	9.6	7.9	15.3	0.0	0.0	100.0
Test Fishery	AD	Nov.	2	36	2	4	3	0	0	0	0	47
		Dec	0	12	1	1	4	0	0	0	0	18
		Jan	0	0	0	15	3	1	1	0	0	20
		Feb	0	1	0	13	2	0	8	0	0	24
		Mar	0	0	0	28	2	2	4	0	0	36
		Apr	0	0	0	28	2	1	5	0	0	36
		Total	2	49	3	89	16	4	18	0	0	181
		%	1.1	27.1	1.7	49.2	8.8	2.2	9.9	0.0	0.0	100.0
Test Fishery	UM	Nov.	1	13	3	2	0	0	0	0	0	19
		Dec	2	6	3	0	0	0	0	0	0	11
		Jan	0	0	0	3	0	0	2	0	0	5
		Feb	0	0	0	5	1	1	0	0	0	7
		Mar	0	0	0	10	5	2	0	0	0	17
		Apr	0	0	0	10	3	3	2	0	0	18
		Total	3	19	6	30	9	6	4	0	0	77
		%	3.9	24.7	7.8	39.0	11.7	7.8	5.2	0.0	0.0	100.0

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

Appendix F-2. Age composition of retained (dockside samples) and encountered (test fishery samples) Chinook salmon, Area 8-2 November 2007-April 2008.

			Age[1] Composition									
Data Source	**Mark-status group**	**Month**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**	**5.2**	**Total**
Dockside Samples	AD	Nov.	0	34	0	5	23	0	0	0	0	62
		Dec	0	27	0	2	7	0	0	0	0	36
		Jan	0	0	0	62	0	4	11	0	0	77
		Feb	0	0	0	60	0	5	19	0	0	84
		Mar	0	0	0	120	1	17	13	0	0	151
		Apr	0	0	0	31	0	5	6	0	0	42
		Total	0	61	0	280	31	31	49	0	0	452
		%	0.0	13.5	0.0	61.9	6.9	6.9	10.8	0.0	0.0	100.0
Test Fishery	AD	Nov.	0	32	7	4	5	0	0	0	0	48
		Dec	0	31	2	0	4	0	0	0	0	37
		Jan	0	0	0	30	1	1	4	0	1	37
		Feb	0	1	0	14	4	0	0	0	0	19
		Mar	0	0	0	15	2	1	2	0	0	20
		Apr	0	0	0	11	1	0	2	0	0	14
		Total	0	64	9	74	17	2	8	0	1	175
		%	0.0	36.6	5.1	42.3	9.7	1.1	4.6	0.0	0.6	100.0
Test Fishery	UM	Nov.	0	7	2	0	0	0	0	0	0	9
		Dec	0	3	1	2	0	0	0	0	0	6
		Jan	0	0	0	7	2	1	0	0	0	10
		Feb	0	0	0	2	0	0	1	1	0	4
		Mar	0	1	0	5	0	0	0	0	0	6
		Apr	0	0	0	4	1	1	1	0	0	7
		Total	0	11	3	20	3	2	2	1	0	42
		%	0.0	26.2	7.1	47.6	7.1	4.8	4.8	2.4	0.0	100.0

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

Appendix G. CWTs recovered from Chinook salmon during the Areas 8-1 and 8-2 November 2007-April 2008 mark-selective Chinook fishery.

