A Multi-year Assessment of the Marine Areas 8-1 and 8-2 Selective Chinook Fishery: 2005-2007

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FINAL WORKING DRAFT

Washington Department of Fish and Wildlife
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A Multi-year Assessment of the Marine Areas 8-1 and 8-2 Selective Chinook Fishery: 2005-2007

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By the WDFW Multi-year Report Workgroup

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EXECUTIVE SUMMARY

Two complete years of the Areas 8-1 and 8-2 "pilot" mark-selective fishery, including the monitoring/sampling programs needed for evaluation of the fishery, have been completed and a third year of the fishery is currently in progress. This multi-year report has been produced to review achievement of the purpose for implementing pilot selective Chinook fisheries in Areas 8-1 and 8-2 during the October-April 2005-06 and October-April 2006-07 seasons. The pilot fishery purpose is stated in the State-Tribal agreement documents (Northwest Treaty Tribes and the Washington Department of Fish and Wildlife, 2007):

> "*The purpose of the 'pilot' fishery is to collect information necessary to enable evaluation and planning of potential future mark-selective fisheries. The 'pilot' fishery provides a basis for determining if the data needed to estimate critical parameters can be collected and if the sample sizes needed to produce these estimates with agreed levels of precision can be realistically obtained*."

These mark-selective fisheries were planned making assumptions about the performance of the fishery and how the fishery will affect wild (unmarked) and hatchery (marked) Chinook salmon. For example, the total number of marked and unmarked Chinook salmon encountered in these fisheries was estimated during the pre-season planning process using the Chinook FRAM and assumptions about fish abundance and angler effort levels. The sampling and monitoring programs in place for the "pilot" fisheries will aid verification of these assumptions. More fundamentally, results of the programs will be used to determine if the data needed to provide usable estimates of critical parameters can be collected.

These monitoring and sampling programs were designed to collect and provide data to estimate the following parameters, as listed in the State-Tribal agreement documents (Northwest Treaty Tribes and the Washington Department of Fish and Wildlife, 2007):

- the mark rate in the fishery: marked and unmarked encounters estimated by both on-the-water and shore-based programs;
- the incidence of partial adipose clips: estimated by both shore-based and on-water programs;
- the number of fish retained or landed: marked and unmarked fish estimated using a shore-based program, including CWT and scale-age sampling;
- the number of unmarked fish released: estimated by shore-based and on-water programs;
- the number of unmarked fish retained: estimated by a shore-based program and compared to enforcement program estimates;
- the number of marked fish released: estimated by a shore-based program in conjunction with on-water mark rate encounter estimates;
- the number of the chinook encounters that are of sub-legal size: estimated by shore-based and on-water programs;
- the stock composition of the mortalities: estimated by CWT recoveries via dockside sampling and DNA samples in the test fishery;

- estimates of marked and unmarked mortalities of double-index tag (DIT) and other CWT stocks.

With the exception of partial adipose-clip incidence (*bullet 2*) and DNA-based stock composition (*bullet 8*), we evaluate each of the above parameters in this multi-year review document. Additionally, we present analyses of several other parameters of significance to the evaluation and future management of selective Chinook fisheries.

This report was completed by WDFW, while incorporating extensive review and input from the Tribes. We review and analyze results of the monitoring/sampling program to evaluate if the intended objectives of the first two years of pilot fisheries in Areas 8-1 and 8-2 have been achieved. These objectives include: 1) collect information necessary to enable evaluation and planning of future potential Chinook mark-selective fisheries; and 2) determine if the data needed to estimate critical parameters can be collected and if the sample sizes needed to produce these estimates with agreed-to levels of precision can be realistically obtained. We initiated our review efforts with the intent of completing a thorough and timely evaluation that could help inform managers as they plan the 2008 season.

Our multi-year report contains two sections, each of which addresses separate aspects of the Areas 8-1 and 8-2 selective fisheries. In Section I, we present the modeling, sampling, and estimation methods that were employed in our evaluation of these two fisheries; provide resulting estimates of key fishery parameters; and discuss their patterns and significance on both a within- and between- area and season basis. In Section II, we address four topical questions relating to how the sampling, estimation, and modeling of the Areas 8-1 and 8-2 fisheries has been conducted over the past two seasons. These questions and their associated analyses are presented and discussed in a manner that aims to facilitate discussions for improved selective fisheries monitoring in the future.

Section I: Within- and Between-Year Patterns in Fishery Parameters

From October 1 to April 30 of 2005-6 (the "05-06 Season" hereafter) and October 1 to April 30 2006-7 (the "06-07 Season" hereafter), we implemented separate sampling programs in Areas 8-1 and 8-2 in order to collect the data necessary to estimate critical fishery parameters. For each area, the general study design was built around Murthy's population-total estimator (Murthy 1957, Cochran 1977) and was focused specifically on obtaining daily estimates of total catch (landed and released) and total effort which could be expanded to weekly, monthly, and ultimately season-total values. Our sampling program incorporated comprehensive and complementary data collection strategies, including: 1) dockside-based angler interviews and catch sampling ("creel sampling"); 2) on-the-water total (instantaneous) effort surveys; 3) test fishing; and 4) voluntary reports of completed trips provided by charter boats and private anglers. We combined datasets collected through each of these sampling efforts within a rigorous estimation framework to characterize the behavior of the private recreational fleet (catch, effort, etc.) and characterize the overall impacts of the Areas 8-1 and 8-2 pilot selective fisheries.

Additionally, we quantified and analyzed the biological attributes (size and age) of landed catch sampled in the creel as during catch test-fishery sampling.

Creel Sampling Results

Estimates of total fishing effort, total landed catch, and average catch per unit of effort (CPUE) were remarkably consistent for the first two seasons of the pilot Areas 8-1 and 8-2 selective blackmouth fishery. Approximately 12,000 anglers participated in the combined fishery during both the 05-06 (12,495) and 06-07 (11,302) seasons; the majority of effort (two thirds) of effort occurred in Area 8-2. Within-season (i.e., month-to-month) effort patterns were also consistent between the two pilot seasons. On average, peak effort occurred in October in both areas, followed by a late-winter/early-spring effort peak (February-April). Only a limited amount of fishing effort occurred effort between November and the end of January.

Though nearly twice as many Chinook were harvested in Area 8-2 compared to Area 8-1, monthly average and season-total landed catch differed little between the 05-06 and 06-07 selective winter blackmouth seasons (pooled areas: 1,152 in 05-06, 1,210 in 06-07). Within seasons, there was limited Chinook harvest during October and November, followed by increased catches from December through to the end of the season; in both years, there was a February-March catch peak. Catch per unit effort (CPUE; estimated total landed catch / estimated total angler trips) averaged 0.10 Chinook retained per angler trip in both areas and years; however, there was evidence of considerable within-season variation in CPUE. Though total catch and effort were lowest at this time, the highest values of monthly CPUE were observed during mid-winter (Dec/Jan on average).

During creel interviews, dockside samplers measured the lengths of 1,215 marked, 15 unmarked, and 4 unknown mark-status Chinook that were harvested. From this, 99% (05-06: 596/601) and 98% (06-07: 619/629) of Chinook harvested from 8-1 and 8-2 combined were adipose clipped and 93% and 90% (05-06 and 06-07, respectively) retained marked fish were legal in size. With the exception of fish sampled in Area 8-2 during 06-07, there was little difference in Chinook total length between areas and seasons. However, we documented clear and systematic within-season size patterns whereby the monthly mean total length of landed-marked Chinook increased by 4 to 8 cm between October and April. The majority of marked salmon harvest consisted of individuals that were either 2 or 3 years in age, with little between-area and -year variation (80.1% in 05-06, 86.3% in 06-07; age-4 individuals accounted for the remainder of catch in both years (19.9% and 13.7% in 05-06 and 06-07, respectively).

The 05-06 and 06-07 pilot blackmouth seasons differed markedly in terms of estimated total Chinook releases. This result was consistent for both of the estimation approaches that we employed (i.e., “Method 1”, relies solely on interview-based estimates; and “Method 2”, relies on creel survey estimates of legal-marked retained Chinook expanded by test fishery proportions). Combining both areas and all release categories, between 4 (Method 2) and 7 (Method 1) times as many Chinook were hooked and released in the

06-07 season than during the 05-06 season. When apportioned to mark-status groups using test-fishery data, 5-9 (Method-1 to Method-2 range) times as many marked and 3-5 (Method1-Method 2) times as many unmarked Chinook were encountered during 06-07 compared to 05-06. Approximately 253-281 (Method 1-Method 2) unmarked and 267-301 (Method 1-Method 2) marked Chinook were encountered and released during each month of the 05-06 selective season, with little month-to-month variability. During the 06-07 season, 831-1,279 (Method 2-Method 1) unmarked and 1,515-2,438 (Method 2-Method 1) marked Chinook were encountered and released during each month on average, with October constituting the greatest number of releases for the season. Given the consistency of landed catch between areas and years, total 06-07 Chinook encounters (retained + released) were 4 (Method 2) to 7 (Method 1) times greater than for the 05-06 season.

Based on dockside sampling of landed catch and angler-reported release estimates for known mark-status groups, mark rates varied little between months and areas within years but considerably so between years. 2005-06 mark rates were 0.61 in Area 8-1 and 0.60 in Area 8-2; averaging an absolute 10% higher in 06-07, mark rates for the two respective areas were 0.71 and 0.73. Thus, between two thirds and three quarters of all Chinook encountered were visibly of hatchery origin.

Test Fishery Results

Over the two areas and two seasons, test fishers spent 2,476 hours and 496 days pursuing Chinook salmon for WDFW monitoring purposes. These efforts yielded a total of 3,727 Chinook encounters, the majority of which occurred during the 06-07 season. Monthly test-boat encounters averaged 133 across the two areas and seasons and ranged from 24 to 615. Using assumed mortality rates, we estimated total test-fishing impacts at 715 Chinook mortalities (253 unmarked, 462 marked) for the two areas and seasons, the majority of which were for the 06-07 season.

The size/mark-status composition of test-fishery encounters was similar between the two areas, but differed markedly between seasons. For 05-06, the overall mark rate (i.e., marked encounters / all encounters) was 0.58 in 8-1 and 0.62 in 8-2. In 06-07, values were higher in both areas, at 0.65 and 0.67, respectively. Legal mark-rates (i.e., legal-marked encounters / all legal encounters) were even more disparate between years: 8-1 test-fishery estimates were 0.62 in 05-06 and 0.72 in 06-07; 8-2 legal-mark rates were 0.56 in 05-06 and 0.79 in 06-07. Although the size/mark-status composition of test-fishery encounters was varied from month to month, there was a tendency towards an increased legal-sized proportion towards the close of the fishery.

We analyzed length data for Chinook encountered in the Areas 8-1 and 8-2 test fisheries and found that a significant proportion of total-length variation was due to area, season, mark-status effects. In particular, we documented a trend towards smaller Chinook sizes during 06-07 relative to 05-06 – especially for Area 8-2. We also found that between 6 and 10% of all encountered marked Chinook were within 2 inches of the legal length

limit (i.e., $20 < x < 22$ in). Finally, we the average size of test-boat encountered Chinook increased as the season progressed during both years, with mean total length of marked fish increasing from 35-40 cm to approximately 50 cm over the seven month test fishery.

Similar to mark-rates and other fishery attributes, we found little difference in the age composition of test fishery encounters (marked and unmarked) within seasons and between areas but considerable differences between seasons. In particular, there was a clear shift towards increased age-1 and age-2 relative abundance in 06-07 compared to 05-06. In 05-06, 55% of marked and 63% of unmarked encounters were age 2 or less; in 06-07, these same two age (1 and 2) classes comprised 72 and 81% of all marked and unmarked Chinook encountered in the test fishery.

Total Fishery Impacts

We estimated total mortality due to the combined 8-1/8-2 selective fishery by combining creel-based estimates of Chinook encounters, test-fishery data on the size/mark-status composition of the pool of fishable Chinook, and agreed-to selective fishing mortality rates (*sfm*). For the 05-06 season, total Chinook mortality for the combined fishery was estimated at 1,840 (based on Method 1 encounters) to 1,941 (based on Method 2). 06-07 mortality was estimated to be 2-3 times greater than the 05-06 season, with estimates ranging from 4,481 (Method 2) to 6,311 (Method 1) for this latter season. During both seasons, the majority of mortality was comprised of marked (relative to unmarked), sublegal (relative to legal), and Area 8-2 Chinook (relative to 8-1). In an attempt to characterize selective fishery impacts in a manner independent of assumed *sfm* values, we also evaluated released-to-retained ratios for the Areas 8-1 and 8-2 fisheries for both seasons. Released-to-retained corroborate that the 8-1/8-2 fishery had substantially greater impacts during 06-07 compared to 05-06. During the first pilot season, an average of 2-3 unmarked and 1-3 total (marked and unmarked) releases occurred for each Chinook retained. In 06-07, estimates averaged 21-24 total and 7-9 unmarked releases per kept fish, respectively.

Based on coded-wire tag (CWT) recoveries (unexpanded), Puget Sound hatchery stocks comprised the majority of marked, tagged Chinook harvested during the 05-06 and 06-07 selective seasons. Out of the 209 CWTs recovered during the first two pilot seasons, only three came from hatcheries from outside of Puget Sound (two from Canadian facilities and one from the Columbia River). During the 05-06 season, 29 of 101 CWT recoveries were double index tags (DITs); 20 of 108 CWTs recovered in 06-07 were DITs. Unmarked-DIT mortality estimates (using λ at release) due to selective fishing were low for both seasons. We estimated that 9 and 5 unmarked-DIT Chinook perished as a result of the 05-06 and 06-07 selective seasons, respectively.

Angler Compliance and Enforcement Summary

For the two pilot seasons that Areas 8-1 and 8-2 were under mark-selective rules for Chinook retention, available information suggests that angler compliance with

regulations was quite high. For anglers sampled at dockside, we estimated an unmarked retention error (no. unmarked [legal and sublegal] Chinook landed / no. unmarked [legal and sublegal] Chinook encountered) of 0.0% and 0.9% for 05-06 and 06-07 in Area 8-1 and 5.2% and 1.0% in Area 8-2 during the same respective seasons. Yearly enforcement reports compiled for the North of Falcon season-setting process corroborate these sample-based estimates of compliance. Overall compliance with salmon rules for Area 8-1 was 95.7% for 2005 and 97% for 2006 and there were no citations issued for possession of wild Chinook. In Area 8-2, compliance with salmon rules was 86.6% during 2005 and 90% for 2006, and three fishery-related arrests were made during the latter season (two for wild Chinook and one for over-limit [salmon] possession).

SECTION I: SUMMARY AND DISCUSSION

Based on two years of experience with implementing and intensively monitoring the pilot Areas 8-1 and 8-2 mark-selective blackmouth fisheries, we note and conclude the following:

- Monthly and season-total patterns fishing effort, CPUE, and total Chinook landings were relatively stable for the two areas and years.
- The first two pilot seasons differed considerably in total estimated impacts, due primarily to increased sublegal-sized Chinook (marked and unmarked) abundance.
- The combined Areas 8-1 and 8-2 selective fishery generally operated at or below expected (i.e., FRAM-modeled) level of impact.
- The impacts of the Areas 8-1 and 8-2 selective fisheries on the coast-wide CWT program—assessed in terms of estimated capture-and-release mortalities inflicted upon unmarked-DIT Chinook encountered—were minor for both seasons.
- Estimated mark rates were high relative to what is deemed acceptable for implementing successful mark-selective fisheries.
- Dockside data and WDFW-Enforcement summary reports indicate that anglers closely followed mark-selective Chinook harvest regulations during both seasons of the pilot fisheries.

Section II: An Assessment of Selective Fishery Sampling and Analysis Methods

To better understand the quality of existing monitoring data and to guide future work, we addressed four topical questions relating to how the planning (i.e., Fishery Regulation Assessment Model application), sampling, and evaluation (i.e., data analysis) of the Areas 8-1 and 8-2 fisheries has ensued over the past two seasons:

1) Have the sampling programs performed at a level sufficient to characterize fishery impacts within acceptable bounds of precision?

2) Have the test-boat anglers succeeded at emulating the private recreational fleet, in terms of fishing methods and Chinook encounters (i.e., size/mark-status composition)?
3) Which method [i.e., "Method 1" (creel-only based) or "Method 2" (creel-based landed catch expanded by test fishery proportions)] is most likely to yield unbiased estimates of total Chinook encounters?
4) How well has the Fishery Regulation Assessment Model (FRAM) performed in planning the combined Areas 8-1 and 8-2 selective Chinook fisheries?

Question 1: Adequacy of the Areas 8-1 and 8-2 Selective Fishery Sampling Program

To answer Question 1, we: 1) characterized the intensity of sampling efforts in both Areas 8-1 and 8-2, 2) evaluated the adequacy of dockside and test-fishery sampling programs relative to pre-determined and agreed-upon sample-size objectives, 3) described the relative precision of key quantities estimated from sample-program data, and 4) evaluated the effects of reduced sampling on the precision of season-wide estimates of test-fishery parameters.

During the first two seasons of the 8-1 and 8-2 selective fisheries, we directly sampled 4,950 angling parties, yielding data on a total of 9,580 angler-trips and 11,223 Chinook encounters. We sampled Chinook encounters (retained and released) and fishing effort at a level commensurate with the stated goal (100 encounters per month), with few exceptions. Relative to sample-rate objectives defined for CWT sampling in selective Chinook fisheries, we met our target (20% of all harvested Chinook) for 25 of 28 Area-month combinations. We were also successful at sampling completed fishing trips at a high rate (20-50%). Finally, coefficients of variation (CVs) for season-total and monthly estimates of fishing effort, Chinook landings, and released Chinook encounters averaged 10-20%. Overall, these findings illustrate that the dockside component of our monitoring program is successful at achieving sampling objectives and delivering precise estimates of catch and effort.

Relative to Question 1, we also assessed the ability of our test-fishing program to meet specified objectives. As test-fishery encounters consistently exceeded the stated objective of 100 Chinook encounters per management regime, we evaluated whether or not opportunities exist for scaling back efforts without significantly compromising the precision of parameter estimates. This re-sampling exercise demonstrated that the variance around test fishery-based estimates of mark rates and legal-marked proportions decreases with increasing sampling intensity, but not at a constant rate. The sharpest variance reductions were observed for sample rates that were 10-40% of the present level; variance decreased little at sample rates that were 50% or greater. Thus, clear opportunities exist for scaling back test fishing efforts without significantly compromising the precision of estimates.

Question 2: How well does the test fishery emulate the private recreational fleet?

The test-fishing component of the Areas 8-1 and 8-2 selective fisheries monitoring program supplies critical information used for fishery characterization and total encounters and mortalities estimation. In using an experimental fishery to fulfill these data needs, we have by default assumed that the size/mark-status composition of test-fishery Chinook encounters approximates that experienced by the private recreational fleet.

While emulating the fleet is generally achieved in practice, we formally addressed Question 2 by comparing parameters describing the composition of Chinook encounters between test-fishery and private-fleet datasets. For all Chinook encounters, we compared overall mark rates between test-fishing and dockside datasets; for known mark-status fish, test-fishery and dockside-based estimates of overall mark rates were virtually identical for both areas during 05-06 but not 06-07. We separately compared mean sizes and length-frequency distributions between test-fishery legal-marked Chinook encounters and those retained by anglers that were inspected during creel surveys for each Area-season combination. While length–frequency distributions were similar in shape, lengths differed for 3 of 4 test-fishery vs. fleet comparisons; test-fishery lengths were 1-2 cm smaller than those estimated for the fleet. Finally, we compared the age composition of legal-marked Chinook observed at dockside and sampled in the test-fishery. From this, the age composition of legal-marked Chinook encountered in the test fishery appears similar to that experienced by the private fleet. With some comparisons illustrating similarities and other suggesting differences in measured attributes of Chinook encounters, it remains equivocal as to whether or not the 8-1 and 8-2 test fisheries perfectly mimic the private fleet in its angling behavior. For this reason, future evaluation may be necessary to completely answer Question 2.

Question 3: Does Method 1 or 2 provide a better estimate of total encounters?

To answer Question 3, we evaluated: *i*) Method-1 and -2 total-encounters estimators and their associated assumptions, *ii*) the sensitivity of estimators to assumption violations, and *iii*) the validity of assumptions based on indirect evaluations using empirical data. Method 1 (M1, sum of creel-based estimates for all Chinook encounters categories) and Method 2 (M2, creel-based estimate of legal-marked Chinook landed catch expanded by test-fishery legal-marked proportion) differ computationally and in terms of the assumptions they require for accurate encounters estimation. M1 accuracy relies on the ability and/or willingness of anglers to accurately recall and/or report caught-and-released Chinook encounters (*Assumption 3*). The accuracy of M2 estimates depends on whether or not anglers report all legal-marked Chinook encountered (*Assumption 5*) and the extent to which the size/mark-status composition of test-fishery encounters mirrors that seen by private anglers (*Assumption 6*).

Our M1 vs. M2 sensitivity analysis revealed that: *i*) when Assumptions 3 and 5 are not met, M1 and M2 estimates are affected similarly, *ii*) estimates are most sensitive to Assumption 6 departures, and *iii*) due to compensating effects, M2 has the potential to yield accurate encounters estimates when both Assumption 5 and 6 are imperfectly met. Next, we considered available empirical evidence to gauge the plausibility of Assumptions 3, 5, and 6. For Assumption 3 ("Anglers accurately report released Chinook encounters"), we reviewed pertinent literature, considered patterns in M1 relative to M2 estimates, and inspected raw interview data (i.e., release–frequency distributions). Based on this, we concluded that Assumption 3 is unlikely to be perfectly met—particularly during high-encounters periods—and that in general anglers probably over-report released Chinook encounters. Though few data exist for evaluating Assumption 5, available information suggests that it is violated to a minor degree. Based on voluntary trip reports, we estimate that anglers may release as many as 10% of the legal-marked Chinook that they encounter. Finally, we considered the likelihood of meeting Assumption 6 under Question 2 above. Though this evaluation did not provide uniform support indicating that Assumption 6 is perfectly met, initial findings suggest that it is reasonably approximated but should be assessed further in the future.

Question 4: FRAM vs. Observed Estimates of Selective Fishery Parameters

In this section we evaluated how well the Fishery Regulation Assessment Model (FRAM) predicted fishery outcomes (landings, encounters, mortalities) and we evaluated modeled selective fishery parameters relative to empirical estimates from creel surveys (hereafter referred to as "observed" values). Evaluated parameters include: *i*) encounters by size (legal-size and sublegal-size) and mark status (marked and unmarked) and associated mortalities; *ii*) landed catch (i.e., Chinook that are kept); *iii*) unmarked retention error (legal unmarked kept/legal-unmarked encounters); *iv*) mark release error (legal-marked released/legal-marked encounters); *v*) unmarked sublegal retention error (sublegal unmarked kept/sublegal-unmarked encounters); and *vi*) marked sublegal retention error (sublegal marked kept/sublegal-marked encounters).

FRAM's prediction of *total* Chinook encounters during the 2005-06 season was more than three-fold higher than Method 1 and 2 creel survey estimates. For the 2006-07 season, the FRAM estimate of 19,062 total Chinook encounters fell within the range of total Chinook encounters estimated via Methods 1 and 2. For both seasons, FRAM overestimated *unmarked* Chinook encounters. FRAM overestimated *marked* Chinook encounters in 05-06 for all categories; 06-07 modeled encounters for *marked* fish were an underestimate relative to observed values, with the exception of Chinook landings (which were over-predicted by FRAM). For both seasons, predicted (FRAM) vs. observed (creel) mortality comparisons yielded results that were comparable to those observed for Chinook encounters.

In addition, we considered FRAM's ability to predict total Chinook encounters and landed catch by comparing predictions to historical (1994-2005 for encounters, 1989-2005 for landed catch) estimates derived from a combination of CRC harvest estimates and Baseline creel sampling information about released salmon. FRAM encounters

predictions were lower than the CRC-based 11-year average but well within the 95% confidence interval for this parameter. 05-06 creel estimates were approximately five-fold lower than the average estimate of Chinook encounters, whereas the 06-07 estimates (Method 1 and 2) straddled the historical average. Observed total Chinook landings, when adjusted to make them comparable to historical non-selective values, were consistently less than historical levels and FRAM predictions. Despite this variability, overall FRAM performed relatively well in predicting total Chinook encounters for average years.

In addition to comparing predictions to observations, we also compared parameter values used in modeling to empirical (creel) estimates. First, FRAM uses an unmarked retention error (legal unmarked retained / total legal unmarked encountered) rate of 8% to calculate the number of unmarked legal-size fish that are retained in a selective fishery. Creel estimates of unmarked retention error for 05-06 were 5.3-5.4%, whereas 06-07 season estimates were 3.4-9.2%. Second, mark release error—defined as the number of legal-marked Chinook released divided by legal-marked Chinook encounters—is modeled at 6% in FRAM. Creel-based estimates of legal-marked release error (Method 1 only) were estimated at 8.5% during the 05-06 season and 55.6% during the 06-07 season of the Areas 8-1 and 8-2 selective Chinook fishery. While the 8.5% creel-based value for the 2005-06 season is comparable to the 10% value obtained from the voluntary trip reports, we believe the 06-07 estimate is unrealistically high and probably an artifact of the creel interview process (See Question 3 above). Finally, while neither unmarked nor marked sublegal retention error (sublegal Chinook retained for a given mark-status category / sublegal Chinook encountered for a given mark-status category) is modeled in FRAM (i.e., algorithms assume no sublegal fish are retained), creel survey estimates of unmarked sublegal retention error were 0.0% and 0.1% for 05-06 and 06-07, respectively; marked sublegal retention errors were 0.7% and 4% for 05-06 and 06-07 seasons, respectively.

SECTION II: CONCLUSIONS and RECOMMENDATIONS

Question 1: Sampling Adequacy

- Dockside sampling and test-fishery efforts were successful at achieving agreed-to sampling objectives.
- Dockside sampling and test-fishing efforts yielded precise estimates of key fishery parameters.
- Sampling efficiencies should be pursued where possible, assuming such efficiencies do not affect the integrity/reliability of estimates. As a start, we recommend that a single test fishing vessel be shared between Areas 8-1 and 8-2 to achieve cost savings and sampling efficiencies.

Question 2: Test Boats Emulating the Fleet?