Area	Recov Date	Tag Code	BY	ReleaseSite	RearingH	Release Agency	DIT Code(s)	FL (cm)	Sex	RecovMark	ReleaseMark	Label
81	01-Nov	632879	04	FINCH CR 16.0222	HOODSPORT H	WDFW		62		AD Fin Clp	AD Fin Clp	50150
81	02-Nov	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	55		AD Fin Clp	AD Fin Clp	54903
81	03-Nov	632783	04	CLEAR CR 11.0013C	NISQUALLY H	NISQ	DIT: 210589	63		AD Fin Clp	AD Fin Clp	54652
81	04-Nov	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	54		AD Fin Clp	AD Fin Clp	49012
81	10-Nov	633369	05	FRIDAY CR 03.0017	SAMISH H	WDFW	DIT: 633368	54		AD Fin Clp	AD Fin Clp	32652
81	19-Nov	210598	04	KALAMA CR 11.0017	KALAMA CR H	NISQ		66		AD Fin Clp	AD Fin Clp	32567
81	23-Nov	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	63		AD Fin Clp	AD Fin Clp	54907
81	23-Nov	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	69		AD Fin Clp	AD Fin Clp	32706
81	30-Nov	632873	04	DESCHUTES R 13.0028	TUMWATER FALLS H	WDFW		64		AD Fin Clp	AD Fin Clp	32707
81	30-Nov	632965	04	MINTER CR 15.0048	MINTER H	WDFW		66		AD Fin Clp	AD Fin Clp	32708
81	21-Dec	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	67	M	AD Fin Clp	AD Fin Clp	32874
81	18-Jan	632789	04	WALLACE R 07.0940	WALLACE R H	WDFW	DIT: 632788	60	M	AD Fin Clp	AD Fin Clp	42591
81	25-Jan	632978	04	CHAMBERS CR 12.0007	LAKEWOOD H	WDFW		64		AD Fin Clp	AD Fin Clp	32709
81	22-Feb	210570	04	TULALIP CR 07.0001	BERNIE GOBIN H	TULA		77	M	AD Fin Clp	AD+OTOLITH	32685
81	01-Mar	632880	04	GORST CR 15.0216	GORST CR REAR. PND	SUQ		74		AD Fin Clp	AD Fin Clp	54917
81	02-Mar	185030	05	R-CHILLIWACK R	H-CHILLIWACK R	CDFO	DIT: 185031, 185032	61		AD Fin Clp	AD Fin Clp	54682
81	07-Mar	632888	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632889	66		Unmarked	Unmarked	32710
81	09-Mar	210571	05	TULALIP CR 07.0001	BERNIE GOBIN H	TULA		65	F	AD Fin Clp	AD+OTOLITH	32687
81	16-Mar	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	75		AD Fin Clp	AD Fin Clp	54686
81	30-Mar	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		70		AD Fin Clp	AD Fin Clp	42563
82	01-Nov	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		57		AD Fin Clp	AD Fin Clp	54901
82	03-Nov	633382	05	FINCH CR 16.0222	HOODSPORT H	WDFW		63		AD Fin Clp	AD Fin Clp	54653
82	03-Nov	632877	04	GREEN R 09.0001	ICY CR H	WDFW		67		AD Fin Clp	AD Fin Clp	54902
82	04-Nov	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	57		AD Fin Clp	AD Fin Clp	51369
82	05-Nov	632874	04	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		51		AD Fin Clp	AD Fin Clp	54904
82	17-Nov	632870	04	CHAMBERS CR 12.0007	GARRISON H	WDFW				AD Fin Clp	AD Fin Clp	54663
82	24-Nov	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	52		AD Fin Clp	AD Fin Clp	54668
82	25-Nov	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		62		AD Fin Clp	AD Fin Clp	54910
82	06-Dec	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	65	M	AD Fin Clp	AD Fin Clp	32872
82	08-Dec	633371	05	BIG SOOS CR 09.0072		WDFW	DIT: 633372	54		Unmarked	Unmarked	54671
82	08-Dec	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		67		AD Fin Clp	AD Fin Clp	54672
82	08-Dec	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		59	F	AD Fin Clp	AD Fin Clp	32873
82	13-Jan	633286	05	CLEAR CR 11.0013C	NISQUALLY H	NISQ	DIT: 210681	51	F	AD Fin Clp	AD Fin Clp	32875
82	13-Jan	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	52		AD Fin Clp	AD Fin Clp	54675
82	13-Jan	633383	05	ISSAQUAH CR 08.0178	ISSAQUAH H	WDFW		59	F	AD Fin Clp	AD Fin Clp	32876
82	13-Jan	632874	04	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		58		AD Fin Clp	AD Fin Clp	54913
82	13-Jan	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		70		AD Fin Clp	AD Fin Clp	54912
82	13-Jan	210684	05	WHITEHORSE SPRINGS	WHITEHORSE POND	COOP		53		AD Fin Clp	AD Fin Clp	54674
82	16-Jan	633285	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 210682	61		AD Fin Clp	AD Fin Clp	54676
82	19-Jan	210682	05	GROVERS CR 15.0299	GROVERS CR H	SUQ	DIT: 633285			Unmarked	Unmarked	54677
82	19-Jan	632874	04	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		74		AD Fin Clp	AD Fin Clp	54678
82	04-Feb	632978	04	CHAMBERS CR 12.0007	LAKEWOOD H	WDFW		71		AD Fin Clp	AD Fin Clp	54680