- Whether or not the Areas 8-1 and 8-2 test fisheries *perfectly* mimic the private fleet remains equivocal. We characterized the ability of test-boat anglers to fish like the fleet and demonstrated similarity in some fishery parameters but we also found evidence of small but statistically significant differences in other parameters.
- Opportunities for improved and more efficient collection of test fishing data should be considered in the future. For example, as instituted in November 2007, spatial evaluations of test-fishery and private-fleet effort patterns should be pursued for both in-season guidance and post-season evaluation.
- Given that it is the most reliable (i.e., in terms of control over how data are collected, logged, etc.) dataset on Chinook encounters available and the lack of strong evidence suggesting otherwise, we recommend that the analytical assumptions associated with test fishery data be accepted at the present time. If discrepancies are detected in future analyses, appropriate measures should be taken to modify sampling and/or correct for biases.

Question 3: Evaluating Method 1 versus Method 2

- With the existing sampling program and Methods 1 and 2 as starting points, WDFW and tribal co-managers should work towards a mutually agreeable encounters and mortalities estimation framework.
- The actual percent of released marked legal-size fish remains an unknown parameter. We recommend modifying the dockside creel surveys to query anglers specifically about how many marked legal-size fish they released.

Question 4: Evaluating FRAM vs. Observed Estimates of Selective Fishery Parameters

- FRAM predicted total Chinook encounter estimates that were within the range of historical encounters but sometime over- and under-predicted encounters in particular years. Given this variability, we believe adjustments to the inputs and methods by which FRAM predicts encounters are unwarranted at his time.
- FRAM overestimated unmarked Chinook encounters during both seasons of the selective Chinook fishery in Areas 8-1 and 8-2, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM overestimated landed catch of unmarked and marked Chinook for both seasons, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM is not designed to estimate sublegal retained catch. However, creel survey estimates produced from the 2005-06 and 2006-07 seasons in Areas 8-1 and 8-2 provided low estimates of unmarked sublegal retention error, which are considered to have a minor impact on exploitation rates, especially after being converted to adult-equivalency. To account for sublegal retention error in FRAM would require a major restructure to program catch algorithms, which we do not recommend at this time.

- Currently the exploitation rate scalars in FRAM characterize fishing power during 1989-1993 as estimated in FRAM post-season runs relative to FRAM base period "catch" and stock abundances used in the 2002 and 2005 model calibrations. We recommend continuing the current method of developing fishery input scalars for at least one more year until a pattern is apparent.
- Based on two seasons of observed results, we recommend reducing the FRAM input parameter for unmarked retention error to a value of 6%, to calculate the predicted number of unmarked legal-size Chinook that are retained in a selective fishery.
- We recommend increasing the FRAM input parameter for mark release error to a value of 10%, based on the two seasons of observed results in Areas 8-1 and 8-2.
- FRAM currently models 150 encounters per test fishing boat and month. The average number of actual test fishing encounters per area and month was very close to the modeled number of encounters. We recommend continuing to model 150 Chinook encounters per test fishing boat and month.

INTRODUCTION

Two complete years of the Areas 8-1 and 8-2 "pilot" mark-selective fishery, including the monitoring/sampling programs needed for evaluation of the fishery, have been completed and a third year of the fishery is currently in progress. This multi-year report has been produced to review achievement of the purpose for implementing pilot selective Chinook salmon (*Oncorhynchus tshawytscha*) fisheries in Areas 8-1 and 8-2 during the 2005-06 and 2006-07 seasons. The pilot fishery purpose is stated in the State-Tribal agreement documents (Northwest Treaty Tribes and the Washington Department of Fish and Wildlife, 2007):

> "*The purpose of the 'pilot' fishery is to collect information necessary to enable evaluation and planning of potential future mark-selective fisheries. The 'pilot' fishery provides a basis for determining if the data needed to estimate critical parameters can be collected and if the sample sizes needed to produce these estimates with agreed levels of precision can be realistically obtained*."

These mark-selective fisheries were planned making assumptions about the performance of the fishery and how the fishery will affect wild (unmarked) and hatchery (marked) Chinook salmon. For example, the total number of marked and unmarked Chinook salmon encountered in these fisheries was estimated during the pre-season planning process using the Chinook FRAM and assumptions about fish abundance and angler effort levels. The sampling and monitoring programs in place for the "pilot" fisheries will aid verification of these assumptions. More fundamentally, results of the programs will be used to determine if the data needed to provide usable estimates of critical parameters can be collected.

These monitoring and sampling programs were designed to collect and provide data to estimate the following parameters, as listed in the State-Tribal agreement documents (Northwest Treaty Tribes and the Washington Department of Fish and Wildlife, 2007):

- the mark rate in the fishery: marked and unmarked encounters estimated by both on-the-water and shore-based programs;
- the incidence of partial adipose clips: estimated by both shore-based and on-water programs;
- the number of fish retained or landed: marked and unmarked fish estimated using a shore-based program, including CWT and scale-age sampling;
- the number of unmarked fish released: estimated by shore-based and on-water programs;
- the number of unmarked fish retained: estimated by a shore-based program and compared to enforcement program estimates;
- the number of marked fish released: estimated by a shore-based program in conjunction with on-water mark rate encounter estimates;
- the number of the chinook encounters that are of sub-legal size: estimated by shore-based and on-water programs;

- the stock composition of the mortalities: estimated by CWT recoveries via dockside sampling and DNA samples in the test fishery;
- estimates of marked and unmarked mortalities of double-index tag (DIT) and other CWT stocks.

With the exception of partial adipose-clip incidence (*bullet 2*) and DNA-based stock composition (*bullet 8*), we evaluate each of the above parameters in this multi-year review document. Additionally, we present analyses of several other parameters of significance to the evaluation and future management of selective Chinook fisheries.

Mark-selective fisheries provide fishery managers a means of reducing harvest rates on unmarked, mostly wild stocks, relative to alternative, non-selective fisheries. This conservation benefit of mark-selective fisheries may be offset by reduced accuracy or precision with estimates of mortalities on wild fish. In non-selective fisheries, much of the mortality on unmarked or wild stocks can be estimated using information collected by directly surveying the landed catch (creel or catch record system and some type of dock-side sampling program). However, fish that die in the process of being caught and released, incidental mortalities, must be estimated indirectly with information provided by programs designed to estimate the number of fish encountered and released. The principle focus of "Pilot" mark-selective fisheries recently implemented by Co-manager agreement in Puget Sound for Chinook salmon is to evaluate new and alternative programs designed specifically for this purpose.

Another source of uncertainty introduced by mark-selective fisheries is the increased reliance on assumptions about the proportion of released fish that are expected to die. The effect of uncertainty about release mortality rates on fishery mortality estimates is not a subject of this report.

This report was completed by WDFW, while incorporating extensive review and input from the Tribes. We review and analyze results of the monitoring/sampling program to evaluate if the intended objectives of the first two years of pilot fisheries in Areas 8-1 and 8-2 have been achieved. These objectives include: 1) collect information necessary to enable evaluation and planning of future potential Chinook mark-selective fisheries; and 2) determine if the data needed to estimate critical parameters can be collected and if the sample sizes needed to produce these estimates with agreed-to levels of precision can be realistically obtained. We initiated our review efforts with the intent of completing a thorough and timely evaluation that could help inform managers as they plan the 2008 season.

Our multi-year report contains two sections, each of which addresses separate aspects of the Areas 8-1 and 8-2 selective fisheries. In Section I, we present the modeling, sampling, and estimation methods that were employed in our evaluation of these two fisheries; provide resulting estimates of key fishery parameters; and discuss their patterns and significance on both a within- and between- area and season basis. In Section II, we address four topical questions relating to how the sampling, estimation, and modeling of the Areas 8-1 and 8-2 fisheries has been conducted over the past two seasons. These

questions and their associated analyses are presented and discussed in a manner that aims facilitate discussions for improved selective fisheries monitoring in the future.

STUDY AREA & FISHERIES OVERVIEW

From October 1, 2005 to April 30, 2006 (the "05-06 Season" hereafter) and October 1, 2006 to April 30, 2007 (the "06-07 Season" hereafter), mark-selective Chinook recreational fisheries were implemented in north Puget Sound's Marine Areas 8-1 and 8-2. Area 8-1 includes the marine waters 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 both seasons, fishing was permitted throughout Areas 8-1 and 8-2, excluding waters in and immediately adjacent to Tulalip Bay (Area 8-2).

The 05-06 and 06-07 seasons and Areas 8-1 and 8-2 in particular represent WDFW's first experience with implementing winter blackmouth[1] fisheries under mark-selective harvest regulations in any of Washington's marine waters. During both seasons and in both areas, regulations permitted anglers to retain up to two marked (adipose fin clipped) Chinook salmon that were $\geq$ 22 inches (56 cm) in total length, as part of their daily salmon bag limit (2 total, all salmon species combined). Anglers were required to immediately release, unharmed, any unmarked Chinook that were caught. Though coho (*O. kisutch*) and chum salmon (*O. keta*) are occasionally (during October primarily) caught by anglers fishing in Areas 8-1 and 8-2 between October and April (e.g., WDFW 2007a and b), Chinook salmon are the predominant (>95%) species targeted and encountered in both areas during blackmouth seasons.

[1] Anglers in Puget Sound commonly refer to immature Chinook salmon as "blackmouth".

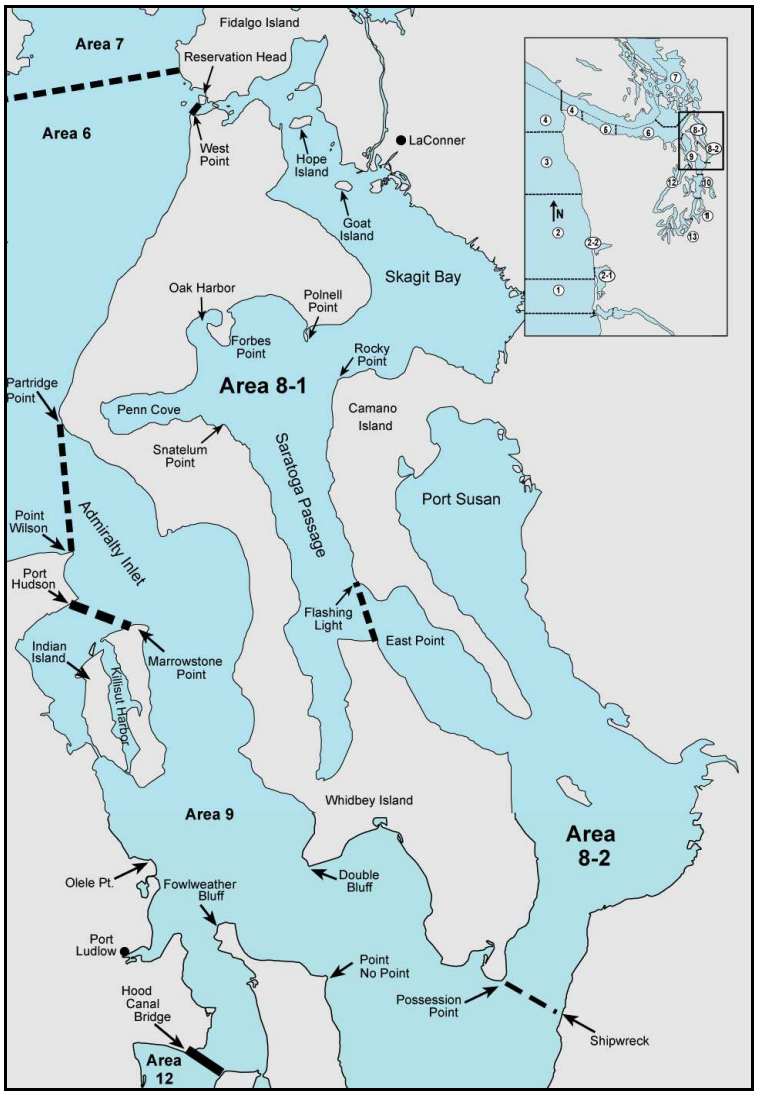


Figure 1. Map of Marine Catch Areas 8-1 and 8-2 in Puget Sound, where the seven-month selective Chinook fishery occurred from October 1-April 30 during 2005-6 and 2006-7.

SECTION I: Within and Between-Year Patterns in Fishery Parameters

METHODS

Overview

From October 1 to April 30 of 2005-6 (the "05-06 Season" hereafter) and October 1 to April 30 2006-7 (the "06-07 Season" hereafter), we implemented separate sampling programs in Areas 8-1 and 8-2 in order to collect the data necessary to estimate critical fishery parameters. For each area, the general study design was built around Murthy's population-total estimator (Murthy 1957, Cochran 1977) and was focused specifically on obtaining daily estimates of total catch (landed and released) and total effort which could be expanded to weekly, monthly, and ultimately season-total values. The program incorporated comprehensive and complementary data collection strategies, including: 1) dockside-based angler interviews and catch sampling; 2) on-the-water total (instantaneous) effort surveys; 3) test fishing; and 4) voluntary reports of completed trips provided by charter boats and private anglers (**Figure 2**).

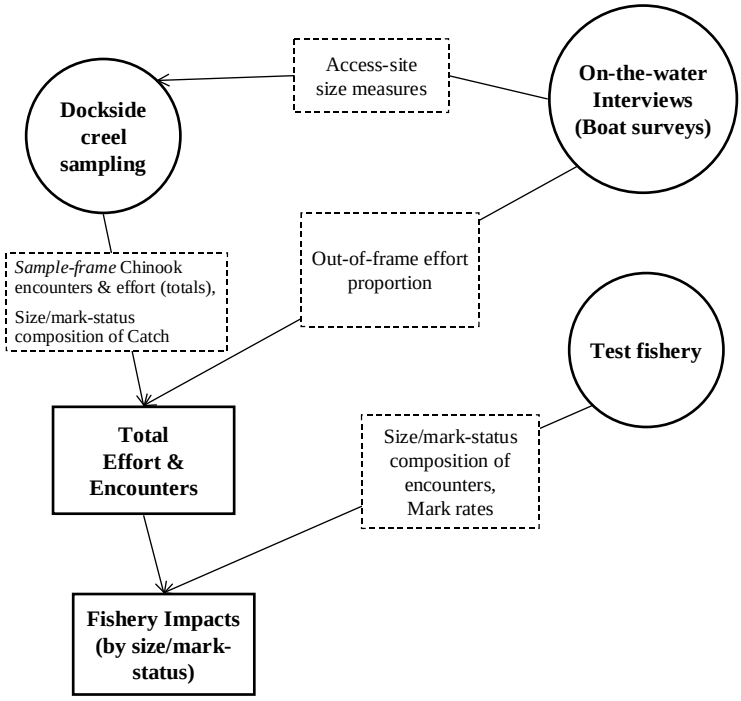


Figure 2. Conceptual diagram of the monitoring plan implemented to estimate fishery impacts in Areas 8-1 and 8-2 during their respective 05-06 and 06-07 mark-selective Chinook seasons. Circles represent sampling programs, dashed boxes represent key parameters that are estimated using data from a given program (i.e., the data necessary for estimating other parameters, e.g., age composition, are collected but not depicted), and solid boxes depict bottom-line quantities estimated using combined programs. As depicted, 'Encounters' includes both harvested and released Chinook salmon.

Dockside Sampling

Catch and effort were estimated by creel surveys following the procedures detailed in WDF and NWIFC (1992), with the exception that expansion factors (i.e., cluster sizes or "size measures") were determined in-season, rather than using previously determined effort levels. Thus, our dockside angler-interview efforts followed a two-stage stratified cluster sample design. At the first stage, we selected sample days from all available selective-fishery days from two time-based strata; at the second stage, we randomly selected (with probability proportional to size, PPS) fishery-access points (i.e., public ramps, boathouses, etc.) at which we interviewed anglers (clustered by site) to collect data about their fishing trips and to sample their catch.

Sampling Strata and Shifts

In order to maximize the accuracy and precision of our estimates of fishery-related parameters, we incorporated temporal stratification into our sample design. We divided each week into "weekday" (Monday through Thursday; low effort days) and "weekend" (Friday, Saturday, and Sunday; moderate to high effort days) sample strata; we scheduled two randomly selected days in the Monday-Thursday (weekday) stratum and all weekend days (Friday, Saturday, and Sunday) for dockside sampling. On selected sample days and at selected access sites (described below), sample shifts lasted from dawn until dark so that samplers could intercept all boats and anglers departing the fishery from that site.

Sample Frame and Site Selection

Before the start of the fishery, we determined our access-site sample frame based on a compilation of all known, publicly accessible (i.e., sampleable), and moderate-to-high effort boat-launch facilities present in Areas 8-1 and 8-2. Access sites with low effort, as determined from boat survey data (see "Boat surveys" section below), were excluded from our sample frame.

For the Area 8-1 fishery, two access sites were randomly chosen for sampling on each scheduled sample day using a weighted random site-selection process. A computer program developed by Mark Hino, WDFW Fish and Wildlife Biologist, was used to select two sites for each sampling day based on their "size" or "weight" (i.e., the proportion of angler effort *contained in the sample frame* that on average uses the site, based on boat-survey estimates; Murthy 1957, Cochran 1977) according to a PPS-without-replacement algorithm. For Area 8-2, we relied on a constrained site-selection process whereby we selected Everett Ramp for all scheduled sample days and randomly chose (PPS) an additional sample site (our "Alternative Site" in past post-season reports) for a single weekend and a single weekday stratum day each week. The "size" estimates (proportion of effort for each site) used during the Area-8-1 (all sites) and -8-2 (Alternative site only) site selection was based on the effort distribution obtained from boat surveys (described below).

Sites included in the Area-8-1 sample frame were: Bowman's Bay Ramp (2005-06 Season only), Camano Island State Park Ramp, Coronet Marina (2005-06 Season only), Coronet Bay Public Ramp, Coupeville Public Ramp, Freeland Ramp, LaConner Ramp, Maple Grove Ramp, Oak Harbor Ramp, and Utsalady Ramp. The Area 8-2 sample frame included: Camano Island State Park Ramp, Dagmar's Landing, Edmonds Boat Basin (Sling), Edmonds Dry Storage (2005-06 Season only), Everett Ramp (Norton St.; always sampled), Kayak Point State Park Ramp, Langley Ramp (2005-06 Season only), Marysville Public Ramp, Mukilteo State Park Public Ramp, and Tulalip Ramp. For more information on within-year patterns in size across sample sites, see WDFW (2007a) and (2007b).

Dockside Interview Procedures

On each day scheduled for sampling during the Areas 8-1 and 8-2 fisheries, 1-3 ramp samplers (depending on day length, anticipated effort, etc.) were stationed at each selected access site so that they could interview all anglers as they exited the fishery at these locations. Samplers interviewed anglers and collected data on trip duration and encounter (fish retained and/or released) composition, by species and mark status (unmarked vs. marked or adipose-fin clipped; Chinook and coho salmon only); data on the size-status (i.e., legal or sublegal) of released fish were not collected. In addition, samplers inspected all landed Chinook and coho salmon for the presence of coded-wire tags (CWT) using wand CWT detectors and snouts were collected from all fish containing CWTs. Biological measurements (fork lengths, total lengths) and scale samples were also acquired from all landed Chinook. In addition, samplers logged counts of all anglers and fish exiting the fishery at sampled access sites and any anglers/boats missed were counted and recorded on sampling forms (i.e., for use during the estimation process).

Additionally, given their daily exposure to anglers encountering recently implemented selective Chinook fisheries, dockside samplers educated anglers about regulations and the proper release of unmarked or sublegal Chinook salmon when time allowed. They relayed that mark-selective regulations permitted the retention of two marked (adipose fin-clipped) Chinook salmon $\geq$22 in ($\geq$56 cm) per day and required the immediate release (outside the gunwales and without boating) of all unmarked Chinook encountered. Dockside samplers also offered anglers a "dehooker" with an accompanying pamphlet which described proper dehooker use, selective fisheries in general, and accurate species/mark-status (i.e., adipose-fin clipped vs. unmarked) identification. Samplers reminded anglers that in addition to marked Chinook, they could retain other salmon species (no minimum size) during the selective Chinook season, under a total combined daily limit of two salmon.

Finally, to help shape test-fishing efforts (described below under "Test Fishing") on an in-season basis, dockside samplers collected data on the type and frequency of fishing methods employed by the private fleet during angling excursions. Specifically, samplers inquired about and recorded the predominant (based on time) angling method that was employed for boats that successfully encountered Chinook. Responses were recorded on

the sampling form according to the following five fishing method categories: 1) weight and bait (i.e., mooching or slow trolling with lead and herring/anchovy); 2) downrigger trolling (using hardware, bait, or both in combination); 3) jigging (i.e., drifting and jerking pole up and down, e.g., using Buzz Bombs, Point Wilson Darts, or Crippled Herring); 4) diver trolling (e.g., trolling with a Deep Six or a Pink Lady using hardware, bait, or both in combination); and 5) other methods (e.g., fly fishing, etc.). Based on these responses, test fishers fished using the same methods in approximately the same proportions as the recreational fleet (see WDFW 2007a and 2007b).

Boat Surveys

In order to obtain precise and up-to-date size measures (i.e., for site selection and within-frame total estimation) and out-of-frame effort proportion estimates (i.e., for expanding catch and effort estimates for our sample frame to fishery-total values), we incorporated on-the-water effort surveys (boat surveys) to estimate the proportion of angler effort originating from different fishery-access points. Boat surveys were comprehensive in space (i.e., they spanned the entirety of each Marine Area) and were assumed to be instantaneous in time. To maximize angler contact, surveys were scheduled during periods of peak fishing effort.

While traversing both Area 8-1 and Area 8-2, boat-survey samplers intercepted all actively fishing boats, and asked occupants how many anglers were on board and where they intended to tie up or exit the fishery upon completing their trip. We excluded non-fishing vessels and vessels that were under way from our sample. Charter boats were also excluded from the boat survey data (but were noted on the form) given that they are treated differently in our sample design and estimation process (see the "Charter Boats" section below).

We conducted a minimum of two and an average of four boat surveys per month in both Areas 8-1 and 8-2, separately. Additional boat surveys were conducted whenever significant changes in effort patterns were anticipated (e.g., if access sites or fisheries in adjacent marine areas opened or closed). Using the most recent boat-survey results, we calculated the size measures of sites contained in the Area-8-1 and -8-2 sample frames for each week during the selective fishery season. If fewer than 100 boats were encountered during a given survey, however, we pooled data from adjacent surveys (separately for weekday and weekend strata) to gain more reliable estimates of site size.

Test Fishing

In order to obtain accurate estimates of the size (legal or sublegal) and mark-status (marked or unmarked) composition of the pool of Chinook salmon encountered by anglers in the Areas 8-1 and 8-2 fisheries, we operated 2 WDFW-staffed test boats (one in each area) for the entirety of the 05-06 and 06-07 seasons. Each test boat had a crew consisting of two WDFW technicians, each of which fished with a single rod. Test fishers fished approximately five days per week (Monday through Friday) during each

season, and assisted with other tasks if weather precluded fishing. Test fishers were also involved with on-the-water boat surveys.

Test-boat crews focused their fishing efforts at locations in both areas that optimized their overall encounter rate (i.e., to increase precision) and mirrored choices made by the at-large private fleet. To better ensure the accuracy of test-fishing data, samplers fished for Chinook with methods and gear that were similar those used by the recreational fleet. We prescribed the proportions of time that the test boats should spend fishing with different methods based on dockside interview results from the preceding week (described above under "*Dockside Interview Procedures*"). In both areas and during both seasons, this led to test fishers trolling with downriggers virtually 100% of the time.

For each test-boat hook-up, the encounter number, time sampled, species, mark status, and DNA vial number (if applicable) was recorded. Care was taken to handle all fish as gently as possible. Chinook that were not lost via "drop off" were brought on board and measured in a cotton mesh net. Samplers recorded the fork length, total length, and mark status, and collected three scales for each Chinook brought on board. Scales were collected following procedures outlined by the International North Pacific Fisheries Commission (1963), to enable age analysis of Chinook encountered in the fishery.

In addition, samplers used scissors to remove a 1-cm^2 section of tissue from the dorsal fin or the caudal fin of all Chinook brought on board, and then placed the sample in a solution of ethanol. Tissue samples were collected to obtain DNA for future genetic analysis of stock composition (i.e., *DNA-based stock composition estimates for Areas 8-1 and 8-2 are presently unavailable*).

Data collected by the two test boats were used to estimate the size/mark-status composition of Chinook encounters and legal mark rates (i.e., % of legal-sized fish that were marked) in the recreational fishery. These size/mark-status group (legal-marked, legal-unmarked, sublegal-marked, sublegal-unmarked) proportions were ultimately used to apportion total Chinook encounters to these same classes for use in fishery-impact estimation (Appendix A). In addition, size distributions (i.e., length-frequency histograms) and age-structure profiles (i.e., Gilbert-Rich age composition and brood-year composition) were derived from test-fishing data for both marked and unmarked groups, separately, for each year. Information on the age of sampled Chinook was obtained via the scale-reading expertise of John Sneva and Lance Campbell (Fish and Wildlife Biologists, WDFW).

Voluntary Trip Reports

Additional data on the size/mark-status composition and mark rates of Chinook encountered during the Areas 8-1 and 8-2 fisheries were obtained from private-boat anglers and Charter captains who submitted Voluntary Trip Reports (VTRs) in each season. Participating anglers were asked to attend a class lasting from 30-45 minutes during which they received information on salmon species identification and became

familiar with the VTR forms, what data to collect, how to fill out the forms, and how to turn in the forms. On VTR forms, anglers were asked to record the date, number of anglers, target species, CRC Area, encountered species (if they positively identified the fish), including each Chinook or coho salmon, whether the fish was kept or released, total length to the nearest $1/8^{th}$ in (0.3 cm), and whether the fish was adipose fin-clipped or not clipped. Based on this information, we estimated the mark rate of legal and sublegal Chinook and then compared these results with test-fishing data and charter VTRs. In addition, we estimated the legal-marked release rate where possible, as the magnitude of this quantity bears directly on the accuracy of "Method-2" estimates of total encounters. Due to the self-selection process associated with VTRs as employed in the 8-1 and 8-2 fishery, however, this estimate (among others obtained from VTRs) may be biased relative to the entire private fleet.

Estimation Methods

Pre-season Fishery Modeling with FRAM

The Fishery Regulation Assessment Model (FRAM) was used to estimate fishing impacts in the 05-06 and 06-07 Areas 8-1 and 8-2 mark-selective recreational fisheries for preseason assessment purposes. In contrast to our fishery-sampling program, FRAM evaluations of Areas 8-1 and 8-2 fisheries are conducted using both areas combined (i.e., it is parameterized for modeling former Marine Area 8 in its entirety). Based on the set of fishery parameters and stock abundances input to the model, FRAM provides estimates of landed catch, total mortality, and the number of Chinook encountered (i.e. brought to the boat), by stock and age. FRAM inputs for the 8-1/8-2 fishery included several fishery related parameters (Table 1) and exploitation rate scalars used to project encounters from the stock abundances and other fishery inputs. FRAM contains three specific selective fishery parameters:

1. "Marked Release Error" is the proportion of the legal-marked Chinook encountered that are released,
2. "Unmark Retention Error" is the proportion of legal-unmarked Chinook encounters that are improperly retained.
3. "Selective Fishery Release Mortality" (*sfm*) is the release mortality on legal size Chinook.