Area	Recov Date	Tag Code	BY	ReleaseSite	RearingH	Release Agency	DIT Code(s)	FL (cm)	Sex	RecovMark	ReleaseMark	Label
82	09-Feb	632874	04	SKOKOMISH R 16.0001	RICKS PD (LLTK)	WDFW		55		AD Fin Clp	AD Fin Clp	54914
82	23-Feb	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		62		AD Fin Clp	AD Fin Clp	54916
82	02-Mar	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		67		AD Fin Clp	AD Fin Clp	54681
82	08-Mar	632978	04	CHAMBERS CR 12.0007	LAKEWOOD H	WDFW		67		AD Fin Clp	AD Fin Clp	54919
82	08-Mar	632786	04	CHAMBERS CR 12.0007	CHAMBERS CR + GARRISON	WDFW		69		AD Fin Clp	AD Fin Clp	54920
82	08-Mar	632794	04	FRIDAY CR 03.0017	SAMISH H	WDFW	DIT: 632795	65		AD Fin Clp	AD Fin Clp	54684
82	08-Mar	632876	04	WALLACE R 07.0940	WALLACE R H	WDFW		72		AD Fin Clp	AD Fin Clp	54685
82	09-Mar	210571	05	TULALIP CR 07.0001	BERNIE GOBIN H	TULA		54		AD Fin Clp	AD+OTOLITH	54602
82	16-Mar	633172	05	NOOKSACK R -NF 01.0120	KENDALL CR H	WDFW	DIT: 633171	52		AD Fin Clp	AD+OTOLITH	54687
82	22-Mar	633369	05	FRIDAY CR 03.0017	SAMISH H	WDFW	DIT: 633368	62		AD Fin Clp	AD Fin Clp	54688
82	30-Mar	632889	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW	DIT: 632888	63		AD Fin Clp	AD Fin Clp	54690
82	20-Apr	632391	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW		82		AD Fin Clp	AD Fin Clp	54606
82	26-Apr	210592	04	GROVERS CR HATCHERY	GROVERS CR H	SUQ	DIT: 632790	84	F	AD Fin Clp	AD Fin Clp	54607
82	27-Apr	632875	04	CASCADE R 03.1411	MARBLEMOUNT H	WDFW		80		AD Fin Clp	AD Fin Clp	54691

Appendix H-1. Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the Area 8-1 November 2007-April 2008 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.

			Retained Catch			Released Salmon						
Month	Date Range	Angler Category	AD Chinook	UM Chinook	Chum	AD Chinook	UM Chinook	Unk. Chinook	Chum	AD Coho	Unk. Coho	UnID'd Salmonid
NOV	11/1-12/2	Private	267	0	0	1,095	510	241	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
DEC	12/3-12/31	Private	32	0	0	117	123	55	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
JAN	1/1-2-3	Private	164	0	0	202	104	14	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
FEB	2/4-3/2	Private	137	0	0	72	57	57	0	19	6	0
		Charter	1	0	0	0	2	0	0	0	0	0
MAR	3/3-3/30	Private	55	5	0	22	30	15	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
APR	3/31-4/30	Private	20	0	0	25	22	4	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
Creel subtotal:			673	5	0	1,534	847	385	0	19	6	0
Charter subtotal:			1	0	0	0	2	0	0	0	0	0
Grand Total:			674	5	0	1,534	849	385	0	19	6	0
Variance:			6,770	15	0	121,361	20,336	2,610	0	123	24	0
CV (%):			12%	86%	-	23%	17%	13%	-	57%	77%	-
95% CI:			513-836	1-12	-	851-2,216	570-1,129	285-485	-	5-41	2-16	-

Appendix H-2. Fishery-total estimates of retained and released salmon (Chinook *and* other species) catch for the Area 8-2 November 2007-April 2008 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.

			Retained Catch			Released Salmon						
Month	Date Range	Angler Category	AD Chinook	UM Chinook	Chum	AD Chinook	UM Chinook	Unk. Chinook	Chum	AD Coho	Unk. Coho	UnID'd Salmonid
NOV	11/1-12/2	Private	155	0	6	229	92	360	2	0	0	20
		Charter	0	0	0	0	0	0	0	0	0	0
DEC	12/3-12/31	Private	84	4	0	107	55	60	0	0	0	0
		Charter	10	0	0	15	6	0	0	0	0	0
JAN	1/1-2-3	Private	148	1	0	154	110	67	0	0	0	0
		Charter	16	0	0	13	4	0	0	0	0	0
FEB	2/4-3/2	Private	136	7	0	132	144	100	0	0	0	0
		Charter	6	0	0	4	2	0	0	0	0	0
MAR	3/3-3/30	Private	239	5	0	157	117	62	0	0	0	0
		Charter	9	0	0	11	3	0	0	0	0	0
APR	3/31-4/30	Private	66	0	0	34	44	31	0	0	0	0
		Charter	0	0	0	0	0	0	0	0	0	0
Creel subtotal:			828	18	6	812	563	680	2	0	0	20
Charter subtotal:			41	0	0	43	15	0	0	0	0	0
Grand Total:			869	18	6	855	578	680	2	0	0	20
Variance:			2,364	50	4	3,955	3,293	7,586	0	0	0	320
CV (%):			6%	39%	35%	7%	10%	13%	0%	-	-	89%
95% CI:			774-964	4-32	2-10	732-978	466-691	509-851	2-2	-	-	4-55