Two other fishery-related mortality rates input to FRAM–"Release Mortality" and "Drop-off Mortality"—are used in non-selective fisheries, as well. Although not a FRAM input per se, the algorithms in FRAM do not account for retention of sublegal fish; i.e., sublegal retention error is zero.

This fishery was modeled as "wide-open", with no adjustments made to fishing effort/power due to the institution of mark-selective regulations. The exploitation rate scalars characterize fishing power during 1989-93 as estimated in FRAM post-season runs relative to the FRAM base period "catch" and stock abundances used in the 2002

and 2005 model calibrations (2.46 and 2.03, respectively). Thus, exploitation rate scalars vary according to catch and abundances for 1989-93 and are not directly correlated to an estimate of angler-trips. Exploitation rate scalars from 1989-93 are used as model input for nearly all Puget Sound marine sport fisheries because these represent a recent period of years with relatively full and stable fishery regulations.

FRAM input parameters and values were discussed and accepted by state and tribal co-managers prior to and during the annual season-setting process. The same rates were used in pre-season modeling for both the 05-06 and 06-07 seasons. Parameter values were based on a combination of studies, anecdotal reports, and/or simply agreed-to values developed for modeling purposes (e.g., Drop-off). The selective fishery parameters (Marked Release Error, Unmarked Retention Error, and Selective Fishery Release Mortality--sfm) were not developed from specific studies for this fishery.

Table 1. Input parameter values used in FRAM pre-season fishery modeling for the combined Areas 8-1/8-2 selective Chinook fisheries set for the 05-06 and 06-07 seasons. Effort scalars applied for the 05-06 and 06-07 seasons were 2.46 and 2.03, respectively.

Parameter	Value	Applies to	Notes
Marked Release Error [1/]	0.06	Legal-marked encounters	
Unmarked Retention Error [1/]	0.08	Legal-unmarked encounters	
Selective Fishery Release Mortality (sfm)	0.10	Legal encounters	Same as Chinook nonretention
Release Mortality (sublegal size)	0.20	Sublegal encounters	Same as non-selective
Drop-off Mortality	0.05	Legal encounters	Same as non-selective
Marked sublegal retention error [1/]	0.00	Marked sublegals	FRAM algorithm assumption
Unmarked sublegal retention error [1/]	0.00	Unmarked sublegals	FRAM algorithm assumption

[1/] FRAM values can be compared with creel survey estimates from the Areas 8-1/8-2 pilot fishery study.

Creel-based Estimates of Catch, Releases, and Effort

Using data acquired from sampled access sites, we estimated total daily encounters (by group, according to the classes enumerated during dockside sampling; e.g., retained-marked Chinook, released unmarked Chinook, retained-marked coho, etc.) and effort (excluding charter vessels) for anglers accessing the fishery from all sites contained in our Area-8-1 and Area-8-2 sample frames, separately, using dockside counts and the size measures of sites sampled on scheduled sample days. We then expanded dockside-frame estimates to daily totals based on the proportion of total fishing effort originating from access sites that were not contained in our sample frame (**Figure 2**). Finally, we expanded daily estimates to stratum (weekday vs. weekend), weekly, monthly, and ultimately season totals. We used a Microsoft Access application developed by Kurt

Reidinger (WDFW Fish and Wildlife Biologist) to enter sample data, generate expanded estimates, and produce appropriate variances for all sampled strata.

Sample-frame total catch and effort were estimated using Murthy's total estimator (Murthy 1957; Cochran 1977):

$$\hat{Y} = \frac{\left[(1-P_2)*(E_1/P_1)+(1-P_1)*(E_2/P_2)\right]}{(2-P_1-P_2)} \quad (1)$$

where:

$\hat{Y}$ = daily estimator (e.g., anglers, marked Chinook retained, etc.),
P = proportion of effort (size measure) at sites *1* and *2*, and
E = sampled (observed) count at site *1* and *2*.

The variance around sample-frame totals was estimated according to:

$$V(\hat{Y}) = \frac{(1-P_1)(1-P_2)(1-P_1-P_2)}{(2-P_1-P_2)^2} * \left[\frac{E_1}{P_1} - \frac{E_2}{P_2}\right]^2 \quad (2)$$

All accounting for missed boats/anglers was done within WDFW's Microsoft Access catch-estimate system; using the average catch-per-boat estimated for a given site-day combination and the number of missed boats logged on forms, an estimate of unobserved catch was incorporated into the sample-frame totals. An analogous computation was made to account for the number of anglers not interviewed from the missed boats.

Finally, we expanded daily catch and effort estimates generated for our sample frame to fishery totals based on the proportion of effort (estimated from boat-survey data) that originated from out-of-frame access sites:

$$\hat{Y}_{adj} = \frac{\hat{Y}}{(1-\hat{p}_{nonsampled})} = \frac{\hat{Y}}{\hat{q}} \quad (3)$$

where:

$\hat{Y}_{adj}$ = daily estimator after expansion by an estimate of the proportion of effort that originated from the non-sampled access sites, and

$\hat{q}$ = expansion factor to account for the proportion of effort originating from out-of-frame access sites, $\hat{p}_{nonsampled}$ (i.e., , sites not included in the sample frame and therefore never sampled).

The variance of expanded total estimates was approximated as:

$$V\left(\hat{Y}_{adj}\right) = \hat{Y}_{adj}^{\,2} * \left[\frac{\hat{V}(\hat{Y})}{\hat{Y}^{2}} + \frac{\hat{V}(\hat{q})}{\hat{q}^{2}}\right] \quad (4)$$

The reliability of estimates of Chinook landings, releases, and/or effort obtained using the above-described approach depends on the validity of the following four assumptions:

- Boat surveys provide unbiased estimates of access-site size measures and out-of-frame effort proportions (*Assumption 1*);
- Relative angling effort originating from a particular access site (i.e., its size measure) is proportional to total catch landed at that site (*Assumption 2*);
- All anglers exiting the fishery at sampled site are interviewed and they accurately report all salmon caught and kept or released (if boats are missed they are counted and catch and effort estimates are expanded appropriately (*Assumption 3*); and
- Catch per unit effort does not differ significantly between in-frame and out-of-frame sites (*Assumption 4*).

Although Conrad and Alexandersdottir (1993) assessed the effects of *Assumption* 2 violations on estimates of catch and effort for Puget Sound salmon fisheries, *Assumptions 1*, *3*, and *4*, have not been explicitly evaluated to date (**Appendix B**).

Given the frequency at which anglers reported releasing unidentified salmon (e.g., Area 8-2 during the 06-07 season), we pursued an additional estimation step to apportion a percent of unidentified released salmon to the released-Chinook category; we did this on a monthly time step according to the composition of known-species salmon releases (i.e., based on expanded Murthy estimates generated from interview data). This quantity–apportioned unidentified salmon ($\hat{N}_{AUS}$) hereafter–is derived from estimated quantities [unidentified salmon, $\hat{N}_{US}$, and the proportion of Chinook in estimated releases ($\hat{p}_{Chin} = \hat{N}_{Chin} / \sum \hat{N}_{ID'd-salmon}$)], and has an estimator (5) and variance (6) of:

$$\hat{N}_{AUS} = \hat{N}_{US} * \hat{p}_{Chin} \quad (5)$$

$$V(\hat{N}_{AUS}) = V(\hat{N}_{US}) * \hat{p}_{Chin}^{\,2} + \hat{N}_{US}^{\,2} * V(\hat{p}_{Chin}) - V(\hat{N}_{US}) * V(\hat{p}_{Chin}), \quad (6)$$

where, also based on estimates:

$$V(\hat{p}_{Chin}) = \hat{p}_{Chin}^{\,2} * \left[\frac{V(\hat{N}_{Chin})}{\hat{N}_{Chin}^{\,2}} + \frac{V(\hat{N}_{ID'd-salmon})}{\hat{N}_{ID'd-salmon}^{\,2}}\right] + V(\hat{N}_{Chin}) * \left[\frac{V(\hat{N}_{ID'd-salmon})}{\hat{N}_{ID'd-salmon}^{\,4}}\right] \quad (7)$$

The final step of our creel estimation procedure involved adding Chinook encounters and fishing effort due to charter activity to private-boat total estimates for each area (8-1, 8-2) and season (05-06 and 06-07 seasons). We treated charter catch and effort data separately because: 1) charter anglers experience substantially higher catch per unit effort than private-boat anglers; 2) charter anglers were generally not subject to sampling (i.e., they often exited the fishery via sites outside of our sample frame); and 3) we had knowledge of and direct communication with charters operating in the two areas and could readily census them via other means (Voluntary Trip Reports, VTRs; described previously). Thus, we simply added charter-reported encounters and effort to private-boat estimates under the assumption that charter data were the result of a complete census (i.e., point estimates were affected by charter-data inclusion, variances were not). Although we typically summarized private- and charter-angler catch and effort both separately and then in combination in past post-season reports (see WDFW 2007a and 2007b), we present only final estimates (charter + private) in this report for efficiency; however, decomposed data are available in **Appendix E**.

Total Chinook Encounters Estimation: Methods 1 and 2

We estimated the total number of Chinook encountered during the Areas 8-1 and 8-2 selective Chinook fisheries during each season using two different estimation approaches ("Method 1" and "Method 2"). Under Method 1 (the harvest-plus-reported-releases method), we simply summed Murthy estimates and variances for all Chinook encounter sub-categories (i.e., retained marked and unmarked Chinook; released marked, unmarked, and unknown-mark-status Chinook; and apportioned unidentified salmon releases), which were estimated according to the process outlined above, to estimate total Chinook encounters. Relative to Method 2, the reliability of Method-1 estimates depends on how accurately anglers recall and report the number of salmon caught and released, and their mark status, during their trips. Although past studies suggest that there is a tendency for over-reporting of releases in Puget Sound and other fisheries (e.g., Noviello 1998; Sullivan 2003), the magnitude of this "prestige bias" has not been quantified for the Areas 8-1 and 8-2 selective Chinook fisheries.

Under Method-2 (the harvest-only method), we estimated total Chinook encounters by combining fishery-total estimates of retained legal-marked Chinook (outlined above) with test-fishery data on the size/mark-status composition of the pool of encountered Chinook salmon. Specifically, we estimated total Chinook encounters ($\hat{E}_{tot}$) for each month, then summed these to get a season total by expanding creel-based estimates of legal-marked Chinook retention ($\hat{N}_{LM}$) by the test-fishing estimate of the legal-marked proportion in the encountered Chinook pool ($\hat{p}_{LM}$) (see Appendix A for variance details):

(8) $$\hat{E}_{tot} = \hat{N}_{LM} / \hat{p}_{LM}$$

Thus, in addition to the usual assumptions affecting the accuracy of Murthy-based estimates of legal-marked Chinook retention (*Assumptions 1-4*), the Method-2 estimation approach also assumes:

- Anglers accurately identify and retain all legal-marked Chinook encountered during fishing trips (*Assumption 5*). If anglers intentionally (e.g., releasing legal-marked Chinook in order to catch and retain larger individuals) or unintentionally (e.g., measurement error) release legal-marked Chinook, Method-2 estimates will have a negative expected bias (relative to the true, unknown value).

- The extent to which test-boat samplers accurately mimic the private fleet in angling behavior also affects the accuracy of Method-2 estimates (i.e., the size/mark-status composition experienced by the private fleet is identical to that seen in the test fishery; *Assumption 6*).

The performance of Method-1 and -2 estimators (and the associated validity of assumptions) under the range of fishery conditions present in Areas 8-1 and 8-2 will be addressed in detail in Section II of this report.

Fishery Impacts (Encounters and Mortalities) by Size/Mark-Status Group

Method-1 and-2 encounter estimates were decomposed to size/mark-status categories using a combination of creel estimates, test-fishery data (size/mark status composition), and dockside observations of landed catch (for apportioning retained-marked and -unmarked fish to size classes). While this and the subsequent mortality-estimation routine are detailed in Appendix A, we briefly describe the process here. For both Method-1 and -2 estimates (separately), we apportioned total Chinook encounters to the four size/mark-status categories of legal-marked (LM), sublegal-marked (SM), legal-unmarked (LU), and sublegal-unmarked (SU) based on the composition of test-boat encounters; thus, *Assumption 6* (i.e., similar encounter composition for the test boat and private fleet) also applies to our mortality estimation scheme. We then estimated total release mortality due to each area (Areas 8-1 and 8-2) and year's (05-06; 06-07) selective fishery by applying size-specific mortality rates to release estimates for the four Chinook size/mark-status classes (LM, LU, SM, and SU). We applied a release mortality rate of 15% to LM and LU (i.e., 10% release plus a drop-off mortality approximated as 5% of legal-size encounters) and 20% to SM and SU encounter estimates, respectively, for direct comparison to FRAM. We then added retention mortality estimates (i.e., harvest) for each size/mark-status group to release mortality estimate for that same group to obtain total class-specific mortality. Similar to encounters, mortalities (and variances) were calculated on a monthly time step and then pooled across each season to estimate total mortality.

Finally, we pooled encounter and mortality estimates for Areas 8-1 and 8-2 and compared these Area-8 composite values to pre-season modeled (FRAM) encounters and mortalities, for each size and mark status category, and for the 05-06 and 06-07 seasons separately. Further, given that Method-1 and -2 encounter estimates are likely to include some degree of bias (assumed positive and negative, respectively) relative to the true number of Chinook encountered in Area 8 during each season, we contrasted FRAM predictions with the ranges bounded by the two estimates. Though our FRAM (predicted) versus observed (i.e., post-season estimates) comparisons are qualitative in

nature, we present the 95% confidence interval (CI) associated with observed estimates to provide perspective on statistical uncertainty about differences. It should be noted, however, that these CIs do not incorporate uncertainty due to the release mortality rates applied (i.e., sfm_L and sfm_S in Appendix A, both are assumed constants) and are therefore minimum estimates.

Coded-Wire Tagged (CWT) Chinook Impacts

To understand the potential effects of the Areas 8-1 and 8-2 fisheries on CWT-based cohort-reconstruction efforts, we estimated the number of unmarked-tagged Chinook mortalities that occurred during the course of the pooled 8-1 and 8-2 selective fishery, for both the 05-06 and 06-07 seasons. Thus, we acquired information on recovered CWTs for all double index tag (DIT) groups encountered and then applied the methods described by WDFW (2002) to estimate the number of unmarked-DIT Chinook that were encountered and the number of these fish that subsequently died due to handling and release impacts.

The approach used to estimate unmarked-DIT mortalities in the selective fishery was developed by the Selective Fisheries Evaluation Committee – Analysis Work Group (SFEC-AWG 2002) and were evaluated by a workgroup consisting of State and Tribal biologists and statisticians, including members of SFEC-AWG (Joint Coho DIT Analysis Workgroup 2003). Given our interest in the effects of the 8-1/8-2 mark-selective fisheries on the CWT program, we used a selective fishery mortality rate (*sfm*) of 10% to estimate unmarked-DIT mortalities in our analysis; this is the same release mortality rate used in FRAM legal-Chinook model runs, *less drop-off mortality* (5% of legal encounters). We used 10% instead of 15% (we apply above to all legal releases), however, because unseen drop-off mortality is theoretically equivalent for marked and unmarked fish and present in both selective and non-selective recreational Chinook fisheries. Thus, our estimates of unmarked-DIT mortalities are analogous to impacts in excess of those that would occur under non-selective regulations.

For each season (05-06, 06-07), we estimated encounters and mortalities for each recovered DIT individually and then summed estimates for each hatchery, brood year, and area, because the sampling rate changed throughout the fishery and was different between areas (WDFW 2002). Thus, the estimated number of unmarked mortalities was calculated as:

$$\hat{U}_a^{MSF} = \lambda^{REL} \hat{M}_a^{MSF} sfm \tag{9}$$

with associated variance:

$$Var(\hat{U}_a^{MSF}) \approx \left(\lambda^{REL}\right)^2 sfm^2 \hat{M}_a^{MSF} \frac{1-s}{s} . \tag{10}$$

where:

sfm = selective fishing mortality rate (10%, *excludes drop-off mortality*),

$U_{a,i}^{MSF}$ = aged *a* unmarked DIT mortalities from stock *i* in the selective fishery,
$M_{a,i}^{MSF}$ = aged *a* marked DIT mortalities from stock *i* in the selective fishery,
s = sampling rate of the catch,
λ^{REL} = unmarked-to-marked ratio *at release* for fish in a DIT group[2]
$Var(U_{a,i}^{MSF})$ = variance of $U_{a,i}^{MSF}$.

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

SECTION I: RESULTS

Pre-Season FRAM Results

Preseason FRAM run results for the combined Area 8-1 and 8-2 Chinook mark-selective sport fishery for 2005-06 and 2006-07 are shown in **Table 2**. Area 8-1 and 8-2 are treated as one fishery in FRAM; consequently separate estimates for Area 8-1 and 8-2 are not produced. These estimates calculated in FRAM incorporate all fishery inputs and marked and unmarked stock abundances for each year. A specialized output from FRAM called the Selective Fishery Report contains more detailed results by stock and age (**Appendix F**).

Table 2. Pre-season FRAM estimates for the combined Areas 8-1 and 8-2 selective winter blackmouth fishery, 2005-06 and 2006-07 seasons.

		Encounter		Landed Catch		Total Mortality	
Season	**Size Class**	**Marked**	**Unmarked**	**Marked**	**Unmarked**	**Marked**	**Unmarked**
2005-06	Legal	1,325	3,172	1,245	254	1,319	705
	Sublegal	3,070	9,515	0	0	614	1,903
	All	4,395	12,687	1,245	254	1,933	2,608
2006-07	Legal	1,876	1,981	1,763	158	1,868	439
	Sublegal	7,745	7,460	0	0	1,549	1,492
	All	9,621	9,441	1,763	158	3,417	1,931

[2] λ^{REL} was used instead of λ at escapement (λ^{ESC}) to estimate total unmarked-DIT impacts attributable to each of the two pilot 8-1/8-2 seasons. While mortality estimates derived using λ^{REL} and λ^{ESC} provide upper and lower bounds to actual unmarked-DIT impacts due to a particular fishery, λ^{ESC} is not yet available for all of the broods that were encountered during 05-06 and 06-07 seasons. Further, DIT analyses conducted for other mark-selective Chinook (CTC 2007) and coho (Joint Coho DIT Analysis Workgroup 2003) fisheries suggest that the choice in λ minimally affects final mortality estimates.

Description of the Fishery

Fishing Effort

At 12,495 and 11,302 angler trips (*effort is discussed in terms of angler trips for the remainder of this report*), respectively, season-total fishing effort in the combined 8-1/8-2 selective winter blackmouth fishery was similar for the 05-06 and 06-07 seasons (**Table 3**). Within-area effort patterns were also stable between years, with approximately twice as many angler trips occurring in Area 8-2 compared to 8-1. For Area 8-1, we estimated season-total angler trips at 3,976 (95% CIs: 2,909-3,999) for the 05-06 and 3,454 (2,909-3,999) for the 06-07 season; estimated total angler trips in Area 8-2 were 8,519 (7,888-9,150) and 7,848 (7,474-8,222) for the same respective seasons.

Within years, we observed month-to-month patterns in effort that also persisted across the first two pilot seasons (**Figure 3**). On average, October was the peak effort month for both areas, followed by a late-winter/early-spring peak (between February and April) that consisted of roughly half of estimated October effort. In both areas and years, November-January was a consistently low-effort period (~22% of total season effort on average).

Table 3. Monthly and season-total angling effort (completed boat ['Boats'] and angler ['Anglers'] trips) point estimates, variances, and 95% confidence intervals for the Areas 8-1 and 8-2 mark-selective Chinook fisheries. See **Appendix E** or WDFW (and 2007b) for separate charter- and private-angler effort estimates.

		2005-06 Season						2006-07 Season					
Area	**Month**	**Boats**	**Variance**	**95% CI**	**Anglers**	**Variance**	**95% CI**	**Boats**	**Variance**	**95% CI**	**Anglers**	**Variance**	**95% CI**
8-1	Oct	637	30,361	295-979	1,154	93,852	554-1,754	444	5,188	303-585	829	17,741	568-1,090
	Nov	200	913	141-259	350	2,387	254-446	110	721	58-163	195	2,079	106-284
	Dec	236	2,368	141-331	427	9,272	238-616	174	440	133-215	310	1,522	234-386
	Jan	186	1,442	112-260	327	4,556	195-459	145	334	109-180	287	1,955	200-373
	Feb	347	2,879	242-452	640	12,068	425-855	196	2,768	93-299	405	13,282	179-631
	Mar	411	13,958	179-643	702	39,675	312-1,092	389	8,266	211-567	762	32,669	408-1,116
	Apr	187	610	139-235	376	3,284	264-488	337	1,804	254-420	667	8,089	490-843
	Total	2,204	52,530	1,755-2,653	3,976	165,094	3,180-4,772	1,795	19,521	1,521-2,069	3,454	77,336	2,909-3,999
8-2	Oct	1,494	16,275	1,244-1,744	2,940	65,302	2,439-3,441	1,130	1,089	1,065-1,195	2,186	3,424	2,072-2,301
	Nov	188	1,095	123-253	353	3,347	240-466	202	286	169-235	392	953	331-452
	Dec	263	1,581	185-341	501	4,310	372-630	366	239	336-396	655	1,284	584-725
	Jan	309	1,176	242-376	586	3,377	472-700	340	669	290-391	655	2,404	559-751
	Feb	661	1,045	598-724	1,293	4,491	1,162-1,424	590	2,835	485-694	1,121	11,156	914-1,328
	Mar	652	1,516	576-728	1,285	7,526	1,115-1,455	686	3,436	571-801	1,334	11,458	1,124-1,544
	Apr	782	2,020	694-870	1,561	15,227	1,319-1,803	762	1,521	685-838	1,505	5,801	1,356-1,655
	Total	4,349	24,708	4,041-4,657	8,519	103,579	7,888-9,150	4,076	10,076	3,879-4,273	7,848	36,481	7,474-8,222
Combined Areas		6,553	77,238	6,008-7,098	12,495	268,673	11,479-13,511	5,871	29,597	5,534-6,208	11,302	113,817	10,640-11,963

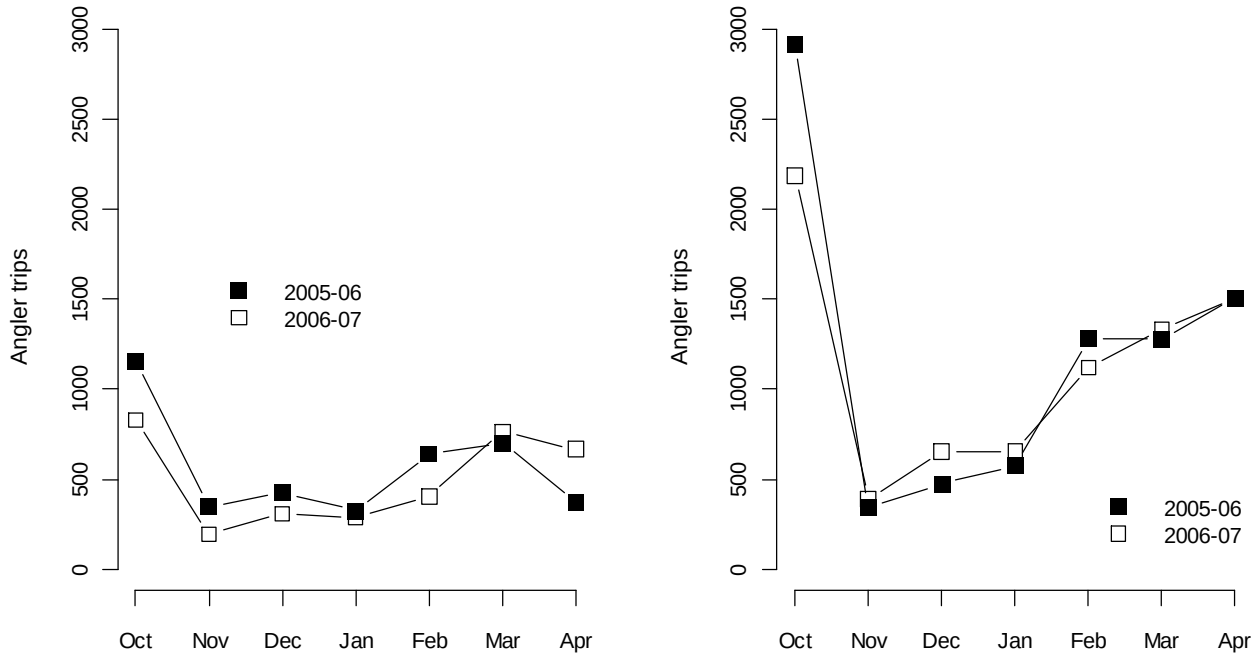


Figure 3. Estimated total monthly fishing effort (completed angler trips) for the Areas 8-1 (*left panel*) and 8-2 (*right panel*) selective blackmouth fisheries, 2005-06 and 2006-07 winters.

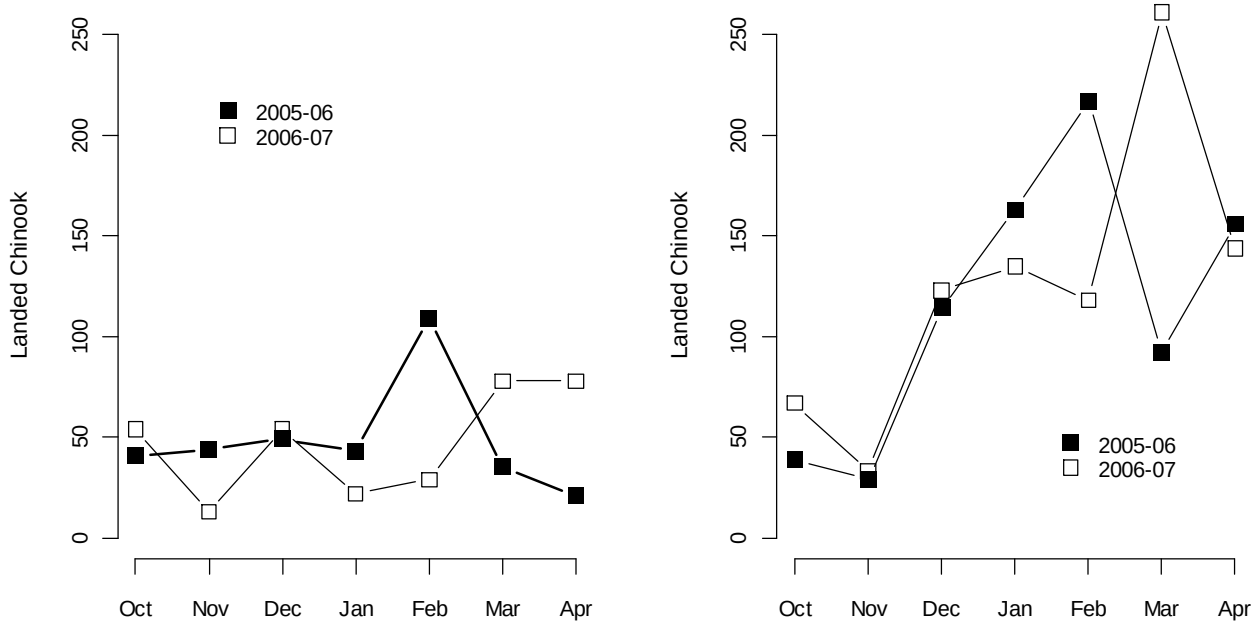


Figure 4. Estimated total monthly retained Chinook salmon for the Areas 8-1 (*left panel*) and 8-2 (*right panel*) selective blackmouth fisheries, 2005-06 and 2006-07 winters.

Chinook Encounters: Estimated Harvest and CPUE

Monthly average and season-total landed catch (pooled areas: 1,152 in 05-06, 1,210 in 06-07) differed little between the 05-06 and 06-07 selective winter blackmouth seasons but appreciably between catch areas (**Table 4**). Twice as many Chinook were hooked and harvested by anglers fishing in Area 8-2 compared to 8-1: Area 8-1 Chinook landings were 342 (95% CIs: 242-448) in 05-06 and 328 (266-390) in 06-07, whereas 8-2 estimates for the same respective classes were 810 (724-896) and 882 (812-952).

Within-season landed-catch patterns were evident (particularly for Area 8-2) based on the two years of pilot-fishery data. In Area 8-2, there was limited Chinook harvest during October and November, followed by increased catches from December through to the end of the season. In both years, there was a February-March catch peak (200-250 fish / month). Overall, catch averaged 116 and 126 Chinook per month in 05-06 and 06-07 seasons, respectively, in Area 8-2. For 8-1, there was less variability in landed catch (compared to 8-2) between the two years and within seasons (47 and 49 fish retained per month in 05-06 and 06-07, respectively). Similar to 8-2, Area 8-1 monthly catches tended towards a February-March peak in both seasons.

Given consistent effort and landings patterns, estimated catch per unit effort (CPUE; estimated total landed catch / estimated total angler trips) was a consistent 0.10 Chinook retained per angler trip in both areas and years. There was evidence of considerable within-season variation in CPUE (**Figure 5**); monthly CPUE ranged from 0.01–0.28 and 0.03–0.21 in 8-2 in 05-06 and 06-07 seasons, respectively, and 0.04–0.17 and 0.07–0.17, in 8-1 (for the same respective seasons). The highest values of monthly CPUE were observed during mid-winter (Dec/Jan on average), during a mid-winter effort lull and roughly 1-2 months before the peak in total Chinook landings.

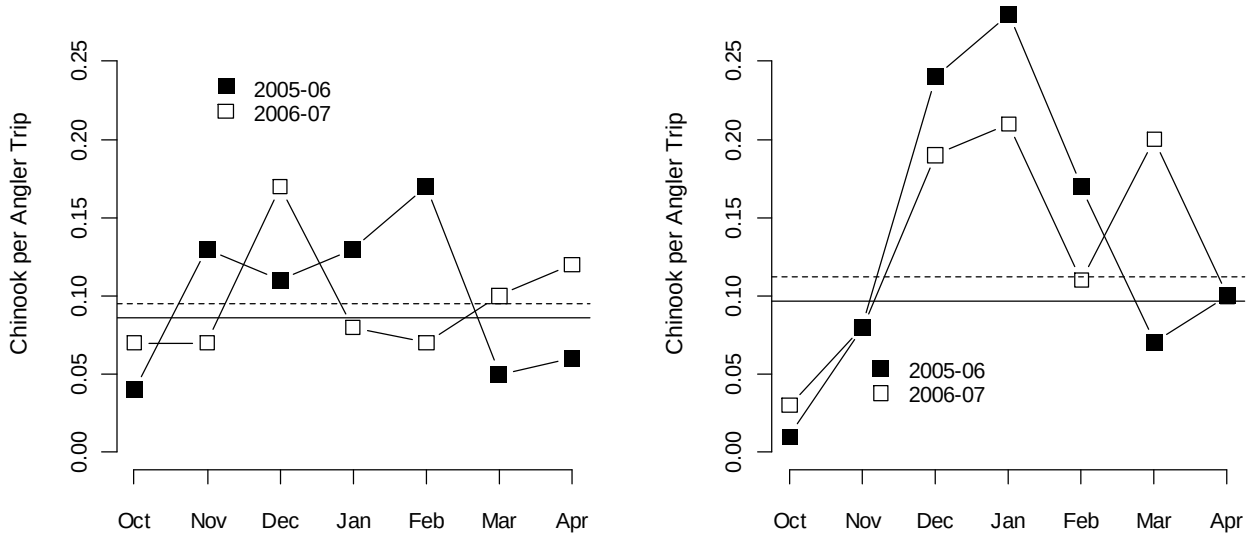


Figure 5. Estimated monthly catch per unit effort (CPUE; measured as *landed Chinook per angler trip*) for the Areas 8-1 (*left panel*) and 8-2 (*right panel*) selective blackmouth fisheries, 2005-06 and 2006-07 winters. In both panels, the solid and dashed horizontal lines represent 05-06 and 06-07 season-total CPUE (sum of season catch/sum of season angler trips) values, respectively.

Estimated Releases & Total Chinook Encounters

Although 05-06 and 06-07 were quite similar in terms of total Chinook retention, effort, and CPUE, these two seasons differed markedly in terms of released-Chinook encounters (**Table 4**), based on both Method-1 and -2 estimation approaches. Combining both areas and all release categories (marked, unmarked, apportioned UnID'd, unknown mark status), 7.1 times as many Chinook were hooked and released in the 06-07 season than the 05-06 season (based purely on expanded interview data, i.e., *Method 1 estimates*). When apportioned to mark-status groups using test-fishery data (see below and Appendix A), 9 times as many marked and 5 times as many unmarked Chinook were encountered during 06-07 compared to 05-06 (**Figures 6 and 7**). Approximately 250 unmarked (86 in 8-1 and 167 in 8-2) and 270 marked (82 in 8-1 and 185 in 8-2) Chinook were encountered and released during each month of the 05-06 selective blackmouth season, with little month-to-month variability. During the 06-07 season, an average of 1,200 (404 in 8-1, 876 in 8-2) unmarked and 2,400 (719 in 8-1, 1,720 in 8-2) marked Chinook were encountered and released each month. In both areas, October constituted the month with the greatest number of released encounters in 06-07. Finally, 2-3 times more released Chinook encounters occurred in Area 8-2 compared to Area 8-1 during both seasons.

Regarding Method-2 results, within-year and between-area trends in estimated release numbers were qualitatively similar to those documented using Method-1 (i.e., there were more fish hooked and released in 8-2 than in 8-1, in 06-07 than 05-06, etc.). In particular, monthly Method-1 and Method-2 estimates of total encounters were moderately to highly (R = 0.55-0.83) correlated, with the exception of Area 8-2 in 05-06 (**Table 5; Figure 8**). This was the case for overall, marked, and unmarked encounter groups. Though there was qualitative similarity in the monthly and between-area trends illustrated by the two methods, the magnitude of departure between estimate types varied between seasons. Both methods yielded comparable monthly and season-total estimates in 05-06 but not during in 06-07. During the second pilot season, however, season-total Method-1 estimates of releases were substantially greater than Method-2 estimates (**Table 6**); in addition, monthly Method-1 estimates were usually greater than their Method-2 analogs.

Finally, given the consistency in landed catch estimates between areas and years, season-total Chinook encounters were double in Area 8-2 compared to 8-1 and between 4 (Method 2) and 7 (Method 1) times greater during the 06-07 compared to the 05-06 season (**Figure 8**).

Encounter Composition/Mark Rates

Based on dockside-based estimates of landed catch and releases for known mark-status Chinook (i.e., excluding apportioned unidentified salmon and unknown mark-status categories), mark rates varied little between months and areas within years but appreciably so between years (**Figure 9**). 2005-6 mark rates were 0.61 (95% CI: 0.42-0.80) in Area 8-1 and 0.60 (0.52-0.67) in Area 8-2; averaging an absolute 10% higher in 06-07, mark rates for the two respective areas were 0.71 (0.52-0.90) and 0.73 (0.63-0.83). Thus, between two thirds and three quarters of all Chinook encountered were adipose clipped (for fish that reported with a known mark-status

category). All dockside mark-rate estimates are based on Method-1 only (i.e., overall mark-rates estimates cannot be estimated using Method 2 independent of test-fishery data).

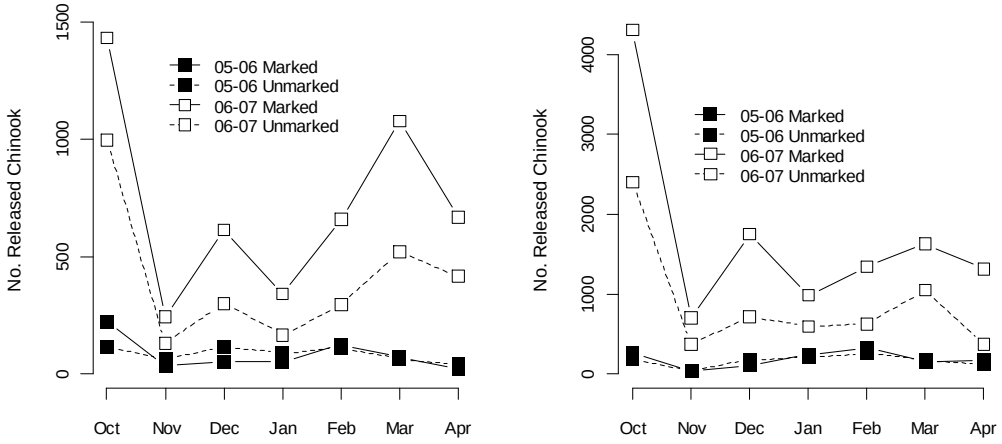


Figure 6. Estimated total monthly releases of encountered Chinook salmon, by mark status (solid line = marked, dashed = unmarked) for the Areas 8-1 (*left panel*) and 8-2 (*right panel*) selective blackmouth fisheries, 2005-06 and 2006-07 winters. *Plotted release estimates were generated using the Method-1 estimation approach.*

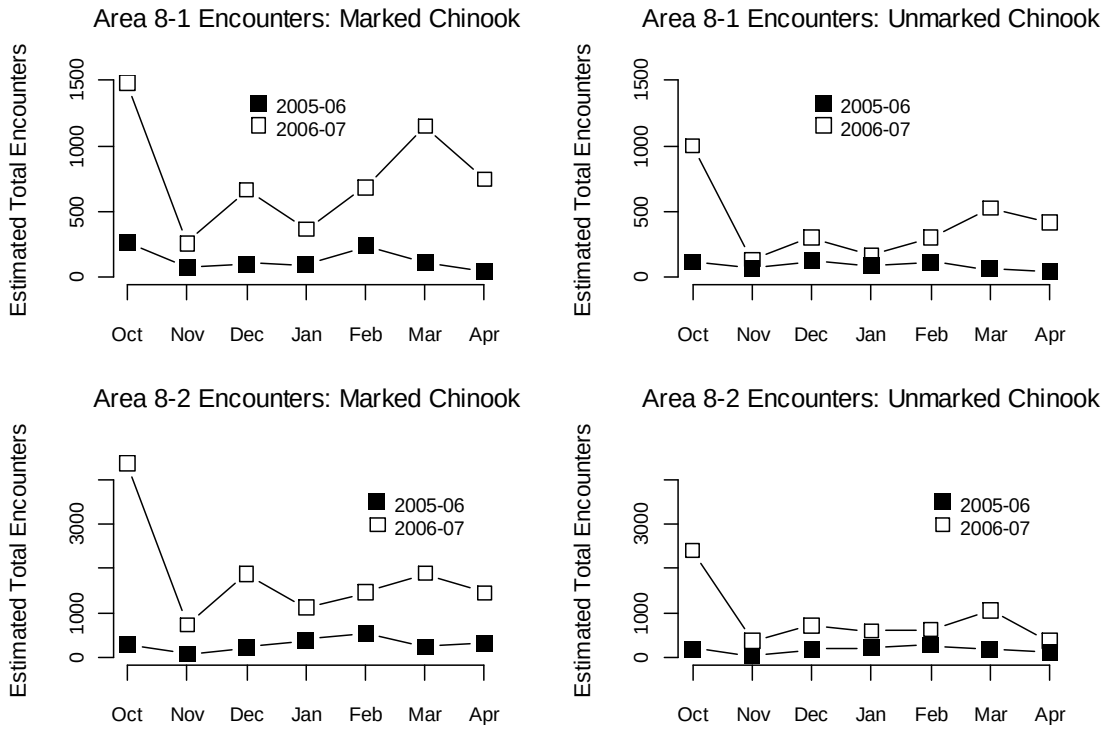


Figure 7. Estimated total monthly encounters of Chinook salmon, by mark status (left column = marked, right column = unmarked) for the Areas 8-1 (*upper row*) and 8-2 (*lower row*) selective blackmouth fisheries, 2005-06 and 2006-07 winters. *Plotted estimates were generated using the Method-1 estimation approach*.

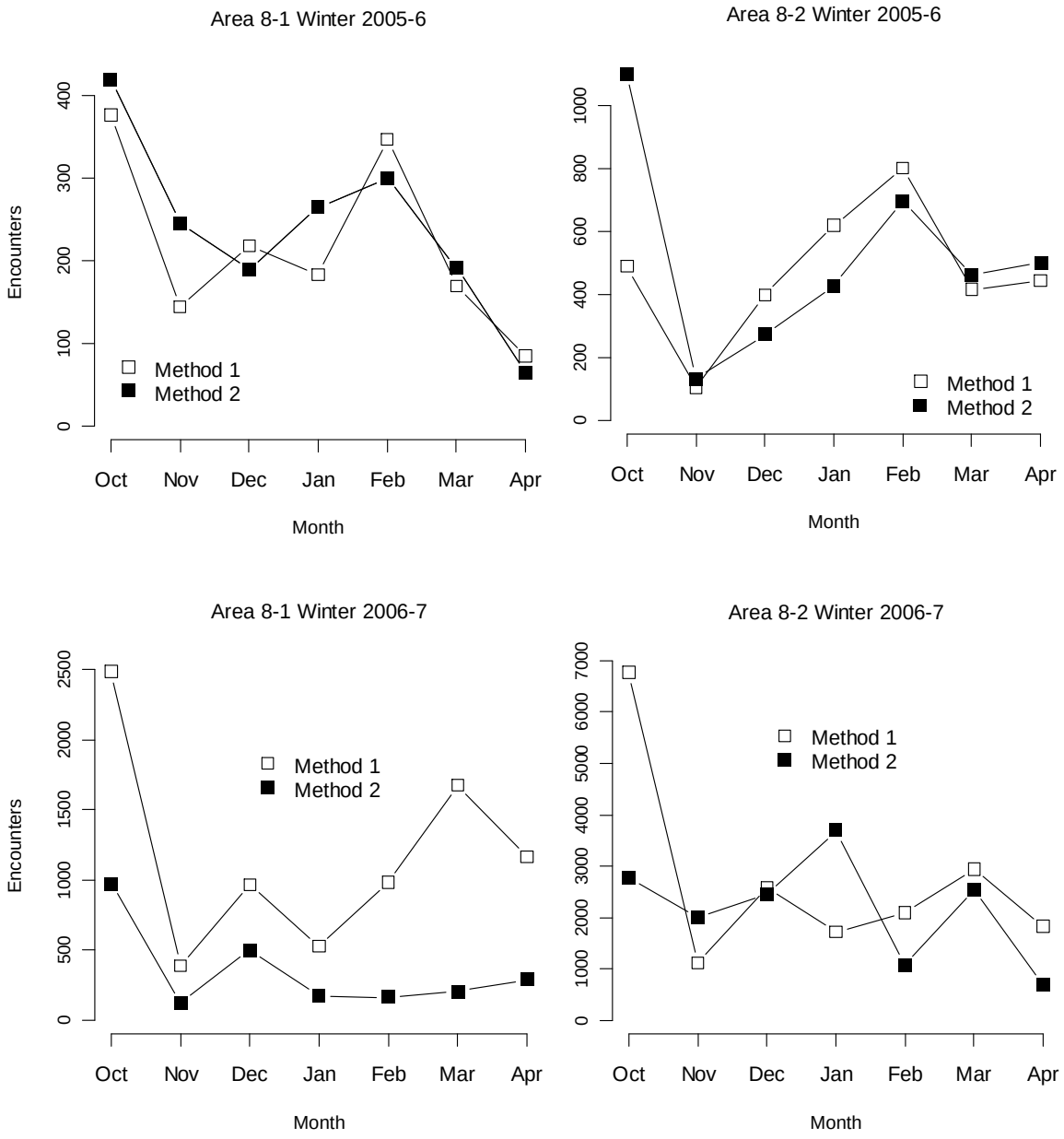


Figure 8. Estimated total monthly Chinook salmon encounters based on estimation Methods 1 and 2 for the Areas 8-1 (*left panel*) and 8-2 (*right panel*) selective blackmouth fisheries, 2005-06 and 2006-07 winters. *y*-axes differ for visualization of patterns within areas.

Table 4. Season-total estimated Chinook encounters, by encounter result (harvested/retained and released), area, and mark-status category for the Areas 8-1 and 8-2 winter blackmouth seasons 2005-06 and 2006-07. All estimates were generated using the *Method-1* approach (i.e., relying on angler-reported releases). See **Appendix E** or WDFW (2007a , 2007b) for a separate charter- and private-angler effort estimates.

			2005-06 Season			2006-07 Season		
Result	**Area**	**Category**	**Estimate**	**Variance**	**95% CI**	**Estimate**	**Variance**	**95% CI**
Retained	8-1	Marked	342	2,735	239-445	316	971	254-377
		Unmarked	0	0	0-0	13	31	2-23
	8-2	Marked	770	1,862	685-855	861	1,254	792-930
		Unmarked	40	55	26-54	21	10	15-27
	8-1 & 8-2	*All categories*	*1,152*	*4,652*	*1,018-1,286*	*1,210*	*2,266*	*1,117-1,303*
Released	8-1	Marked	344	5,358	201-487	3,258	145,288	2511-4005
		Unmarked	442	3,380	328-556	1,439	46,319	1017-1861
		Unknown Mark Status	386	3,875	264-508	3,160	161,921	2371-3949
		Apportioned Unid'd salmon	8	58	0-23	0	0	0-0
	8-2	Marked	483	969	422-544	4,836	77,234	4,291-5,380
		Unmarked	770	2,469	673-867	2,015	10,090	1,818-2,211
		Unknown Mark Status	1,099	5,703	951-1,247	7,887	51,747	7,441-8,332
		Apportioned Unid'd salmon	112	423	72-153	3,429	70,371	2,909-3,949
	8-1 & 8-2	*All categories*	*3,644*	*22,236*	*3,352-3,937*	*26,023*	*562,969*	*24,552-27,493*
Total Encounters	**8-1 & 8-2**	**All categories**	**4,796**	**26,888**	**4,475-5,118**	**27,233**	**565,234**	**25,759-28,706**

Table 5. Correlation coefficients (Pearson product-moment) characterizing the strength of association between monthly Method-1 and Method-2 encounter estimates, by season and area (n = 7 for all cells). Bold-faced, underlined values indicate a significant non-zero coefficient at $\alpha = 0.05$ (t-test); italicized values were significant at $\alpha = 0.10$. See Section II for more details on relationships between Method-1 and Method-2 encounter estimates.

Area	**Season**	**UM-Rel'd**	**M-Rel'd**	**Total Rel'd**	**Total Enc.**
8-1	05-06	*0.694*	**0.905**	**0.829**	**0.861**
8-2	05-06	0.514	0.589	0.548	0.542
8-1	06-07	**0.879**	*0.676*	**0.769**	**0.797**
8-2	06-07	0.392	0.231	0.284	0.279
Pooled	Pooled	**0.676**	**0.684**	**0.679**	**0.687**

Table 6. Point estimates and 95% confidence intervals for season-total Chinook release estimates based on Method-1 and -2 approaches. Note, values displayed are based on apportioned (by test-fishery composition) pooled encounter estimates, less retained Chinook estimates (i.e., Method-1 estimates of apportioned unknown salmon and unknown mark-status Chinook have been reclassified and integrated into release estimates accordingly, See **Appendix A** for details).

			Method-1 Releases			Method-2 Releases		
Season	**Area**	**Class**	**Estimate**	**Var**	**95% CI**	**Estimate**	**Var**	**95% CI**
2005-06	8-1	Marked	577	9,133	390-764	664	41,830	264-1,065
		Unmarked	603	3,612	485-721	668	17,959	405-931
		Total	1,180	12,746	959-1,401	1,332	59,789	853-1,812
	8-2	Marked	1,294	19,301	1,022-1,567	1,485	446,848	175-2,795
		Unmarked	1,170	11,926	956-1,384	1,301	171,417	490-2,113
		Total	2,464	31,227	2,118-2,811	2,787	618,265	1,246-4,328
2006-07	8-1	Marked	5,031	126,275	4,334-5,727	1,245	65,593	743-1,747
		Unmarked	2,826	53,503	2,373-3,280	846	29,732	508-1,184
		Total	7,857	179,778	7,026-8,688	2,091	95,325	1,486-2,697
	8-2	Marked	12,037	175,289	11,216-12,858	9,360	3,398,837	5,746-12,973
		Unmarked	6,129	94,311	5,527-6,731	4,973	1,059,882	2,956-6,991
		Total	18,166	269,600	17,148-19,183	14,333	4,458,718	10,195-18,472

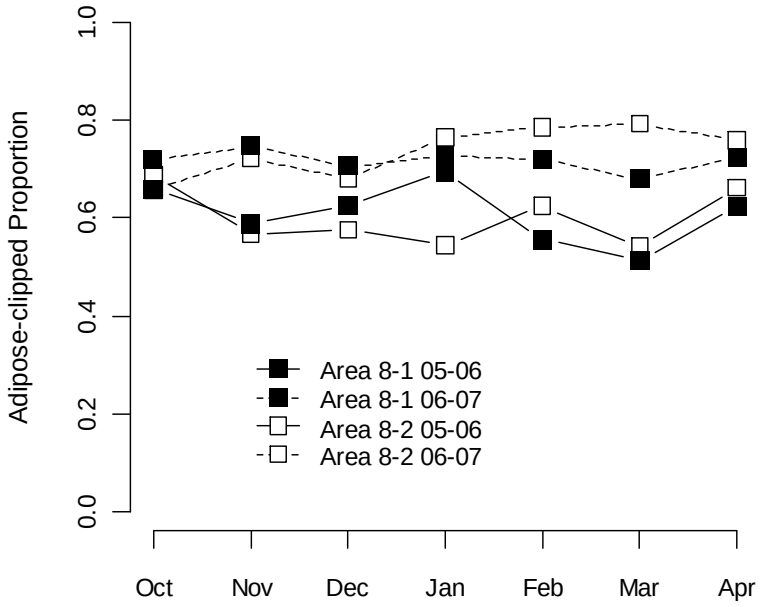


Figure 9. Between-area and within- and between-year patterns in the adipose-clipped (marked) proportion of Chinook encountered by anglers fishing in the Areas 8-1 and 8-2 05-06 and 06-07 selective blackmouth seasons. Displayed proportions were calculated based on known mark-status encounters only and using Method 1 estimates.

Dockside Size Analysis

Based on two seasons of dockside-sampling efforts, dockside samplers measured the lengths of 1,215 marked, 15 unmarked, and 4 unknown mark-status Chinook (Note: these data include observations at Murthy dockside sites [i.e., those monitored expressly for selective fisheries] combined with those made during WDFW "Baseline" sampling efforts). For known mark-status fish, 99% (05-06: 596/601) and 98% (06-07: 619/629) of all Chinook harvested from 8-1 and 8-2 combined were adipose clipped (**Table 7**). Of landed-clipped Chinook, 93% and 90% were of legal size (i.e., $\geq$ 22 in [55.8 cm]). The majority of marked-sublegal retention was within an inch (2.5 cm) of the legal cutoff.

Based on the pooled harvested-marked Chinook dataset, total length differences were present between areas and years [2-way ANOVA, $\log_e$(total length) = area + season + area*season, $F_{3, 1,211} = 24.8$, $P < 0.001$; **Table 8, Figure 10**]. This result, however, was largely the result of 06-07 Area 8-2 landed-marked Chinook being smaller than 06-07 8-1 and 05-06 8-2 landed-marked fish (Bonferroni-adjusted $P < 0.05$ for pair-wise *t*-tests). Observed median total lengths were 65.4 and 63.0 cm in Area 8-1 in 05-06 and 06-07 respectively, and 64.5 and 59.8 cm in Area 8-2 05-06 and 06-07 respectively. Though Within areas and years, there were clear within-season size patterns whereby the monthly mean total length of landed-marked Chinook increased by 4 to 8 cm from October to April (**Figure 11**).

Table 7. Frequencies (proportions in parentheses) of landed Chinook sampled during dockside interviews that were legal ("L") or sublegal ("S") in size and/or mark ("M") or unmarked ("U").