Appendix I-1. Revised total and size/mark-status group-specific estimates of Chinook encounters for previous seasons (2005-2006, 2006-2007 seasons, with 2007-2008 values) of the Area 8-1 mark-selective Chinook fishery. Revisions are based on the bias-corrected "Method 2" approach recommended by Conrad and McHugh (2008). LM = legal-sized, marked; LU = legal-sized, unmarked; SM = sublegal-sized, marked; SU = sublegal-sized, unmarked. Note that estimates include both private and charter anglers.

Marine Area	Season	Month	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Area 8-1	2005-06	OCT	36	0	5	0	5	0	287	146	480
		NOV	39	0	5	0	6	49	105	77	281
		DEC	43	0	6	0	6	22	44	94	216
		JAN	38	0	5	0	6	49	108	96	302
		FEB	97	0	12	0	14	34	108	77	342
		MAR	31	0	4	0	5	13	98	69	219
		APR	19	0	2	0	3	21	13	15	73
		Total	**303**	**0**	**39**	**0**	**45**	**188**	**763**	**575**	**1,914**
	2006-07	OCT	44	3	6	1	7	12	610	435	1,117
		NOV	11	0	2	0	2	3	77	44	139
		DEC	47	0	6	0	7	16	335	163	574
		JAN	19	0	3	0	3	12	112	51	199
		FEB	22	3	3	1	3	6	101	47	186
		MAR	65	3	9	1	10	21	77	47	233
		APR	69	0	9	0	10	49	125	70	333
		Total	**278**	**8**	**37**	**4**	**42**	**118**	**1,437**	**857**	**2,781**
	2007-08	OCT									0
		NOV	252	0	14	0	38	145	1,122	483	2,054
		DEC	30	0	2	0	5	10	25	25	96
		JAN	156	0	9	0	23	64	125	36	412
		FEB	129	0	7	0	19	43	30	19	248
		MAR	52	5	3	0	8	29	39	13	148
		APR	19	0	1	0	3	11	5	2	41
		Total	**638**	**5**	**36**	**0**	**95**	**304**	**1,345**	**577**	**3,000**

Appendix I-2. Revised total and size/mark-status group-specific estimates of Chinook encounters for previous seasons (2005-2006, 2006-2007 seasons, with 2007-2008 values) of the Area 8-2 mark-selective Chinook fishery. Revisions are based on the bias-corrected "Method 2" approach recommended by Conrad and McHugh (2008). LM = legal-sized, marked; LU = legal-sized, unmarked; SM = sublegal-sized, marked; SU = sublegal-sized, unmarked. Note that estimates include both private and charter anglers.

Marine Area	Season	Month	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Area 8-2	2005-06	OCT	36	2	1	0	5	90	715	416	1,266
		NOV	26	2	1	0	3	23	65	32	151
		DEC	103	7	4	0	14	69	45	66	309
		JAN	151	5	7	0	19	107	138	60	487
		FEB	196	11	10	0	30	164	296	95	802
		MAR	82	6	4	0	13	89	205	130	529
		APR	142	7	7	0	22	77	241	78	573
		Total	**735**	**40**	**35**	**0**	**106**	**618**	**1,706**	**876**	**4,116**
	2006-07	OCT	58	3	6	1	7	27	1,930	1,040	3,072
		NOV	28	1	4	0	7	31	1,448	734	2,252
		DEC	108	3	12	0	14	-1	1,849	761	2,746
		JAN	117	3	15	0	17	-2	2,545	1,462	4,156
		FEB	102	3	13	0	15	24	713	338	1,208
		MAR	229	3	30	0	34	76	1,546	945	2,864
		APR	125	3	16	1	18	27	456	127	772
		Total	**766**	**18**	**95**	**3**	**113**	**183**	**10,486**	**5,407**	**17,071**
	2007-08	OCT									0
		NOV	141	0	14	0	21	18	293	90	577
		DEC	87	4	8	1	11	28	170	21	329
		JAN	151	1	13	0	20	20	191	83	479
		FEB	130	6	12	1	20	28	165	46	408
		MAR	226	4	21	1	32	55	124	58	522
		APR	60	0	6	0	9	32	-1	5	112
		Total	**795**	**15**	**74**	**3**	**114**	**181**	**942**	**303**	**2,428**