		Count by category (proportion of Grand total in parentheses)								
Season	**Area**	**Legal & marked**	**Legal & unmarked**	**Sublegal & marked**	**Sublegal & unmarked**	**Legal total**	**Sublegal total**	**Marked total**	**Unmark. total**	**Grand total**
2005-6	8-1	147	1	19	0	148	19	166	1	167
		(0.88)	(0.01)	(0.11)	(0.00)	(0.89)	(0.11)	(0.99)	(0.01)	
	8-2	408	4	22	0	412	22	430	4	434
		(0.94)	(0.01)	(0.05)	(0.00)	(0.95)	(0.05)	(0.99)	(0.01)	
	8-1 & 8-2	**555**	**5**	**41**	**0**	**560**	**41**	**596**	**5**	**601**
		(0.92)	**(0.01)**	**(0.07)**	**(0.00)**	**(0.93)**	**(0.07)**	**(0.99)**	**(0.01)**	
2006-7	8-1	142	2	19	1	144	20	161	3	164
		(0.87)	(0.01)	(0.12)	(0.01)	(0.88)	(0.12)	(0.98)	(0.02)	
	8-2	413	6	45	1	419	46	458	7	465
		(0.89)	(0.01)	(0.10)	(0.00)	(0.90)	(0.10)	(0.98)	(0.02)	
	8-1 & 8-2	**555**	**8**	**64**	**2**	**563**	**66**	**619**	**10**	**629**
		(0.88)	**(0.01)**	**(0.10)**	**(0.00)**	**(0.90)**	**(0.10)**	**(0.98)**	**(0.02)**	

Dockside Age Analysis

Based on the scales collected by dockside samplers, the majority of hatchery Chinook retained by anglers fishing in Areas 8-1 and 8-2 were 2 or 3 years in age, with little between-area and inter-annual variation (80.1% in 05-06, 86.3% in 06-07; **Figure 12**). With the exception of two age-5 fish encountered in 8-1 in 2005-06, age-4 individuals accounted for the remainder of catch

in both years (19.9% and 13.7% in 05-06 and 06-07, respectively). Within-season (monthly) age composition data are presented in **Appendix C**.

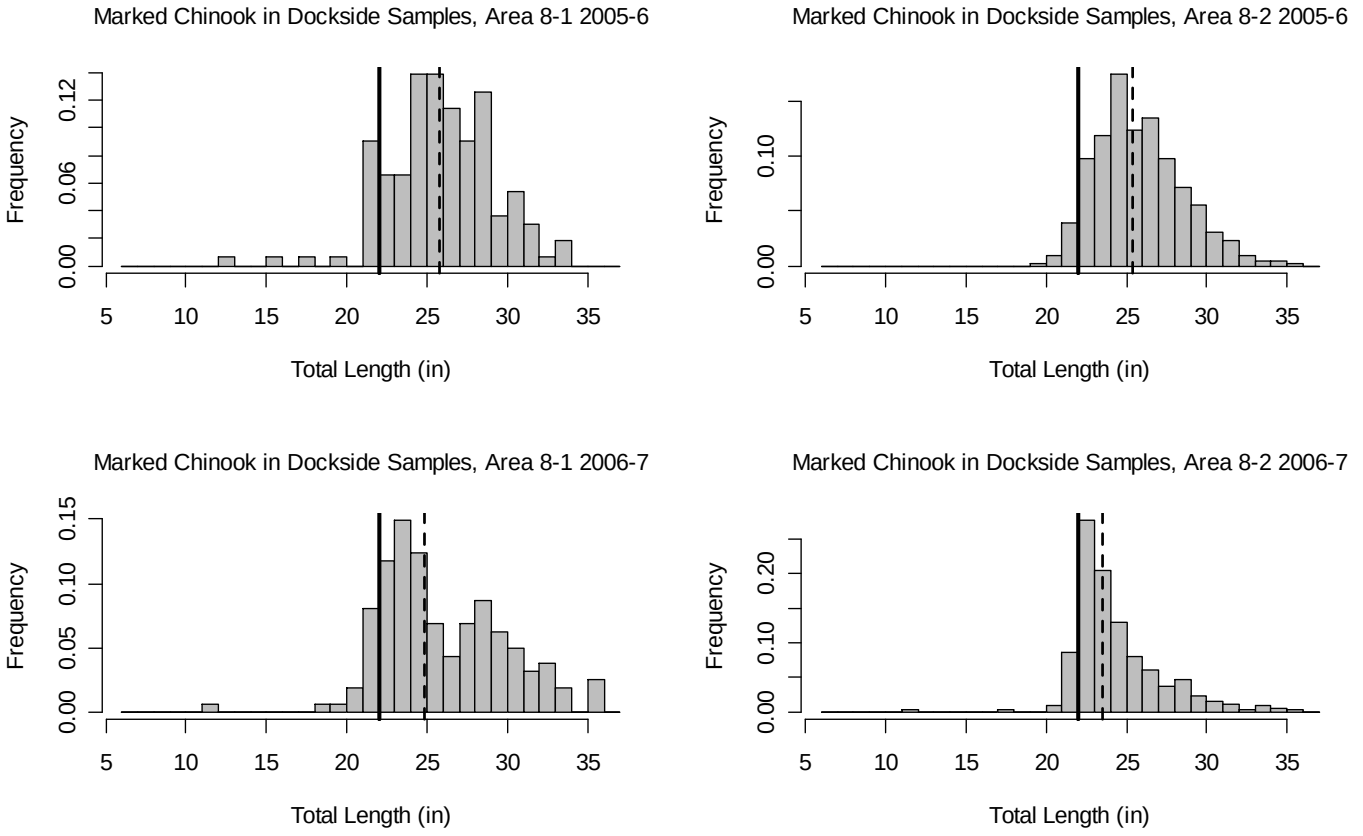


Figure 10. Length-frequency histograms for landed-marked Chinook inspected by dockside samplers during the Areas 8-1 (*left column*; n = 166 in 05-06, n = 161 in 06-07) and 8-2 (*right column*; n = 430 in 05-06, n = 458 in 06-07) selective fisheries in the 05-06 (*upper row*) and 06-07 (*lower row*) seasons. *Values are displayed in inches due to the use of this measurement system in defining size-limit regulations.* The solid vertical line denotes the legal size limit and the dashed vertical line denotes the median of each distribution. In addition to fish summarized above, a total of 15 unmarked Chinook and 4 individuals of undetermined mark status were observed by ramp samplers over the 14 months and two areas of the selective fishery.

Table 8. Mean and median total lengths (TL, and standard deviation [SD]) for marked Chinook harvested by anglers participating in the Areas 8-1 and 8-2 selective fisheries and observed by dockside samplers.

Season	Area	*n*	Mean TL (cm)	Median TL (cm)	SD
2005-6	8-1	166	65.7	65.4	8.3
	8-2	430	65.4	64.5	6.9
2006-7	8-1	161	65.8	63.0	9.9
	8-2	458	61.7	59.8	6.8

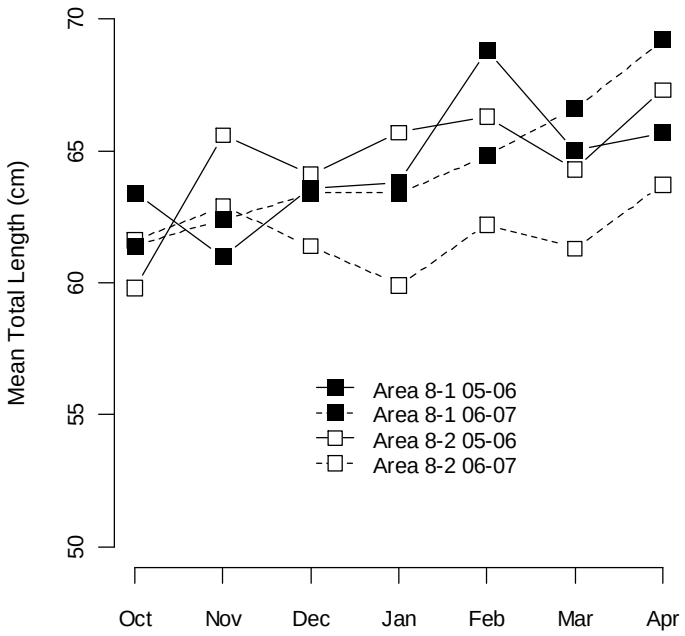


Figure 11. Trends in landed-marked Chinook mean total length (in cm) for Areas 8-1 and 8-2 mark-selective Chinook fisheries during the 05-06 and 06-07 seasons.

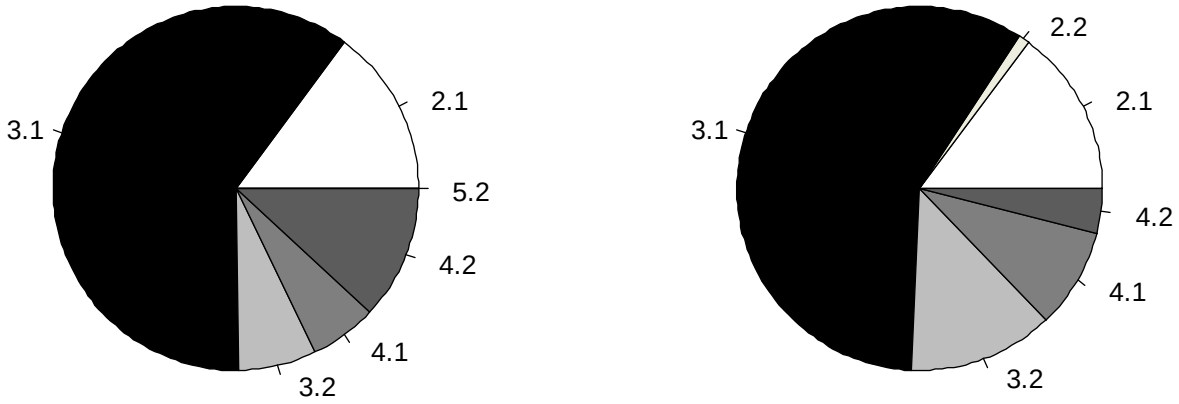


Figure 12. Age (Gilbert-Rich) composition of marked Chinook inspected during dockside sampling of landed catch during the Areas 8-1 and 8-2 selective blackmouth fisheries during 2005-06 (*left pie*) and 2006-07 (*right pie*) winters. See **Appendix C** for within-area and -year composition details.

Test Fishery Results

Fishing Methods and Effort

Over the two areas and two seasons, Area 8-1 and Area 8-2 test fishers spent 2,476 hours (743 h in 8-1 and 581 in 8-2 during 05-06; 650 and 502 h, respectively, in 06-07) pursuing Chinook salmon. In terms of effort descriptors used to characterize the angling public, this translates into a total of 992 angler trips (280 in 8-1 and 216 in 8-2 during 05-06; 304 and 192 h, respectively, in 06-07) and 496 boat trips (140 in 8-1 and 108 in 8-2 during 05-06; 152 and 96 h, respectively, in 06-07; **Table 9**). Test fishers averaged 21 days on the water during each month in Area 8-1 and 15 days in Area 8-2 over the two years, and all missed fishing days (mostly during November/December) were due to a combination of inclement weather and/or boat-maintenance issues. During both the 2005-06 and 2006-07 seasons and in both Areas 8-1 and 8-2, test fishers used downriggers almost exclusively (>99% in all cases), as this was also the predominant private-fleet fishing mode (100% in 8-1 and >99% in 8-2 during 05-06; 99.5% in 8-1 and 97.6% in 8-2 during 06-07). Test fishing results and fishing-method details are summarized in prior post-season reports (WDFW 2007a and 2007b).

Table 9. Summary of fishing effort and Chinook encounters for the Areas 8-1 and 8-2 test fisheries, 2005-6 and 2006-7. For size/mark-status abbreviations, "L" = Legal, "S" = Sublegal, "M" = Marked, and "U" = Unmarked.

	2005-06		2006-07	
Attribute	**Area 8-1**	**Area 8-2**	**Area 8-1**	**Area 8-2**
Fishing time (h)	742.8	581.3	649.7	501.7
Days	140	108	152	96
"Angler trips"	280	216	304	192
LM Encounters	85	69	199	59
LU Encounters	53	54	76	16
SM Encounters	177	114	958	750
SU Encounters	135	60	541	381
Total Encounters	450	297	1,774	1,206
CPUE (Encounters / h)	0.61	0.51	2.73	2.40
LM Mortalities	13	10	30	9
LU Mortalities	8	8	11	2
SM Mortalities	35	23	192	150
SU Mortalities	27	12	108	76
Total Mortalities	83	53	341	237

Total Encounters and Size/Mark-status Composition

Test fishing efforts yielded a total of 3,727 Chinook encounters. The majority test-fishery Chinook encounters occurred during the 06-07 season (05-06 season: 450 and 297 in 8-1 and 8-2, respectively; 06-07 season: 1,774 and 1,206, in the respective areas); encounter rates (no. Chinook encountered per h fished) were 4-5 times greater during the second compared to the first season for both areas (**Table 9**). Monthly encounters averaged 133 across the two areas and seasons and ranged from 24 (Area 8-1 in April 05-06 season) to 615 (Area 8-1 in October 06-07

season). The size/mark-status composition of encountered Chinook was similar between the two areas within seasons, but differed markedly between seasons for both areas. During the 2005-06, the overall mark rate (i.e., marked encounters / all encounters) was 0.58 in 8-1 (95% CI: 0.54-0.63) and 0.62 in 8-2 (0.56-0.67). In 2006-07, values were higher in both areas, at 0.65 (0.64-0.66) and 0.67 (0.66-0.68), respectively, due to increased relative abundance of both legal- and sublegal-marked encounter components (e.g., **Figure 13**). Legal mark-rates (i.e., legal-marked encounters / all legal encounters) were even more disparate between years: 8-1 test-fishery estimates were 0.62 (0.58-0.66) in 05-06 and 0.72 (0.70-0.75) in 06-07; 8-2 legal-mark rates were 0.56 (0.52-0.60) in 05-06 and 0.79 (0.75-0.82) in 06-07. Finally, within years, the monthly size/mark-status composition of test-fishery encounters varied across both seasons, with a tendency towards increased legal Chinook (marked and unmarked) relative abundance towards the close of the fishery (**Figure 13**; **Table 10**), a result consistent with the mean total-length changes that are described below.

Table 10. Monthly size/mark-status proportion estimates (variance in parentheses) for the Areas 8-1 and 8-2 test fisheries during the 05-06 and 06-07 seasons.

Season	Area	Stat. Month	Legal-Marked prop'n	Legal-unmarked prop'n	Sublegal-Marked prop'n	Sublegal-Unmarked prop'n
2005-6	8-1	Oct	0.09 (0.04)	0.00 (0.00)	0.61 (0.07)	0.30 (0.07)
		Nov	0.16 (0.04)	0.17 (0.05)	0.39 (0.06)	0.28 (0.05)
		Dec	0.23 (0.07)	0.10 (0.05)	0.23 (0.07)	0.44 (0.08)
		Jan	0.15 (0.03)	0.16 (0.03)	0.37 (0.05)	0.32 (0.04)
		Feb	0.32 (0.06)	0.10 (0.04)	0.35 (0.06)	0.23 (0.05)
		Mar	0.16 (0.04)	0.06 (0.03)	0.47 (0.05)	0.31 (0.05)
		Apr	0.29 (0.09)	0.29 (0.09)	0.21 (0.08)	0.21 (0.08)
	8-2	Oct	0.02 (0.02)	0.07 (0.04)	0.57 (0.08)	0.33 (0.07)
		Nov	0.17 (0.05)	0.17 (0.05)	0.46 (0.07)	0.21 (0.06)
		Dec	0.38 (0.08)	0.24 (0.07)	0.14 (0.06)	0.24 (0.07)
		Jan	0.34 (0.07)	0.23 (0.06)	0.30 (0.07)	0.13 (0.05)
		Feb	0.28 (0.06)	0.22 (0.06)	0.38 (0.07)	0.12 (0.05)
		Mar	0.18 (0.06)	0.18 (0.06)	0.39 (0.07)	0.25 (0.07)
		Apr	0.28 (0.08)	0.14 (0.07)	0.45 (0.09)	0.14 (0.07)
2006-7	8-1	Oct	0.05 (0.01)	0.01 (0.00)	0.55 (0.02)	0.39 (0.02)
		Nov	0.09 (0.02)	0.02 (0.01)	0.57 (0.04)	0.32 (0.04)
		Dec	0.09 (0.02)	0.03 (0.01)	0.59 (0.03)	0.28 (0.03)
		Jan	0.11 (0.02)	0.06 (0.01)	0.57 (0.03)	0.26 (0.02)
		Feb	0.14 (0.02)	0.05 (0.01)	0.56 (0.03)	0.26 (0.03)
		Mar	0.32 (0.04)	0.10 (0.03)	0.37 (0.04)	0.21 (0.04)
		Apr	0.24 (0.04)	0.15 (0.03)	0.40 (0.05)	0.21 (0.04)
	8-2	Oct	0.02 (0.01)	0.01 (0.00)	0.62 (0.02)	0.35 (0.02)
		Nov	0.01 (0.01)	0.01 (0.01)	0.64 (0.04)	0.33 (0.04)
		Dec	0.04 (0.02)	0.00 (0.00)	0.67 (0.04)	0.29 (0.03)
		Jan	0.03 (0.02)	0.00 (0.00)	0.61 (0.05)	0.35 (0.05)
		Feb	0.10 (0.03)	0.02 (0.02)	0.60 (0.05)	0.28 (0.05)
		Mar	0.09 (0.03)	0.03 (0.02)	0.55 (0.05)	0.33 (0.05)
		Apr	0.18 (0.04)	0.04 (0.02)	0.61 (0.05)	0.17 (0.04)

Based on assumed legal (sfm_L = 0.15) and sublegal (sfm_S = 0.20) release mortality rates, we estimated total test-fishing impacts at 253 unmarked (35%), 462 marked (65%), and 715 total Chinook mortalities for the pooled areas and seasons (**Table 9**). In each season, the majority of the impact was on marked fish (60% in 05-06, 65% in 06-07; both expressed relative to a marked + unmarked total); sublegal individuals (71% 05-06, 91% in 06-07; both expressed relative to a legal + sublegal total) also constituted the greatest proportion of estimated mortality. Finally, 60% of the total estimated test-fishing impact occurred in 8-1, whereas the remaining 40% occurred in 8-2.

Test Fishery Size Analysis

We analyzed the length-frequency (total length) distributions of Chinook groups encountered in the Areas 8-1 and 8-2 test fisheries by year and mark status (**Figure 14**). Although total-length variation was due to a combination of area, mark-status class, and season effects [3-way ANOVA; model $\log_e(TL)$ = area + mark-status + season + interactions, $F_{7, 3,723} = 44.09$, $P < 0.001$], the only consistent trend observed was one towards smaller Chinook size during the 06-07 relative to the 05-06 season, particularly for Area 8-2 (**Table 11**). In addition, for areas 8-1 and 8-2 in 05-06, 6 and 10%, respectively, of all encountered marked Chinook were within 2 inches (5 cm) of the legal limit (i.e., $20 < x < 22$ in). Eight percent of 8-1 and 7% of 8-2 marked Chinook encounters were in this same size interval (i.e., $20 < x < 22$ in) during the 06-07 season. For both areas and seasons, 19% of all encountered marked Chinook were within 4 inches (8 cm) of the legal limit (i.e., $18 < x < 22$ in).

Table 11. Mean and median total lengths (TL, and standard deviation [SD]) for marked and unmarked Chinook encountered in the Areas 8-1 and 8-2 test fisheries, 2005-06 and 2006-07.

Season	Area	Mark-status	*n*	Mean TL (cm)	Median TL (cm)	SD
2005-06	8-1	Marked	262	45.3	43.5	16.1
		Unmarked	188	42.2	35.5	16.1
	8-2	Marked	183	49.2	50.2	14.2
		Unmarked	114	50.0	54.1	16.0
2006-07	8-1	Marked	1,152	42.4	40.5	13.8
		Unmarked	620	39.1	34.1	13.8
	8-2	Marked	815	38.0	35.4	11.6
		Unmarked	397	34.0	31.0	8.7

Finally, similar to dockside samples of landed marked Chinook, the average size of test-boat encountered Chinook (marked and unmarked) increased as the season progressed during both seasons (**Figure 15**). The mean total length of marked fish increased from 35-40 cm to approximately 50 cm over the seven month test fishery, whereas that for unmarked fish increased from 30-35 cm to ~50 cm.

Test Fishery Age Analysis

Based on the scales collected in the test fishery, we found minimal differences in the age composition of marked and unmarked Chinook encountered in the test fishery between years and areas (**Figure 16**; **Appendix C**). For mark-status group comparisons within each season, age-1 individuals comprised a higher proportion and age-3 individuals a lower proportion of unmarked relative to marked Chinook. Although there were no systematic differences between the two areas, age-3+ individuals (marked and unmarked) comprised a greater proportion of encounters in Area 8-2 than 8-1 in 05-06; in 06-07, 8-1 and 8-2 test-fishery age composition estimates were similar. Finally, there was a clear shift towards increased relative abundance of $\leq$ age-2 fish in 06-07 compared to 05-06. In 05-06, 55% of marked and 63% of unmarked encounters were age 2 or less, whereas in 06-07, these same two age (1 and 2) classes comprised 72 and 81% of all marked and unmarked Chinook encountered in the test fishery. This shift was due entirely to an increase in the age-1 proportion in both marked (11% in 05-06 vs. 31% in 06-07) and unmarked (17% in 05-06 vs. 41% in 06-07) Chinook mark-status groups.

Voluntary Trip Reports

Over the two areas and seasons, we received a total of 185 (99 from private anglers, 86 covering charter anglers) voluntary trip reports (VTRs) from anglers participating in the areas 8-1 and 8-2 selective Chinook fisheries. These VTRs provided data on 473 angler trips (166 private, 307 charter) and 1,148 total Chinook encounters (300 private, 848 charter; **Table 12**). The majority (84%) of the returned VTR response for both seasons was from Area 8-2; the only appreciable 8-1 response was from private anglers in 06-07.

Based on VTRs returned for areas and seasons with adequate angler-trip and Chinook encounter coverage (i.e., all VTRs excluding 8-1 charter in 06-07), we estimated a combined charter-private CPUE (Chinook landed per angler trip) of 0.33 for 05-06 and 0.29 for 06-07. Although class-specific (private and charter) overall and legal-size mark rates were estimated for all VTR classes separately (private and charter), values were variable and have limited value in some low-response situations (e.g., Area 8-1 in 05-06; **Table 12**). Thus, we emphasize 8-2 charter and private VTR data for both seasons and 8-1 private VTRs for 06-07 only from hereafter. Based on this subset of respondents, we estimated a VTR-based overall mark rate (both areas and fishing classes) of 0.67 for 05-06 and 0.76 for 06-07. Legal-size mark rates were of 0.65 for 05-06 and 0.82 for 06-07 for this same subset of VTR-reported encounters. Finally, based an aggregation of all VTRs reporting legal-marked Chinook encounters, anglers participating in the VTR program intentionally released 9.4% of the Chinook that they could have legally harvested (**Table 12** and **Table 24** in Section II).

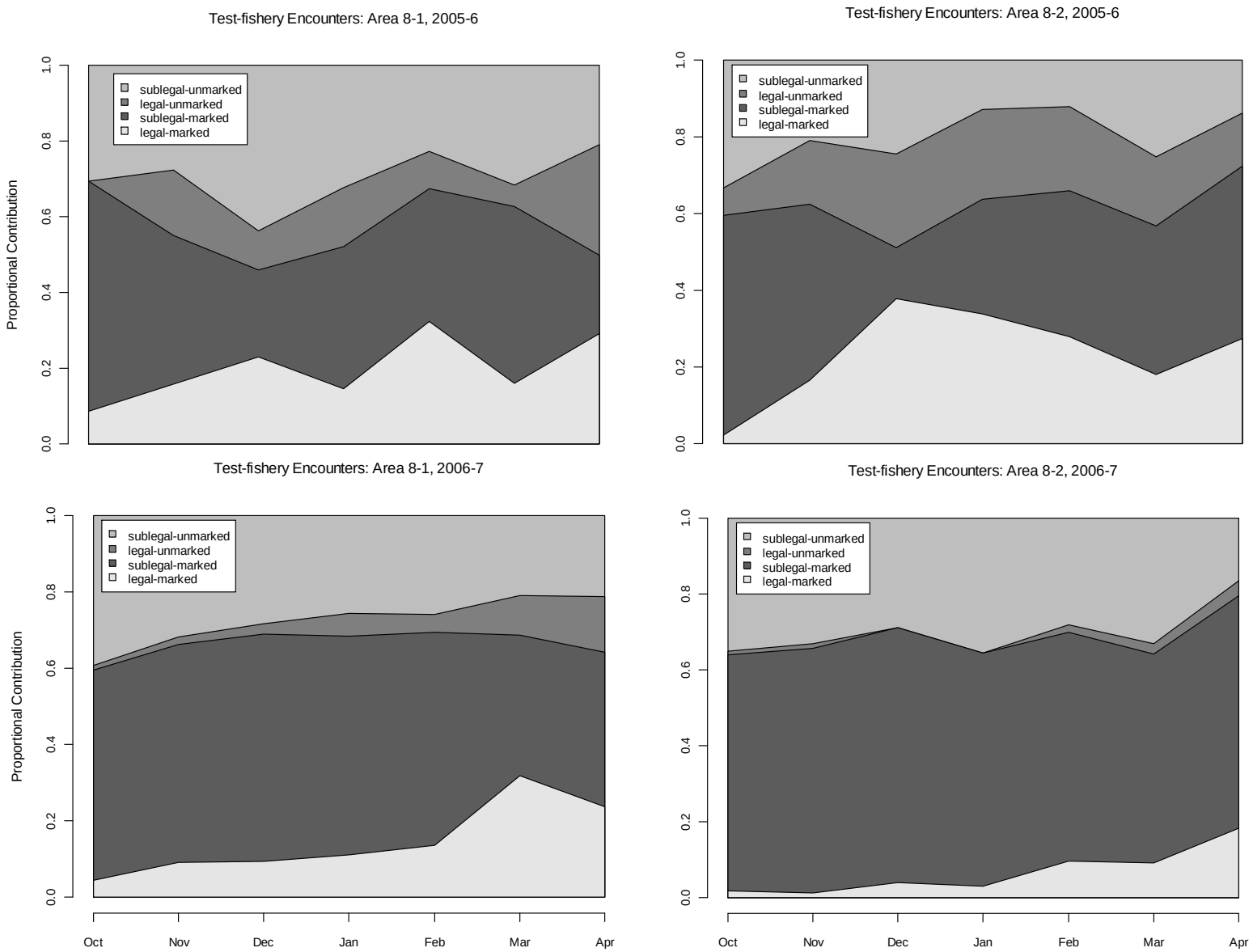


Figure 13. Size/mark-status composition of test-fishery encounters from October to April, 2005-6 (*upper row*) and 2006-7 (*lower row*) in the areas 8-1 and 8-2 mark-selective Chinook fisheries.

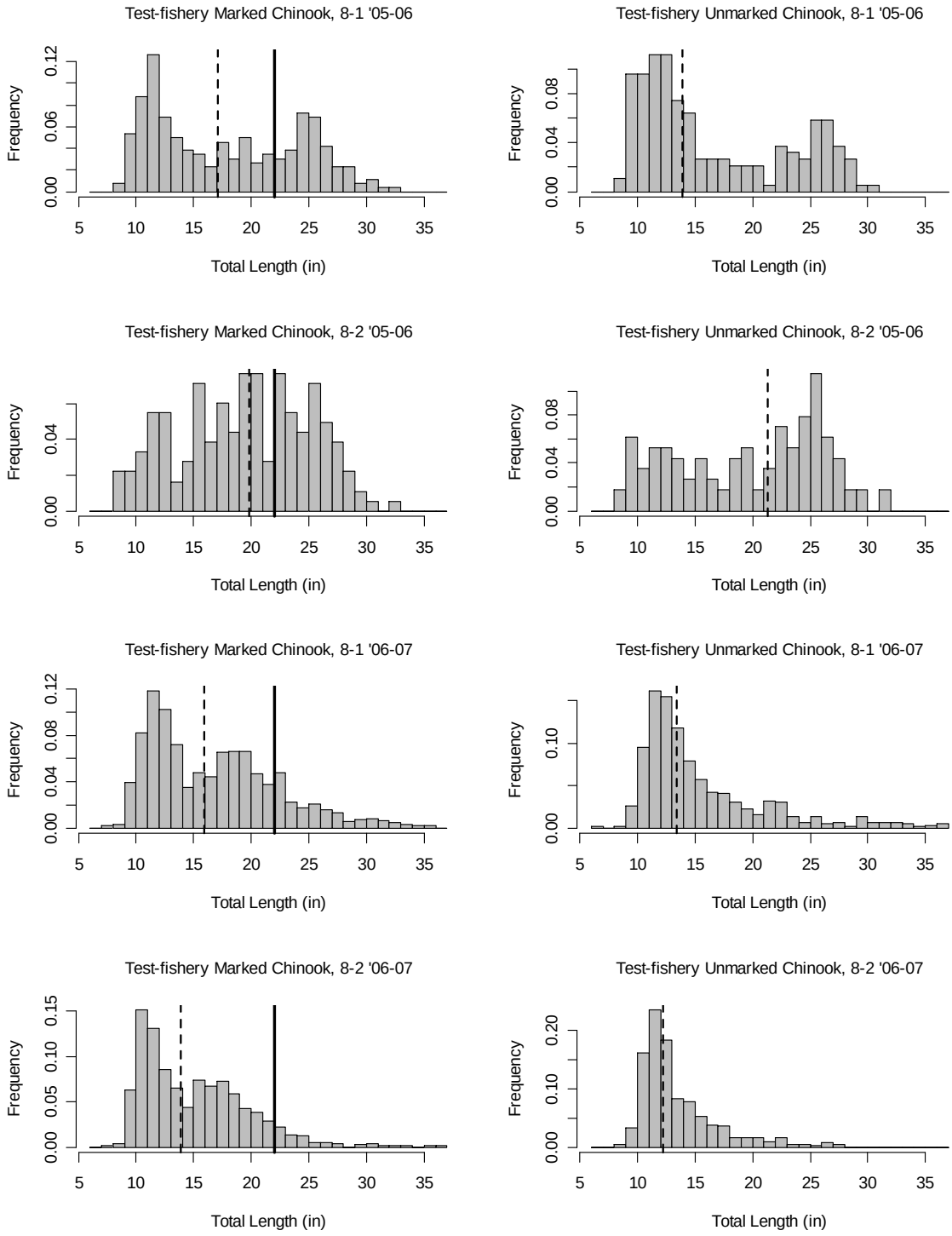


Figure 14. Length-frequency histograms for marked (*left column*) and unmarked (*right column*) Chinook encountered by test-boat anglers during the areas 8-1 and 8-2 winter selective blackmouth fisheries during 05-06 (*upper half*) and 06-07 (*lower half*) seasons. *Values are displayed in inches due to the use of this measurement system in defining size-limit regulations.* The solid vertical line on marked Chinook plots denotes the legal size limit and the dashed vertical line denotes the median of each distribution. All pair-wise $\log_e$(TL) comparisons were statistically significant (pair-wise *t*-tests, Bonferroni-adjusted $P < 0.05$) except for between-season contrasts for both marked and unmarked Chinook in 8-1 and between mark-status contrasts in 8-2 during 05-06.

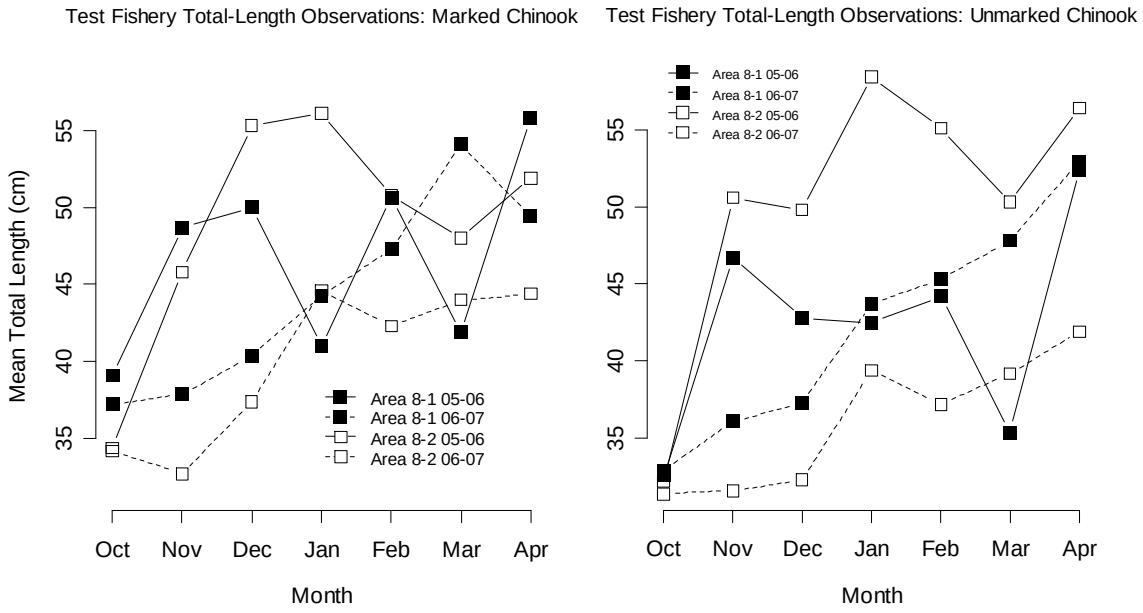


Figure 15. Trends in monthly mean total length (in cm) for marked (*left panel*) and unmarked (*right panel*) Chinook encountered in the Areas 8-1 and 8-2 test fisheries during the 05-06 and 06-07 seasons.

Comparing Private Fleet, Test-fishery, and VTR data: Mark Rates

Given the limited number of encounters encompassed by private and charter VTRs in Area 8-1, we restricted our between-method mark-rate comparison for this section to Area 8-2 only; however, related creel vs. test-fishery comparisons are pursued for both areas in Section II of this report. Where possible, we tested for differences in overall mark rates (i.e., total marked encounters / total encounters) between test-fishery, charter VTR, private VTR, and dockside sampling methods and legal-size mark rates (i.e., legal-marked encounters / total legal encounters) between test-fishery and both charter and private VTR observations using χ^2 tests.

Overall mark rates differed between methods during the 06-07 season ($\chi^2 = 28.3$, df = 2, $P < 0.001$) and marginally for the 05-06 season ($\chi^2 = 8.6$, df = 3, $P = 0.04$). Based on post-hoc pairwise proportion tests (Bonferroni-adjusted $\alpha = 0.01$), overall mark-rate comparison results for 05-06 were driven by charter VTR-based mark rates being higher than dockside ($\chi^2 = 7.3$, df = 1, $P = 0.007$), test-fishery ($\chi^2 = 3.7$, df = 1, $P = 0.054$), and private VTR estimates ($\chi^2 = 3.6$, df = 1, $P = 0.059$). For 06-07, overall mark-rate results were due to test-fishery estimates being lower than both dockside-based ($\chi^2 = 13.4$, df = 1, $P < 0.001$), charter-VTR-based estimates ($\chi^2 = 24.7$, df = 1, $P < 0.001$), and private VTR-based estimates ($\chi^2 = 2.8$, df = 1, $P = 0.096$); additionally, the difference between charter and dockside estimates was significant ($\chi^2 = 8.2$, df = 1, $P = 0.004$). Legal mark rates did not differ between methods in either 05-06 ($\chi^2 = 3.1$, df = 2, $P = 0.216$) or 06-07 ($\chi^2 = 0.3$, df = 1, $P = 0.575$; *NOTE*: *this comparison is restricted to test fishery vs. charter VTRs only due to few legal Chinook being reported on private VTRs*). In sum, although test-fishery and VTR programs yielded comparable legal-size Chinook mark rates in both years, Charter VTRs yielded higher overall mark rates than other methods during 05-06 and the test fishery yielded lower mark rates than other methods during the 06-07 season. Test-fishery versus creel mark-rate comparisons are considered further in Section II.

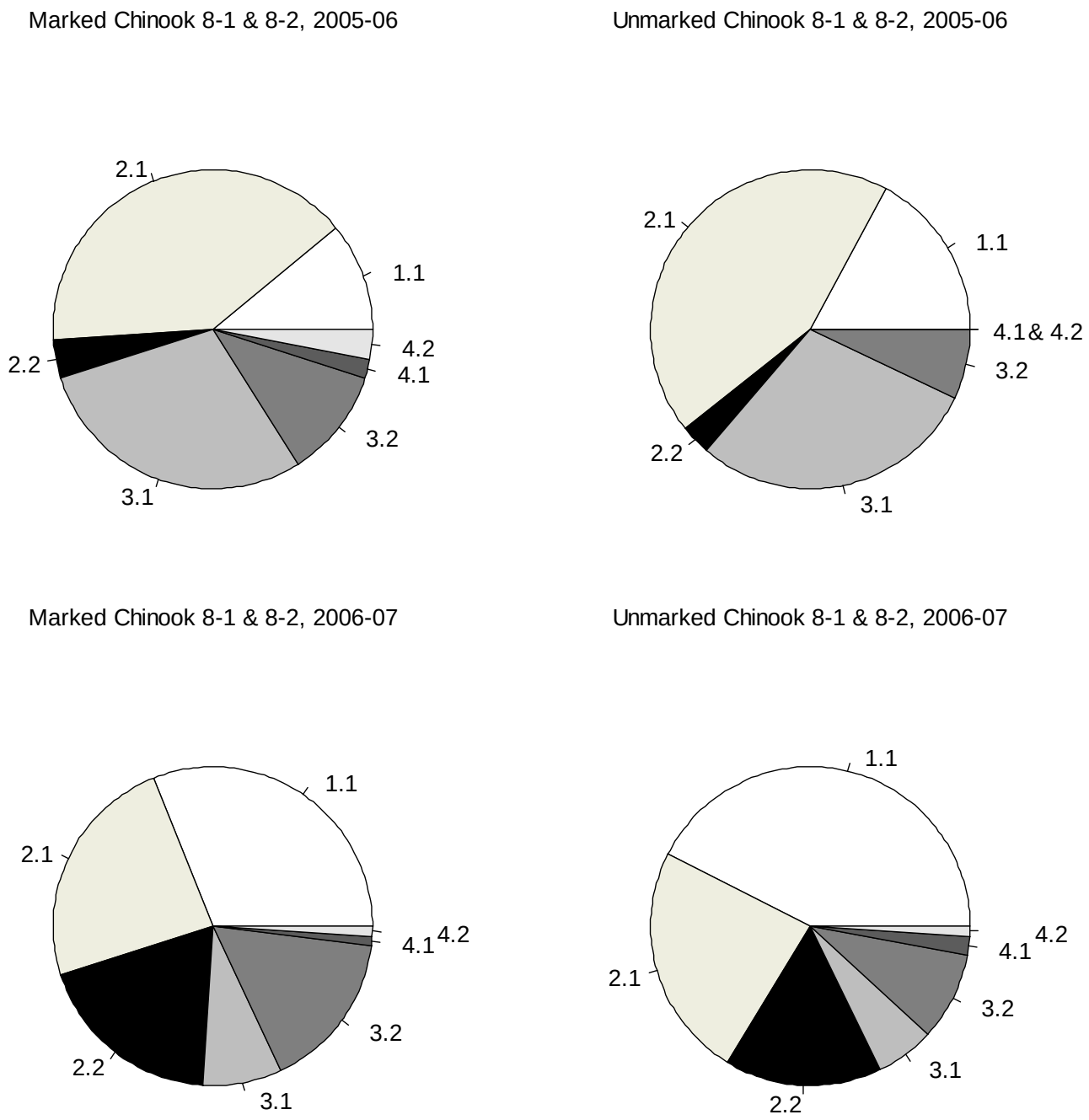


Figure 16. Age (Gilbert-Rich) composition of marked (*left column*) and unmarked (*right column*) Chinook encountered in the 8-1 and 8-2 test fisheries during the Areas 8-1 and 8-2 selective blackmouth fisheries during 2005-06 (*upper row*) and 2006-07 (*lower row*) winters. See Appendix C for within-area and -year composition details.

Table 12. Mark-rate (Overall and Legal-only) and legal-marked release rate estimates from VTRs (Private and Charter), Dockside interviews, and test-fishing efforts. Size abbreviations are "L" and "S" for legal and sublegal; mark-status classes are "M" (marked) and "U" (unmarked).

				Retained Encounters				Released Encounters						
Season	**Area**	**Sampling Method**	**Total Enc's**	**LM**	**LU**	**SM**	**SU**	**LM**	**LU**	**SM**	**SU**	**Overall mark rate**	**Legal mark rate**	**LM release rate**
05-06	8-1	Private VTR	6	3	0	0	0	1	1	0	1	--[b]	--[b]	--[b]
		Charter VTR	6	0	0	0	0	0	3	2	1	--[b]	--[b]	--[b]
		Test Fishing	450	0	0	0	0	85	53	177	135	0.58	0.62	--[c]
		Creel[a]	317	95	0	0	0	84	138	0	0	0.56	--[c]	--[c]
	8-2	Private VTR	54	16	0	1	0	1	11	12	13	0.56	0.61	0.06
		Charter VTR	215	76	0	0	0	7	41	68	23	0.70	0.67	0.08
		Test Fishing	297	0	0	0	0	69	54	114	60	0.62	0.56	--[c]
		Creel[a]	790	294	17	0	0	179	300	0	0	0.60	--[c]	--[c]
06-07	8-1	Private VTR	127	8	0	0	0	1	1	76	41	0.67	0.90	0.11
		Charter VTR	0	0	0	0	0	0	0	0	0	--[b]	--[b]	--[b]
		Test Fishing	1,774	0	0	0	0	199	76	958	541	0.65	0.72	--[c]
		Creel[a]	1,379	106	3	0	0	863	407	0	0	0.70	--[c]	--[c]
	8-2	Private VTR	113	3	0	0	0	1	4	81	24	0.75	--[b]	--[b]
		Charter VTR	627	39	1	0	0	4	7	448	128	0.78	0.84	0.09
		Test Fishing	1,206	0	0	0	0	59	16	750	381	0.67	0.79	--[c]
		Creel[a]	3,303	400	12	0	0	2,002	889	0	0	0.73	--[c]	--[c]

a. Angler interview values are observed totals (i.e., sample *n*s) for known (or reported) mark-status fish; values listed under "LM" and "LU" under retained and released fields are *all* (legal and sublegal) marked and unmarked totals (i.e., size-status is not recorded during the interview process).
b. This quantity could not be estimated for this group due to limited data.
c. The information necessary to estimate this quantity is not collected for this group or the parameter is not applicable.

Total Fishery Impacts

For the 05-06 season, total mortality for the combined Areas 8-1 and 8-2 mark-selective Chinook fisheries was estimated at 1,940 (80.5% marked, 19.5% unmarked; 65% sublegal, 35% legal) using Method 1 and 1,840 (79.5% marked, 20.5% unmarked; 60% sublegal, 40% legal) using Method 2 (**Table 13**). Thus, for this first selective season, both estimation approaches yielded results of comparable magnitude and size/mark-status composition (**Figure 17**). Consistent with overall effort and encounter patterns for 05-06, Area 8-2 impacts were 50% to 100% greater than those due to Area 8-1 fishing activity (see **Appendix E**, for within-area estimates).

At 2-3 times greater than the 05-06 season, total Chinook mortality due to the 06-07 selective 8-1/8-2 season was estimated to be between 4,481 (73.6% marked, 26.4% unmarked; *Method 2*) and 6,311 (71.7% marked, 28.3% unmarked; *Method 1*). With non-overlapping total-mortality confidence intervals (M2 95% CI: 3,641-5,322; M1 CI: 6,041-6,581) and a ~2,000 fish difference between point estimates, Method-1 and Method-2 estimates for 06-07 were quite disparate. As both approaches rely on the same harvest information, differences were entirely due to our estimates for the released Chinook component (**Figure 17**). Further, a greater proportion of the estimated impact in this season was on sublegal Chinook (78% of total mortality under Method 1, 75% under Method 2) than was observed for the 05-06 season. As in 05-06, estimated total impacts were ~75% due to 8-2 fishing activity (see **Appendix E** for within-area estimates). As a final note, total impacts (encounters or mortalities) estimated for the first two seasons of the combined pilot Areas 8-1 and 8-2 selective fishery were less than those modeled using FRAM during the season-setting process (**Tables 2** vs. **Table 13**); we evaluate FRAM predictions relative to creel estimates in greater detail under Question 4 in Section II (See **Tables 23-25** for tabular summaries).

In an attempt to characterize selective fishery impacts in a manner independent of assumed selective fishing mortality (*sfm*) rates, we also examined released-to-retained ratios for the Areas 8-1 and 8-2 fisheries for both seasons (**Figure 18**); ratios were assessed for total and unmarked-only Chinook release groups (*Method-1 estimates*) relative to total estimated retention. Similar to mortality estimates, released-to-retained ratios illustrate that the 8-1 and 8-2 fisheries had substantially greater impacts during 06-07 compared to 05-06. During 05-06, an average of 2 unmarked and 3 total (marked and unmarked) releases occurred for each Chinook retained in Area 8-1; in Area 8-2, 05-06 ratios averaged 3 total and 1 unmarked releases per harvested Chinook. In 06-07, monthly estimates averaged 24 total and 9 unmarked releases per kept fish for Area 8-1 and 21 (total) and 7 (unmarked), respectively, for Area 8-2. In both areas and years (particularly during 2006-07), there was substantial month-to-month variability in released-to-retained ratios; relatively high values were seen in October and low values during other months (**Figure 18**). Method-2 estimates of retained-to-released ratios demonstrate similar within-season patterns, but with lower ratio values.

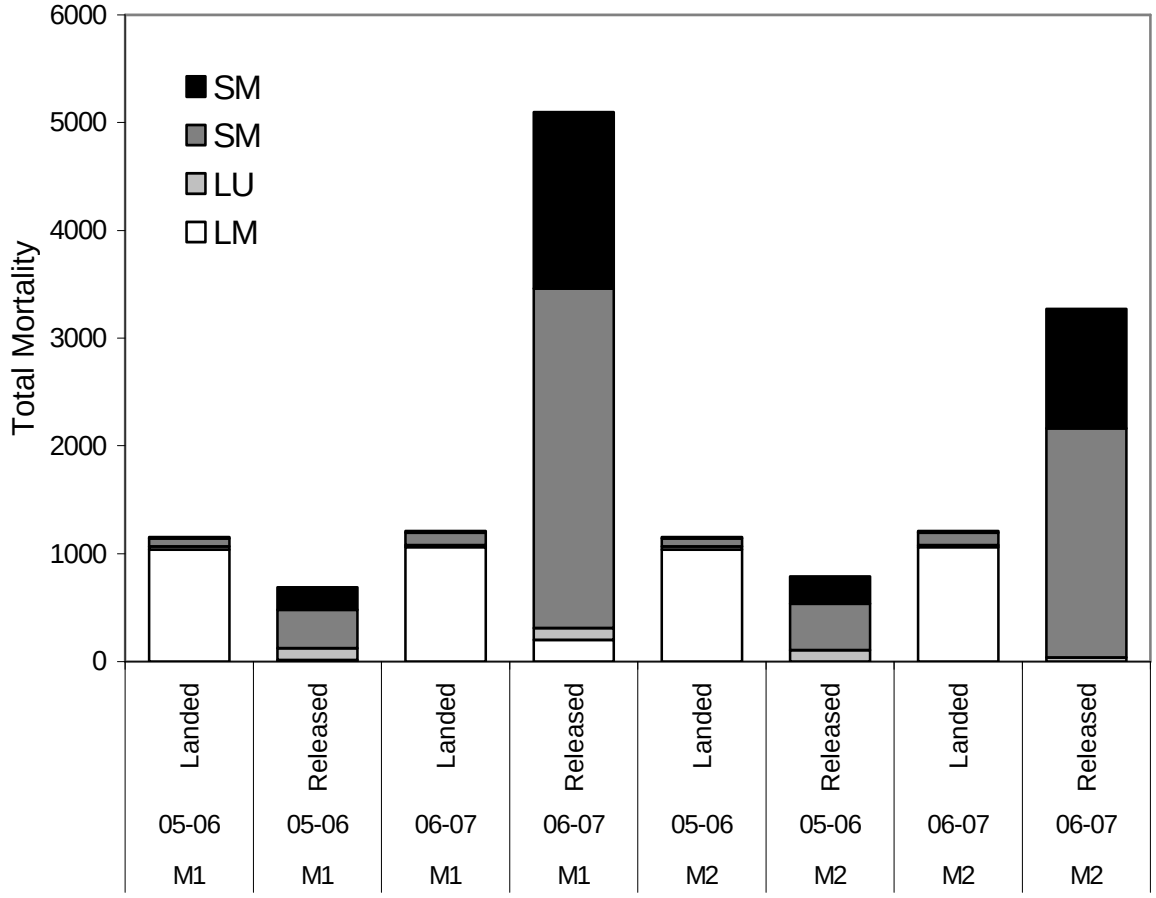


Figure 17. Estimated mortality for landed and released Chinook, by size/mark-status class ("L" = Legal, "S" = Sublegal, "M" = Marked, "U" = Unmarked), estimation method (Method 1 = "M1", left 4 bars; Method 2 = "M2", right 4 bars), and season (0506 and 0607). See Table 10 for confidence intervals for confidence intervals around class-specific estimates.

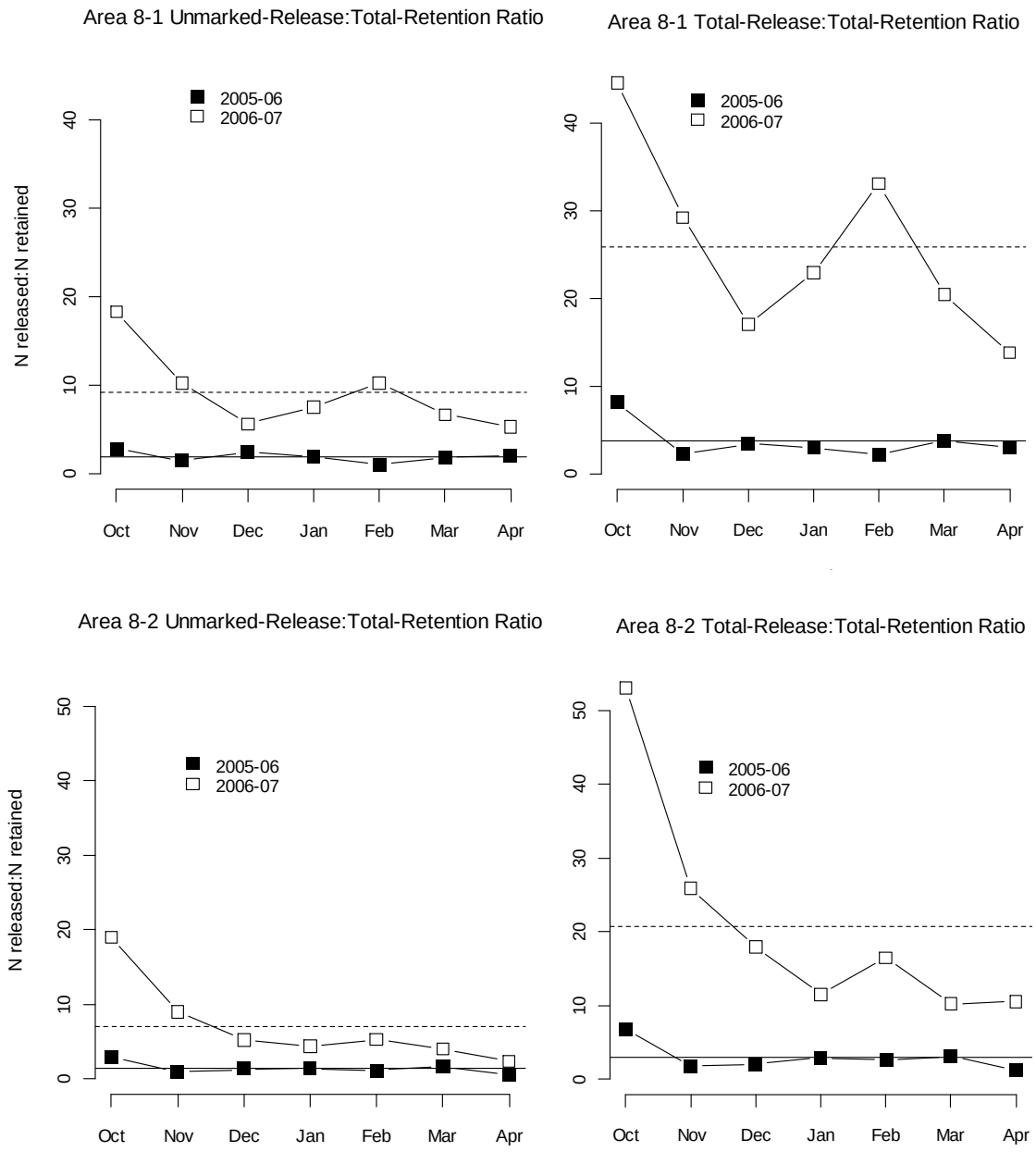


Figure 18. Ratios of estimated unmarked (*left column*) and total (*right column*) Chinook releases to estimated Chinook harvest for Areas 8-1 (*upper row*) and 8-2 (*lower row*) during 2005-6 and 2006-7. The horizontal solid and dashed lines represent season-wide averages for the 05-06 and 06-07 seasons. All values displayed are based on Method-1 estimates of encounters (i.e., based on dockside interview data only).

Table 13. Total encounters and mortality estimates (and 95% CIs), by size/mark-status class ("L" = Legal, "S" = Sublegal, "M" = Marked, "U" = Unmarked), estimation method (Method 1 = "M1", left 4 bars; Method 2 = "M2", right 4 bars), and season (05-06 and 06-07) for the Areas 8-1 and 8-2 mark-selective Chinook fishery. See Section II, **Tables 23-25**, for a similarly formatted display of for pre-season predictions of fishery impacts.

				Encounters		Landed Catch		Total Mortality	
Method	**Season**	**Areas**	**Size class**	**Marked**	**Unmarked**	**Marked**	**Unmarked**	**Marked**	**Unmarked**
Method 1	2005-06	8-1 & 8-2	Legal	1135	756	1038	40	1052	147
			CI	(946 - 1,324)	(596 - 916)	(916 - 1,160)	(26-54)	(926 - 1,178)	(119-176)
			Sublegal	1,849	1,056	74	0	429	211
			CI	(1,607 - 2,091)	(872 - 1,240)	(59 - 89)	(0-0)	(378 - 480)	(175-248)
			Total	2,983	1,813	1,112	40	1,481	359
			CI	(2,676 - 3,290)	(1,569 - 2,057)	(989 - 1,235)	(26-54)	(1,345 - 1,617)	(312-405)
			Legal	2,383	772	1,059	26	1,257	138
Method 1	2006-07	8-1 & 8-2	CI	(1,996 - 2,770)	(569 - 975)	(976 - 1,142)	(17-36)	(1,155 - 1,359)	(106-170)
			Sublegal	15,861	8,217	118	7	3,266	1,649
			CI	(14,860 - 16,862)	(7,491 - 8,943)	(103 - 133)	(2-12)	(3,065 - 3,467)	(1,504-1,794)
			Total	18,244	8,988	1,176	33	4,524	1,787
			CI	(17,171 - 19,317)	(8,235 - 9,741)	(1,091 - 1,261)	(22-44)	(4,299 - 4,749)	(1,638-1,936)
Method 2	2005-06	8-1 & 8-2	Legal	1,038	742	1,038	40	1,038	145
			CI	(916 - 1,160)	(480 - 1,004)	(916 - 1,160)	(26-54)	(916 - 1,160)	(103-187)
			Sublegal	2,224	1,267	74	0	504	253
			CI	(854 - 3,594)	(456 - 2,078)	(59 - 89)	(0-0)	(230 - 778)	(91-416)
			Total	3,262	2,010	1,112	40	1,542	399
			CI	(1,887 - 4,637)	(1,157 - 2,863)	(989 - 1,235)	(26-54)	(1,242 - 1,842)	(231-566)
			Legal	1,059	289	1,059	26	1,059	61
Method 2	2006-07	8-1 & 8-2	CI	(976 - 1,142)	(166 - 412)	(976 - 1,142)	(17-36)	(976 - 1,142)	(40-82)
			Sublegal	10,723	5,564	118	7	2,239	1,123
			CI	(7,075 - 14,371)	(3,522 - 7,606)	(103 - 133)	(2-12)	(1,509 - 2,969)	(715-1,532)
			Total	11,781	5,853	1,176	33	3,297	1,184
			CI	(8,132 - 15,430)	(3,807 - 7,899)	(1,091 - 1,261)	(22-44)	(2,562 - 4,032)	(775-1,593)

CWT analysis

Puget Sound hatchery stocks comprised 97% and 100% of the recovered coded-wire tagged Chinook during the 2005-06 and 2006-07 selective Chinook fishery seasons, respectively, for Areas 8-1 and 8-2 combined (**Tables 14-17**; see **Appendix G** for individual tag recovery records). Samplers recovered a total of 101 coded-wire tags from Chinook harvested during the 2005-06 season; of these, 98 were Puget Sound stocks, two were Canadian stocks, and one was a Columbia River stock. Similarly, samplers recovered 108 coded-wire tags from Chinook harvested during the 2006-07 season, and all were Puget Sound stocks.

During the 2005-06 season, 29 of the 101 CWT recoveries were double index tags (**Table 14**). Chinook from Wallace River, Marblemount, and Grovers Creek hatcheries contributed the highest number of double index tags. Similarly, during the 2006-07 season, 20 of the 108 CWT recoveries were double index tags. Chinook from Garrison, Wallace River, Marblemount, and Hoodsport hatcheries contributed the highest number of double index tags during 2006-07 (**Table 15**).

Estimates of mortalities (based on λ at release) of unmarked legal-size double index tagged Chinook due to the selective Chinook fishery in Areas 8-1 and 8-2 were very low in both the 2005-06 and 2006-07 seasons. We estimated 9 mortalities of unmarked double index tagged Chinook during the 2005-06 season and only 5 mortalities during the 2006-07 season (**Tables 16**, **17**).

Table 14. Summary of total observed (in-sample) coded-wire tag recoveries from Chinook salmon harvested during the Chinook selective fishery in Areas 8-1 and 8-2 from October 1, 2005 through April 30, 2006. Locations were defined based on river basin outlets; North Sound includes all sites in basins draining into Marine Areas 7, 8-1 and 8-2; South Sound includes all sites in basins draining into Marine Areas 11 and 13; Central Sound includes all sites in basins draining into Marine Areas 9 and 10; Hood Canal includes all sites in Area 12.

Rearing Hatchery	Release Agency	Location (Region)	#CWT's Recovered	% of Total	# of DIT's
WALLACE R HATCHERY	WDFW	North Sound	13	13%	3
MARBLEMOUNT HATCHERY	WDFW	North Sound	11	11%	10
GROVERS CR HATCHERY	SUQ	Central Sound	11	11%	11
ICY CR HATCHERY	WDFW	Central Sound	9	9%	
BERNIE GOBIN HATCH	TULA	North Sound	9	9%	
VOIGHTS CR HATCHERY	WDFW	South Sound	6	6%	
MINTER HATCHERY	WDFW	South Sound	5	5%	
ISSAQUAH HATCHERY	WDFW	Central Sound	5	5%	
CHAMBERS CR HATCHERY	WDFW	South Sound	5	5%	
HOODSPORT HATCHERY	WDFW	Hood Canal	4	4%	
GORST CR REARING PND	SUQ	Central Sound	4	4%	
GARRISON HATCHERY	WDFW	South Sound	4	4%	
WHITEHORSE POND	STIL	North Sound	2	2%	
TUMWATER FALLS HATCH	WDFW	South Sound	2	2%	
SAMISH HATCHERY	WDFW	North Sound	2	2%	2
PORTAGE BAY HATCHERY	UW	Central Sound	2	2%	
NISQUALLY HATCHERY	NISQ	South Sound	2	2%	2
ENDICOTT PD (SKOK.R)	WREG	Hood Canal	1	1%	
COUNTY LINE PONDS	WDFW	North Sound	1	1%	
SPRING CR NFH	FWS	Columbia Basin	1	1%	
H-CHILLIWACK R	CDFO	Canada	1	1%	1
H-CHEMAINUS R	CDFO	Canada	1	1%	
Total CWT's Recovered: 2005-06 Season			**101**	**100%**	**29**

Table 15. Summary of total observed (in-sample) coded-wire tag recoveries from Chinook salmon harvested during the Chinook selective fishery in Areas 8-1 and 8-2 from October 1, 2006 through April 30, 2007. Locations were defined based on river basin outlets; North Sound includes all sites in basins draining into Marine Areas 7, 8-1 and 8-2; South Sound includes all sites in basins draining into Marine Areas 11 and 13; Central Sound includes all sites in basins draining into Marine Areas 9 and 10; Hood Canal includes all sites in Area 12.

Rearing Hatchery	Release Agency	Location (Region)	#CWT's Recovered	% of Total	# of DIT's
GARRISON HATCHERY	WDFW	South Sound	17	16%	
WALLACE R HATCHERY	WDFW	North Sound	16	15%	3
MARBLEMOUNT HATCHERY	WDFW	North Sound	12	11%	7
HOODSPORT HATCHERY	WDFW	Hood Canal	12	11%	
VOIGHTS CR HATCHERY	WDFW	South Sound	6	6%	
MINTER HATCHERY	WDFW	South Sound	6	6%	
CHAMBERS CR HATCHERY	WDFW	South Sound	4	4%	
GORST CR REARING PND	SUQ	Central Sound	4	4%	
GROVERS CR HATCHERY	SUQ	Central Sound	4	4%	4
ENDICOTT PD (LLTK)	WDFW	Hood Canal	4	4%	
TUMWATER FALLS HATCH	WDFW	South Sound	4	4%	
ISSAQUAH HATCHERY	WDFW	Central Sound	4	4%	
NISQUALLY HATCHERY	NISQ	South Sound	4	4%	4
CLARKS CRK HATCHERY	PUYA	South Sound	3	3%	
WHITEHORSE POND	COOP	North Sound	2	2%	
GEORGE ADAMS HATCHRY	WDFW	Hood Canal	1	1%	1
SOOS CREEK HATCHERY	WDFW	Central Sound	1	1%	1
LAKEWOOD HATCHERY	WDFW	South Sound	1	1%	
BERNIE GOBIN HATCH	TULA	North Sound	1	1%	
ICY CR HATCHERY	WDFW	Central Sound	1	1%	
WHITE RIVER HATCHERY	MUCK	Central Sound	1	1%	
Total CWT's Recovered: 2006-07 Season			**108**	**100%**	**20**

Table 16. Observed number of double index tagged (DIT) Chinook kept by anglers, and the estimated mortality of unmarked double index tagged Chinook due to catch and release mortality, during the Chinook selective fishery in Marine Areas 8-1 and 8-2, from October 1, 2005 through April 30, 2006.

Hatchery	Brood Year	Observed DIT Tagged fish	Estimated Harvest of Marked DIT fish	Variance Estimated Harvest of Marked DIT fish	Lambda @ Release: Unmark/ Mark	Estimated Unmarked DIT fish Encountered	Estimated Mortality of Unmarked DIT fish	Variance Estimated Mortality Unmarked DIT fish	Standard Error Estimated Mortality Unmarked DIT fish
Grovers Creek Hatchery	2002	1	2.17	2.53	0.9797	2.12	0.21	0.02	0.16
	2003	10	28.89	84.39	0.9380	27.10	2.71	0.74	2.18
H-Chilliwack River Hatchery	2003	1	3.50	8.75	0.9422	3.30	0.33	0.08	0.28
Marblemount Hatchery	2002	10	37.68	274.19	1.0037	37.82	3.78	2.76	3.21
Nisqually Hatchery	2003	2	5.60	10.08	0.9852	5.52	0.55	0.10	0.44
Samish Hatchery	2002	1	1.50	0.75	1.0103	1.52	0.15	0.01	0.09
	2003	1	2.62	4.24	0.9849	2.58	0.26	0.04	0.20
Wallace River Hatchery	2002	1	2.88	5.39	1.0187	2.93	0.29	0.06	0.24
	2003	2	4.76	7.07	0.9847	4.69	0.47	0.07	0.36
TOTAL: 2005-06 Season		**29**	**89.60**	**397.39**		**87.58**	**8.76**	**3.87**	**7.15**

Table 17. Observed number of double index tagged (DIT) Chinook kept by anglers, and the estimated mortality of unmarked double index tagged Chinook due to catch and release mortality, during the Chinook selective fishery in Marine Areas 8-1 and 8-2, from October 1, 2006 through April 30, 2007.

Hatchery	Brood Year	Observed DIT Tagged fish	Estimated Harvest of Marked DIT fish	Variance Estimated Harvest of Marked DIT fish	Lambda @ Release: Unmark/Mark	Estimated Unmarked DIT fish Encountered	Estimated Mortality of Unmarked DIT fish	Variance Estimated Mortality Unmarked DIT fish	Standard Error Estimated Mortality Unmarked DIT fish
George Adams Hatchery	2003	1	2.24	2.76	0.9959	2.23	0.22	0.03	0.17
Grovers Creek Hatchery	2004	4	10.36	20.44	1.1291	11.70	1.17	0.26	0.91
Marblemount Hatchery	2003	2	6.74	17.70	1.0130	6.83	0.68	0.18	0.57
	2004	5	10.36	11.48	0.9848	10.20	1.02	0.11	0.73
Nisqually Hatchery	2003	1	3.50	8.77	0.9852	3.45	0.35	0.09	0.29
	2004	3	5.55	4.80	1.0114	5.61	0.56	0.05	0.38
Soos Creek Hatchery	2003	1	1.98	1.93	1.0017	1.98	0.20	0.02	0.14
Wallace River Hatchery	2003	1	4.70	17.37	0.9847	4.63	0.46	0.17	0.41
	2004	2	7.27	19.59	0.9957	7.23	0.72	0.19	0.62
TOTAL: 2006-07 Season		**20**	**52.70**	**104.85**		**53.87**	**5.39**	**1.10**	**4.22**

Angler Compliance and Enforcement Summary

For the two seasons that Areas 8-1 and 8-2 were under mark-selective rules for Chinook retention, overall angler compliance with regulations was considered to be high. This can be attributed in part to easy-to-understand regulations and the dockside education efforts provided by WDFW sampling staff. Dockside education efforts included informing anglers about fishery regulations and proper methods for handling and releasing fish; samplers offered anglers a "dehooker" and a pamphlet describing mark-selective fisheries, species and mark-status identification, and dehooker use.

Survey-based (i.e., dockside) estimates of angler compliance in Area 8-1 suggest that anglers closely followed regulations during this fishery. For the 2005-06 season, we estimated that anglers did not retain a single unmarked Chinook, yielding an unmarked retention error of 0% (0 unmarked [legal and sublegal] Chinook landed / 442 unmarked [legal and sublegal] Chinook encountered). In the 2006-07 season, we estimated that anglers retained only 13 unmarked Chinook out of 1,451 encountered, demonstrating a similarly low unmarked retention (0.87% or 13 retained / 1,451encountered unmarked Chinook). An examination of yearly enforcement reports compiled for the North of Falcon season-setting process corroborates sample-based estimates; overall compliance with salmon rules for Area 8-1 was 95.7% for 2005 and 97% for 2006 and there were no citations issued for possession of wild Chinook.

Angler compliance in Area 8-2 while under mark selective rules was similarly high. For the 2005-06 season, we estimated that anglers retained 40 unmarked Chinook, yielding an unmarked retention error of 5.2% (40 retained / 770 encountered). In the 2006-07 season anglers retained half as many unmarked Chinook as in 2005-06, even though they encountered over twice as many unmarked fish (21 retained / 2,036 encountered or 1%). Additionally, yearly enforcement reports compiled for the North of Falcon season-setting process illustrate that overall compliance with salmon rules for Area 8-2 was 86.6% during 2005 and 90% for 2006. Two arrests were made for possession of wild Chinook and one for over-limit (salmon) possession in 2006; no arrests were made for sub-legal retention.

Though neither creel sampling nor enforcement reports are expected to provide unbiased estimates of actual angler compliance, these results suggest that anglers closely followed the mark-selective regulations that were instituted in Areas 8-1 and 8-2 during their first two pilot seasons.

SECTION I SUMMARY AND DISCUSSION

Based on two years of experience with implementing and intensively monitoring the pilot Areas 8-1 and 8-2 mark-selective blackmouth fisheries, we note and conclude the following:

- Estimates of monthly and season-total fishing effort, CPUE, and total Chinook landings were quite similar for the first two seasons of the pilot Areas 8-1 and 8-2 fisheries; additionally, the distribution of catch and effort over the two Marine Areas was virtually identical for both seasons (i.e., 2/3 in Area 8-2, 1/3 in Area 8-1). Thus, in terms of angler behavior and Chinook harvest, we preliminarily conclude that the Areas 8-1 and 8-2 fisheries are relatively stable. When data from the third pilot season (2007-08) become available we will further evaluate this conclusion.

- The first two pilot seasons differed considerably in total estimated impacts, with 06-07 resulting in an estimated 2-3 times more mortality (all size/mark-status groups) than 05-06. Given that impacts on legal-sized (marked and unmarked) were Chinook comparable for the two seasons, the observed increase was primarily due to increased sublegal (marked and unmarked) Chinook encounters. For this reason, the higher degree of capture-and-release impact estimated for the second season cannot be directly attributed to mark-selective harvest regulations *per se*.

- The combined Areas 8-1 and 8-2 selective fishery generally operated at or below expected level of impact. Estimated total encounters and mortalities were less than (05-06) or similar to (06-07) values predicted by FRAM during the pre-season planning process. See Question 4 in Section II for a more detailed evaluation of FRAM vs. creel comparisons in the context of the Areas 8-1 and 8-2 selective fisheries.

- The impacts of the Areas 8-1 and 8-2 selective fisheries on the coast-wide CWT program—assessed in terms of estimated capture-and-release mortalities inflicted upon unmarked-DIT Chinook encountered—were minor to nonexistent for both seasons. Based on recovered CWTs and using the unmarked-to-marked ratio at the time of release, a estimated total of 9 and 5 unmarked-DIT Chinook mortalities occurred as a result of the first and second 8-1/8-2 seasons, respectively; relative to total tagged releases for the unmarked-DIT groups encountered (i.e., no adjustments were made for natural or fishery-related mortality), these values are equivalent to exploitation rates that are less than 0.001%.

- In both areas, estimated Chinook salmon mark rates (overall and for legal-size fish only; based on test-fishery data) were high relative to what is deemed acceptable for implementing successful mark-selective fisheries. Mark-rates for legal-sized Chinook estimated through test fishing averaged 67% across the 28 area-months that were open to selective fishing. Overall mark rates were similarly high.

- Dockside data and WDFW-Enforcement summary reports indicate that anglers closely followed mark-selective Chinook harvest regulations during both seasons of the pilot Areas 8-1 and 8-2 selective fisheries. Further, the modest increase in compliance that occurred between the two seasons suggests that education and outreach efforts helped raise awareness about the newly implemented regulations.

SECTION II: An Assessment of Selective Fishery Sampling and Analysis Methods

Section Overview

In Section I, we characterized the within- and between-year patterns of several parameters relevant to discussions about the behavior and impacts of mark-selective winter blackmouth fisheries in CRC Areas 8-1 and 8-2. To better understand the quality of existing data and to guide future work, here we attempt to answer four topical questions relevant to how the planning (i.e., FRAM modeling), sampling, and evaluation (i.e., data analysis) of these fisheries has ensued over the past two seasons:

1) Have the Areas 8-1 and 8-2 sampling programs performed at a level sufficient to characterize fishery impacts within acceptable bounds of precision?
2) Have the 8-1 and 8-2 test-boat anglers succeeded at emulating the private recreational fleet, in terms of fishing methods and Chinook encounters (i.e., size/mark-status composition)?
3) Which method [i.e., "Method 1" (creel-only based) or "Method 2" (creel-based landed catch expanded by test fishery proportions)] is most likely to yield the most accurate total Chinook encounter estimates?
4) How well has the Fishery Regulation Assessment Model (FRAM) performed in planning the combined Areas 8-1 and 8-2 selective Chinook fisheries?

Though each question is evaluated in its own (i.e., in a subsection, each with its own narrative and discussion), we revisit them all at the end of Section II to summarize our general findings and to make recommendations about where program changes are needed.

Question 1: Adequacy of the Areas 8-1 and 8-2 Selective Fishery Sampling Program

To understand and effectively manage mark-selective Chinook fisheries, WDFW has implemented rigorous sampling programs designed with a goal of collecting the data required to reliably characterize fishery impacts and characteristics. With two years of sampling experience in 8-1 and 8-2, it is appropriate to ask whether or not this goal has been achieved for these fisheries in particular. To get at this question, we: 1) characterized the intensity (i.e., how much?) of our 8-1 and 8-2 sampling efforts, 2) evaluated the adequacy of dockside and test fishery sampling programs relative to the specific sample-size objectives defined in the *Puget Sound Sampling Program Operating Plan for 2007-08* (hereafter referred to as the "Operating Plan"), and 3) described the relative precision of key quantities estimated through our efforts. Finally, we evaluated the effects of reduced sampling (i.e., test fishing, the program with the greatest impacts on fish populations) on the precision of season-wide estimates of two test-fishery parameters of importance.

First, where objectives exist, we compared the sample sizes and sample rates achieved in each area during the 2005-06 and 2006-07 seasons to those specified by the Operating Plan. The Operating Plan specifies the following objectives for *dockside sampling* in selective Chinook fisheries:

> *Objective 1*: "Sample size is set at 100 encounters per area…and month for Chinook."
> *Objective 2*: "At least 10% of the fishery will be sampled for coded wire tags, with a goal of 20% for any Chinook selective fishery."

In addition to comparing actual sample sizes and achieved sample rates to the objectives defined in the Operating Plan (1-2 above), we also quantified the relative precision of monthly and season-total catch and effort estimates. Specifically, we computed coefficients of variation (% CV = standard error / Estimate x 100) for total estimates of landed and released Chinook and completed angler trips.

For the *test-fishing* component of selective fishery monitoring, the Operating Plan specifies:

> *Objective 3*: "…the sampling goal is set at a minimum of 100 salmon encounters per stratum (management regime)."

where management regime is taken as an area–season combination (e.g., October-April in Area 8-1). Below, we report the season-total encounters in the test fishery relative to this objective and subsequently evaluate the potential for reduced test fishing given the data observed in the two areas over the past two seasons.

To date, sample-size objectives have not been specified for the *on-the-water boat survey* portion of our selective fishery-monitoring program. Thus, we refer the reader to WDFW (2007a and 2007b) for details on this aspect of our sampling program. In practice, however, we have aimed for a minimum of 4 surveys per month (2 weekend, 2 weekday) and have typically pooled across surveys in order to achieve a 100-boat minimum for size-measure estimation.

Dockside Sampling Adequacy

During the first two seasons of the 8-1 and 8-2 selective fisheries, we directly sampled 4,950 angling parties (i.e., boats returning to an access-site upon completing a fishing trip), yielding data on a total of 9,580 angler-trips and 11,223 Chinook encounters (927 retained, 10,296 released). There was consistency in the number of anglers and landed Chinook sampled in each area during the two seasons; however, larger sample sizes (fish and people) were always obtained in Area 8-2 compared to 8-1, and slightly larger angler sample sizes were achieved during 2006-07 compared to the prior season. In contrast to angler and landed-Chinook samples, the number of released Chinook encounters "sampled" (i.e., enumerated during interviews) differed markedly between the two seasons, with 2006-07 sample sizes being 6+ times greater than those acquired during 2005-06.

Table 18. Sample sizes for Chinook encounters assessed during dockside angler interviews during the 2005-06 and 2006-07 Areas 8-1/8-2 selective fisheries. The Operating-Plan objective is 100 encounters / month for each area.

			Harvested Chinook		Released Chinook				
Season	Area	Month	Marked	Unmark.	Marked	Unmark.	Unknown	All Encounters	Objective met?
2005-06	81	Oct	5	0	13	17	16	51	**no**
		Nov	8	0	6	16	6	36	**no**
		Dec	6	0	13	10	9	38	**no**
		Jan	14	0	14	11	17	56	**no**
		Feb	41	0	21	48	31	141	yes
		Mar	12	0	8	24	14	58	**no**
		Apr	9	0	9	12	10	40	**no**
	82	Oct	13	1	11	11	166	202	yes
		Nov	11	1	0	6	25	43	**no**
		Dec	32	3	12	27	53	127	yes
		Jan	54	1	37	79	57	228	yes
		Feb	89	4	69	83	117	362	yes
		Mar	41	3	30	48	56	178	yes
		Apr	54	4	20	46	54	178	yes
2006-07	81	Oct	12	1	155	75	288	531	yes
		Nov	4	0	32	7	41	84	**no**
		Dec	13	0	160	85	62	320	yes
		Jan	10	0	86	35	96	227	yes
		Feb	12	1	93	43	80	229	yes
		Mar	21	1	165	61	175	423	yes
		Apr	34	0	172	101	176	483	yes
	82	Oct	25	2	316	208	1094	1645	yes
		Nov	10	1	78	21	165	275	yes
		Dec	52	2	453	230	503	1240	yes
		Jan	85	2	378	160	492	1117	yes
		Feb	58	1	213	59	577	908	yes
		Mar	102	2	357	129	538	1128	yes
		Apr	68	2	207	82	516	875	yes

In terms of the sampling objectives defined for the dockside program in the Operating Plan (i.e., 1 and 2 above), we sampled Chinook encounters (retained and released) and fishing effort at a level commensurate with the stated goals, with a few exceptions (**Table 18**). First, we met or exceeded the dockside goal of sampling 100 encounters during most months for Area 8-2 in both seasons (6/7 and 7/7 months in 05-06 and 06-07 seasons) and in 8-1 during 2006-07 (6/7 months). In contrast, we failed to meet the 100-encounter dockside objective 6 of 7 months in Area 8-1 during the 2005-06 season, partially owing to a low number of encounters (e.g., monthly *totals* averaged 217; **Appendix E**).

Table 19. Areas 8-1 and 8-2 effort and catch sample rates. Depicted are samples (*n*), total estimates, and sample rates (i.e., *n* / Total estimate). The Operating Plan objective for landed Chinook category is 20%; bold-faced, underlined values are cases where the objective was not reached. No sample-rate objective is defined for effort.

			Boats			Anglers			Landed Chinook		
Season	**Area**	**Month**	***n***	**Total Estimate**	**Sample rate**	***n***	**Total Estimate**	**Sample rate**	***n***	**Total Estimate**	**Sample rate**
2005-06	8-1	Oct	69	637	10.8%	126	1,154	10.9%	**5**	**41**	**12.2%**
		Nov	42	200	21.0%	75	350	21.4%	**8**	**44**	**18.2%**
		Dec	45	236	19.1%	80	427	18.7%	**6**	**49**	**12.2%**
		Jan	42	185	22.7%	77	325	23.7%	14	43	32.6%
		Feb	124	347	35.7%	241	640	37.7%	41	109	37.6%
		Mar	85	411	20.7%	160	702	22.8%	12	35	34.3%
		Apr	65	187	34.8%	128	376	34.0%	9	21	42.9%
		Total	472	2,203	21.4%	887	3,974	22.3%	95	342	27.8%
	8-2	Oct	789	1,486	53.1%	1,587	2,911	54.5%	14	29	48.3%
		Nov	79	183	43.2%	148	338	43.8%	12	23	52.2%
		Dec	87	253	34.4%	159	465	34.2%	35	94	37.2%
		Jan	120	306	39.2%	231	575	40.2%	55	142	38.7%
		Feb	307	657	46.7%	601	1,280	47.0%	93	214	43.5%
		Mar	306	648	47.2%	590	1,274	46.3%	44	90	48.9%
		Apr	317	763	41.5%	604	1,486	40.6%	58	140	41.4%
		Total	2,005	4,296	46.7%	3,920	8,329	47.1%	311	732	42.5%
2006-07	8-1	Oct	92	444	20.7%	171	829	20.6%	13	54	23.9%
		Nov	26	110	23.6%	49	195	25.1%	4	13	31.2%
		Dec	49	174	28.2%	88	310	28.4%	13	54	24.3%
		Jan	43	182	23.6%	86	367	23.4%	10	22	45.3%
		Feb	39	226	17.3%	81	471	17.2%	13	29	45.1%
		Mar	115	322	35.7%	228	616	37.0%	22	78	28.2%
		Apr	136	337	40.4%	267	667	40.0%	34	78	43.5%
		Total	500	1,795	27.9%	970	3,455	28.1%	109	328	33.2%
	8-2	Oct	554	1,114	49.7%	1,070	2,128	50.3%	27	52	51.9%
		Nov	94	200	47.0%	181	384	47.1%	11	32	34.4%
		Dec	157	359	43.7%	276	632	43.7%	54	108	50.0%
		Jan	169	338	50.0%	325	649	50.1%	87	130	66.9%
		Feb	272	589	46.2%	528	1,118	47.2%	59	116	50.9%
		Mar	334	686	48.7%	663	1,334	49.7%	104	261	39.9%
		Apr	395	759	52.0%	770	1,490	51.7%	70	142	49.3%
		Total	1,975	4,045	48.8%	3,813	7,735	49.3%	412	841	49.0%

Relative to the sample-rate objectives defined for CWT sampling in selective Chinook fisheries, we met our target (i.e., 20% of all harvested Chinook; objective 2 above) in all but the first 3 months of Area 8-1 during 05-06 (**Table 19**). We were also successful at sampling completed fishing trips at a high rate, though no sampling objective was specified for this aspect of dockside sampling during selective fisheries. Effort (angler trips) was sampled at a rate that averaged 20-30% in Area 8-1 and nearly 50% in Area 8-2 during both years (**Table 19**).

Table 20. Estimates, standard errors, and coefficients of variation (CV = SE / Est. x 100) for effort and Chinook harvest and releases for the Areas 8-1 and 8-2 selective fisheries, 2005-06 and 2006-07.

			Effort (Angler Trips)			**Harvested Chinook**			**Released Chinook**		
Season	**Area**	**Month**	**Est.**	**SE**	**CV (%)**	**Est.**	**SE**	**CV (%)**	**Est.**	**SE**	**CV (%)**
2005-6	8-1	Oct	1154	306	27%	41	18	44%	335	74	22%
		Nov	350	49	14%	44	24	54%	100	33	33%
		Dec	427	96	23%	49	21	43%	169	43	26%
		Jan	327	68	21%	43	15	34%	140	30	21%
		Feb	640	110	17%	109	22	20%	238	47	20%
		Mar	702	199	28%	35	13	36%	134	29	22%
		Apr	376	57	15%	21	6	31%	64	18	28%
		Total	3976	406	10%	342	47	14%	1180	113	10%
	8-2	Oct	2940	256	9%	39	9	23%	450	59	13%
		Nov	353	58	16%	29	1	5%	75	12	16%
		Dec	501	66	13%	114	16	14%	284	58	21%
		Jan	586	58	10%	163	24	15%	457	81	18%
		Feb	1293	67	5%	217	24	11%	586	101	17%
		Mar	1285	87	7%	92	8	9%	324	54	17%
		Apr	1561	123	8%	156	15	9%	288	66	23%
		Total	8519	322	4%	810	42	5%	2464	177	7%
2005-6	8-1	Oct	829	133	16%	54	17	31%	2429	304	13%
		Nov	195	46	23%	13	5	42%	375	64	17%
		Dec	310	39	13%	54	12	23%	912	82	9%
		Jan	287	44	15%	22	7	34%	507	64	13%
		Feb	405	115	28%	29	8	28%	953	150	16%
		Mar	762	181	24%	78	10	13%	1598	192	12%
		Apr	667	90	13%	78	12	15%	1084	115	11%
		Total	3454	278	8%	328	29	9%	7857	424	5%
	8-2	Oct	2186	306	14%	67	4	6%	6702	306	5%
		Nov	392	100	26%	33	4	11%	1078	100	9%
		Dec	655	154	24%	123	5	4%	2469	154	6%
		Jan	655	133	20%	135	7	5%	1583	133	8%
		Feb	1121	202	18%	118	14	12%	1973	202	10%
		Mar	1334	250	19%	261	26	10%	2677	250	9%
		Apr	1505	145	10%	144	11	8%	1683	145	9%
		Total	7848	519	7%	882	33	4%	18166	519	3%

Given that we achieved both sample-size and sample-rate goals defined in the Operating Plan, we were also interested in assessing the precision of the estimates. With the exception of harvested Chinook in 8-1 during 05-06 (CV = 14%), CVs were typically $\leq$ 10% for seasonal

estimates of effort, landed Chinook, and released Chinook (**Table 20**). Monthly estimates were also precise with CVs for effort averaging 21% or less and for landed and release Chinook, 8-37% and 8-24%, respectively. Further, with the exception of rare classes (e.g., unmarked harvested), monthly and season-total estimates for harvested and released Chinook sub-classes were estimated with precision comparable to that described above (e.g., **Appendix A**).

In sum, we conclude that the dockside component of our monitoring program succeeded at achieving (or exceeding) Operating-Plan sampling objectives and delivering precise estimates of catch and effort. Additionally, the above review highlights our ability to adapt sampling efforts in response to experience (i.e., Area 8-1 during 2005-06); we made small changes to our Area 8-1 dockside sample frame between 2005-06 and 2006-07 (i.e., we dropped low-to-no-effort sites) that allowed us to collect larger sample sizes, achieve greater sample rates, and increase estimate precision. Ultimately, these observations suggest there may be future opportunities to run our dockside program more efficiently without compromising the quality of parameter estimates.

Test Fishery Sampling Adequacy

In addition to evaluating dockside efforts relative to Operating-Plan goals, we assessed the ability of our test-fishing program to meet specified objectives and to characterize the size/mark-status composition of the fishable pool of Chinook salmon with precision. For each area and season, we greatly exceeded the Operating Plan goal of 100 encounters per management regime, particularly during the high-encounter season of 2006-07 (**Table 21**). Though test-fishery sampling objectives were not specified on a monthly basis, test fishers were also capable of obtaining large sample sizes on this time step; monthly encounters (i.e., total Chinook encounters per month) averaged 64 (05-06 season) and 253 (06-07 season) in Area 8-1 and 42 (05-06 season) and 172 (06-07 season) in Area 8-2 (**Appendix E**). At the full-season level, test fishery efforts yielded sufficient encounters to estimate mark rates (for legal-sized Chinook) with a high degree of precision (e.g., CVs = 4-8%).

Given that test-fishery encounters have consistently exceeded Operating-Plan objectives and the potential for test fishing to negatively affect the fish populations of interest (i.e., due to handling-and-release mortality impacts; **Table 9, Section I**), we conducted additional "sampling adequacy" analyses for this aspect of our monitoring program. In particular, we used a re-sampling strategy to determine whether or not opportunities exist for scaling back test fishing without significantly compromising the precision of test-fishery-related parameter estimates. Thus, for each area-season combination, we created 1,000 re-sampled datasets from the observed test-fishing data [i.e., randomly drawn (without replacement) sample days, each of which was characterized by counts of encounters in the each four size/mark-status classes (legal-marked, legal-unmarked, sublegal-marked, sublegal-unmarked)] using 9 reduced-sampling levels (i.e., 10% reductions relative to a full-season's data). From each replicate dataset, we obtained point and variance estimates for two parameters that are important descriptors of selective Chinook fisheries: *i*) the legal-sized Chinook mark rate (i.e., legal-marked Chinook / total legal encounters) and *ii*) the proportion of all Chinook encountered that were legal-sized and marked (i.e., p_{LM}, which is used in encounters and mortalities estimation; **Appendix A**). We then examined plots of estimates and confidence bounds as a function of sample rates to gain a

perspective on precision levels we could have expected to achieve (over many possible realizations of the observed data) given that we had sampled at lower levels in the past.

Table 21. Test fishery Chinook encounters by management regime. For month and size/mark-status class-specific sample sizes, see **Appendix E**. The sample size objective for test fishing is 100 encounters per area–season combination or management regime.

Season	Area	Total Encounters	Objective met?
2005-06	8-1	450	yes
	8-2	297	yes
2006-07	8-1	1,774	yes
	8-2	1,206	yes

This re-sampling exercise of the Areas 8-1 and 8-2 test fishing data demonstrates that the variance around mark-rate and legal-marked proportion estimates decreases with increasing sampling intensity, but not at a constant rate (**Figures 19** and **20**). For both parameters and across all areas-season datasets, the sharpest variance reductions occurred between sample rates that were 10-40% of the full-sample level (i.e., based on 5 days per week for the duration of the fishery). Season-total mark-rate and legal-marked proportion confidence intervals changed minimally at sample rates beyond 50% of current levels. On a monthly time scale, this same conclusion also applies (**Figure 21**), but to a lesser degree. In combination, these results suggest that our test fishery may presently be "over-sampling" (i.e., in terms of variance reductions per cost) the fishable pool of Chinook in these two areas. Further, these results suggest that our test fishery could provide estimates with similar precision if it were scaled back to a limited extent. For example, one test boat fishing in both Areas 8-1 and 8-2 on a rotating basis could deliver a dataset of similar caliber to that achieved with two full-time boats fishing simultaneously in each area.

Conclusions and Recommendations

- Dockside sampling and test-fishery components of the Areas 8-1 and 8-2 selective fishery monitoring programs were successful at achieving agreed-to sampling objectives.
- Dockside sampling and test-fishing efforts yielded precise estimates of key fishery parameters.
- Sampling efficiencies should be pursued where possible (i.e., assuming they do not affect the integrity/reliability of estimates). For initial changes, we recommend the following:
    - For the fourth year of the Areas 8-1 and 8-2 selective Chinook fishery, conduct baseline sampling only and rely on Catch Record Card estimates, instead of conducting intensive creel survey estimates.
    - Share a test fishing vessel between Areas 8-1 and 8-2 to achieve cost savings and sampling efficiencies, and yet retain precision levels that are similar to the former sampling levels for mark rate and encounter rate estimates.

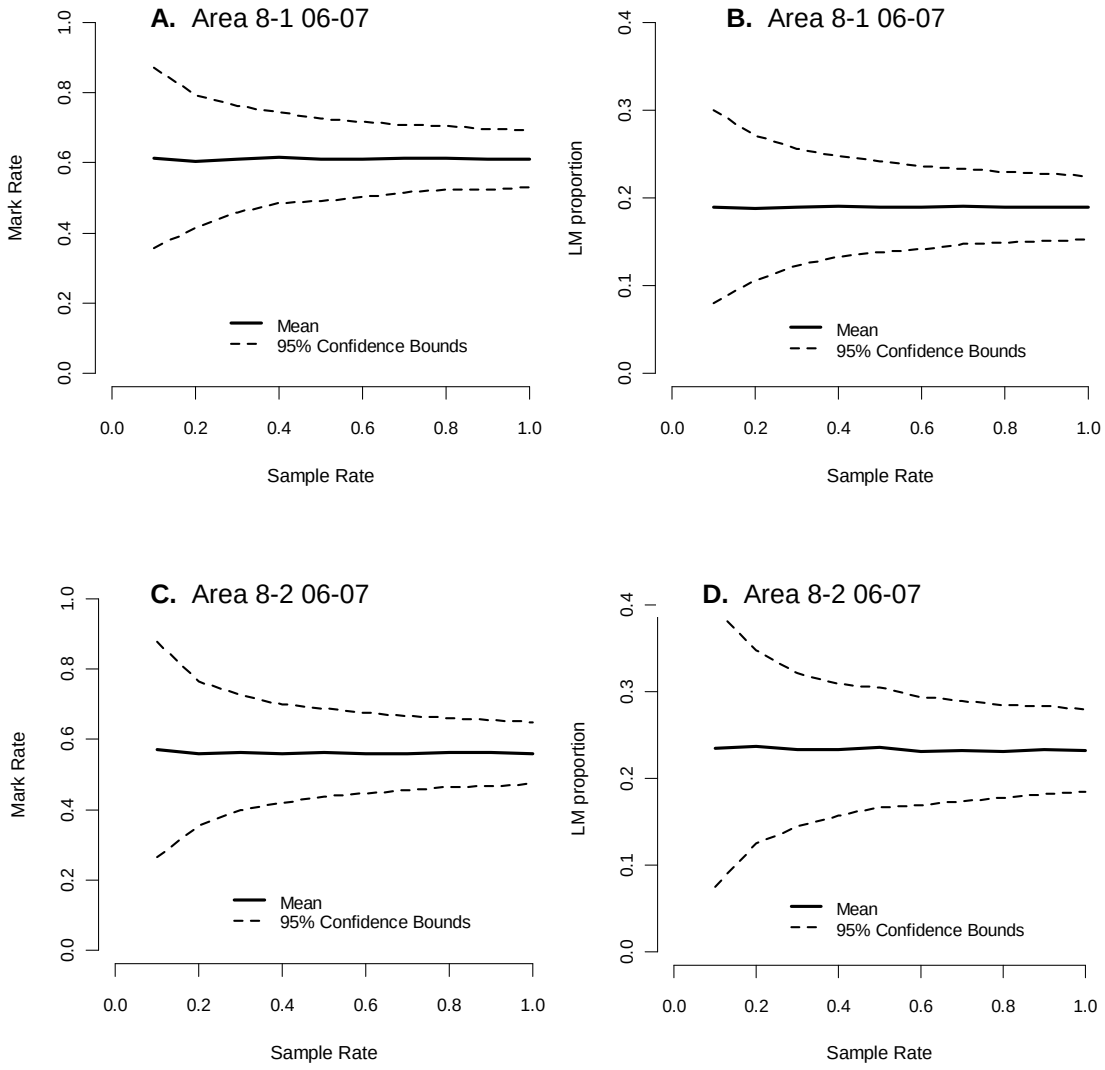
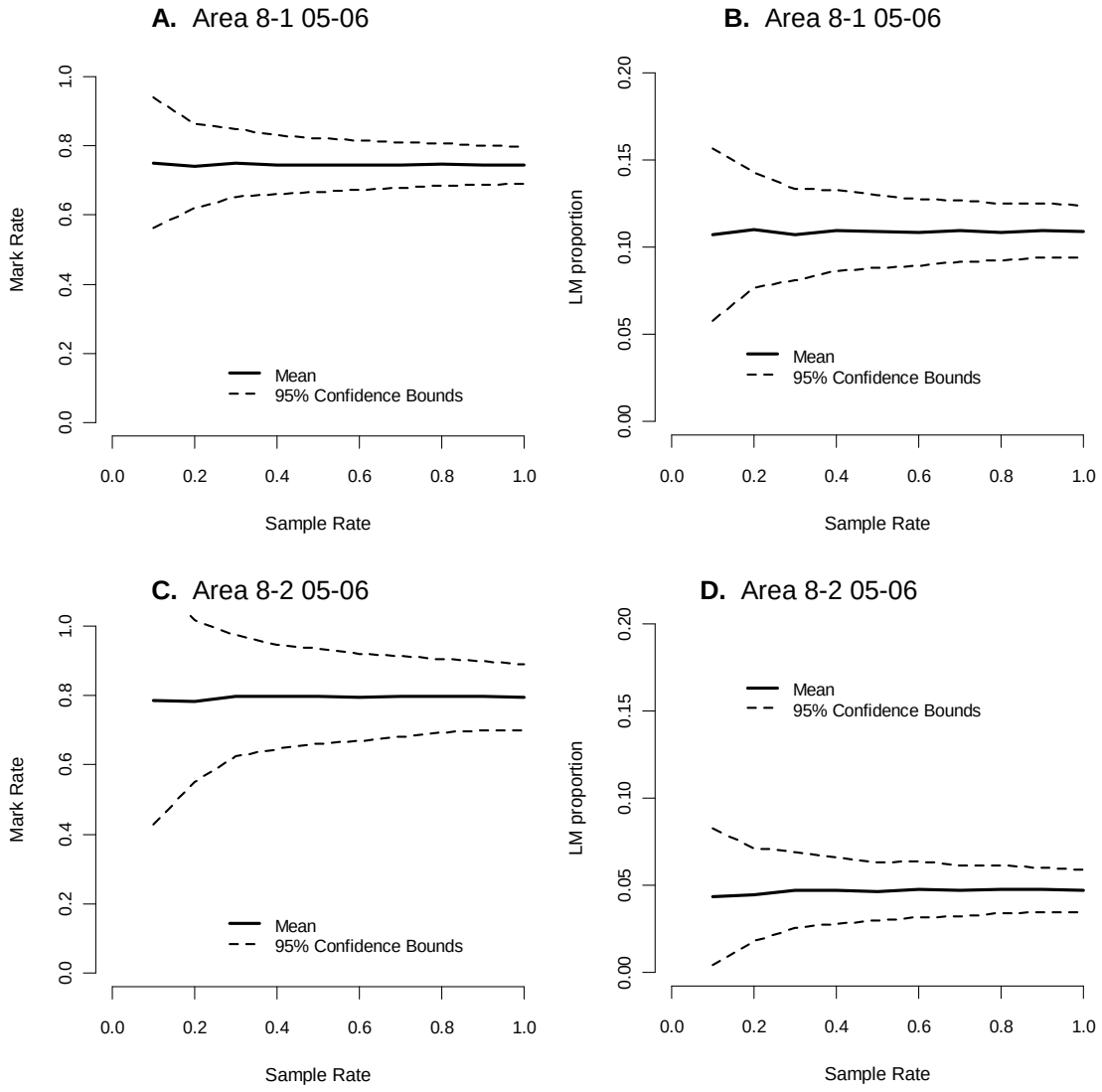


Figure 19. Effects of test-fishing reductions on 2005-06 point estimates and confidence bounds. Sample rate = 1 represents sampling at the current rate. Estimates are means obtained from n = 1,000 datasets created through re-sampling (without replacement) of the observed data; confidence bounds are based on the average variance of the 1,000 datasets. The upper and lower rows correspond to the Area 8-1 and 8-2 fisheries, respectively. LM proportion = LM encounters / total encounters; Mark Rate = legal-marked encounters / all legal encounters.



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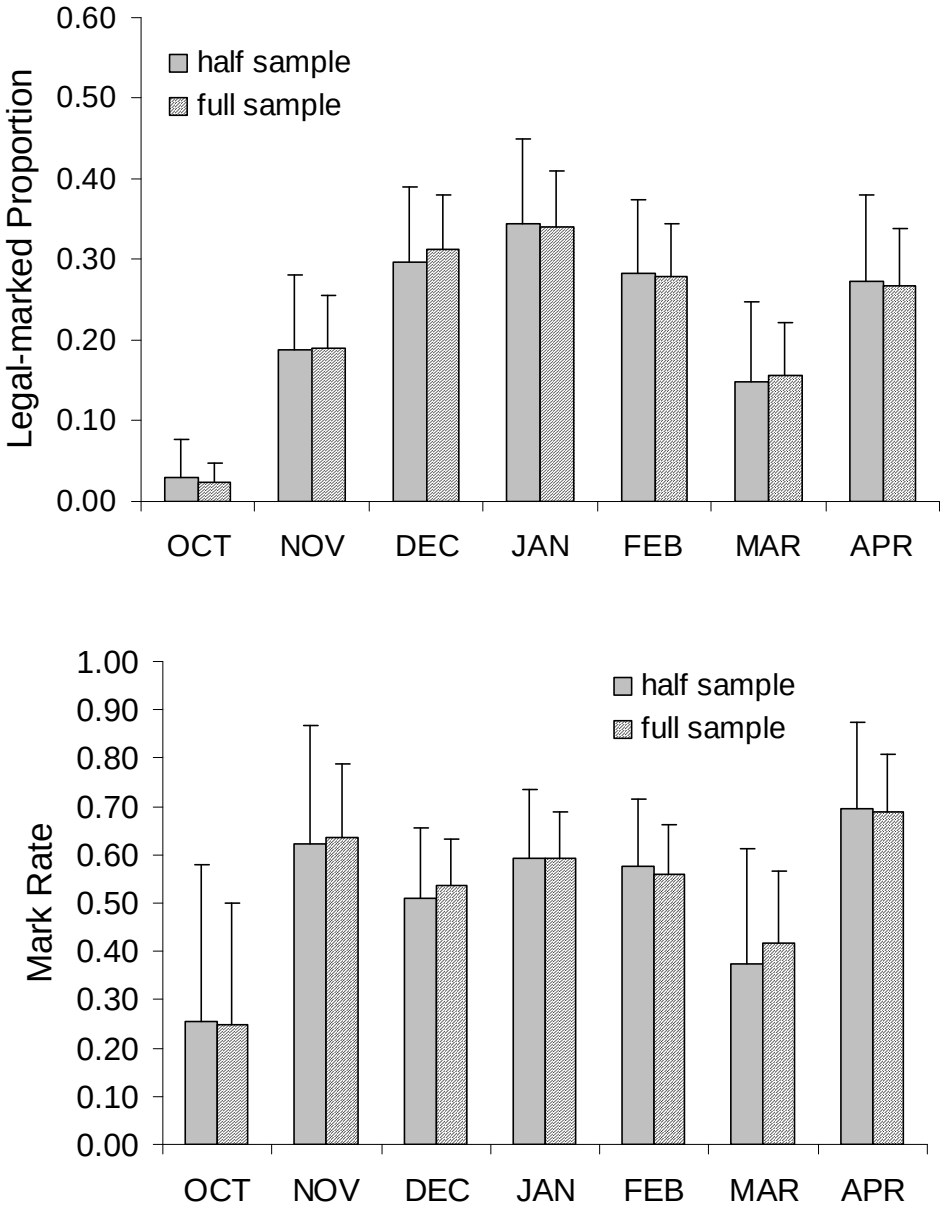

Figure 21. Effects of reduced sampling effort on *monthly* estimates of test-fishery parameters and their associated variability. Estimates are means obtained from n = 1,000 datasets created through re-sampling (without replacement) of the observed data; error bars represent standard errors based on the mean variance of the 1,000 datasets. LM proportion = LM encounters / total encounters; Mark Rate = legal-marked encounters / all legal encounters. LM proportion = LM encounters / total encounters; Mark Rate = legal-marked encounters / all legal encounters. The data displayed are for Area 8-2 in 2005-06, the worst-case (i.e., lowest sample-size) scenario of all area-season combinations considered.

Question 2: How well does the test fishery emulate the private recreational fleet?

The test-fishing component of the Areas 8-1 and 8-2 selective fisheries monitoring program supplies critical information used for fishery characterization (e.g., mark rates, size and age structure data, etc.) and total encounters (i.e., using the Method-2 approach, see the following section or Appendix A for details) and mortalities estimation. In using an experimental fishery to fulfill these data needs, we have by default assumed that the size/mark-status composition of test-fishery Chinook encounters approximates that experienced by the private recreational fleet (**Assumption 6**, **Appendix B**). Given its relevance to past and future post-season selective fishery evaluations, we assess the validity of this assumption here. First, we describe implementation measures taken to emulate the fishing behavior of the private fleet during test fishing. Second, using data from test fishing and creel sampling, we compare available parameters describing encounters composition between test-fishery and private-fleet datasets.

Emulating the Fleet: Implementation

In practice, implementing a recreational test fishery involves staffing boats with experienced anglers that are trained to fish like the subset of the private fleet that encounters Chinook salmon. If test-boat anglers are successful at fishing like (i.e., *where*, *when*, and *how*) the "average" Chinook salmon angler, they should theoretically acquire unbiased information about the pool of fish that was actually encountered by the private fleet in a particular fishery. Here, we provide a brief evaluation of past test-fishing efforts relative to this *de facto* operational goal.

Where to fish

As the Areas 8-1 and 8-2 fisheries are geographically small, there is a finite number of locations that provide ideal conditions for blackmouth angling. Thus, the bulk of angling effort is concentrated in a handful of well-known spots. For example, unpublished data from a series of instantaneous on-the-water effort counts (taken in Nov-Dec 2007) illustrates that 38% of 8-2 anglers fish at a single site known locally as the "Racetrack". However, fishing location choices are also dynamic; anglers move extensively between locations during individual trips in response to environmental conditions (e.g., weather and tides) and accounts from (or observations on) other boats. Given this complexity and the fact that test-boat anglers are both familiar with these fisheries and in communication with the angling community, they are given license to make location decisions with the requirement that they fish *with* the fleet. To evaluate the extent to which this pattern results in fleet emulation and to facilitate some in-season guidance on where more or less fishing is needed for it to occur, we have instituted (November 2007) an effort-mapping protocol for use during both test fishing and on-the-water boat surveys. Whether or not the *where* aspect of fleet emulation is perfectly achieved can only be speculated on until these data become available for analysis.

When to fish

Achieving the *when* part of a perfect emulation scenario poses problems that are beyond the tight control that is typical of other sampling programs. On weekly time scales, the majority of private-fleet effort occurs on weekends whereas that for the test fishery occurs on weekdays (for

both social and logistical reasons). As test-fishing data are aggregated across weeks before they are used in any particular analysis, such sub-weekly effort discrepancies are likely negligible. Of greater consequence, persistent weather and/or the availability of other fishing options (e.g., openings in adjacent CRC areas) causes seasonality in private-fleet angling patterns (e.g., the apparent November-December effort lull; See Section I: Description of the Fishery: Fishing Effort for details) whereas test-boat anglers attempt to fish 5 days a week from October-April. Across the two seasons and areas, this has resulted in some discrepancy between fleet and test-boat effort patterns (**Figure 22**); test fishers fish proportionally less in October and more from November-January than do private anglers. While these temporal discrepancies in effort can be accommodated analytically to minimize the potential for bias (e.g., weighting test-fishery parameters by monthly encounters), this illustrates that test fishers do not always fish *when* the private fleet does.

How to fish

To achieve the *how* part of the ideal test-fishing scenario, test-boat anglers are given weekly fishing-method prescriptions (e.g., 25 hours downrigger trolling, 5 hours weight-and-bait; See Section I: Dockside Interview Procedures, p. 8) that enable them to fish using the same methods in the same proportions as anglers reporting (i.e., during creel interviews) Chinook salmon encounters in the previous week. In Areas 8-1 and 8-2, this has consistently resulted in test fishers trolling (with downriggers) lures, bait, or combinations thereof for ~100% of their fishing time (See WDFW 2007a and 2007b for details). Thus, with the exception of imposing strict gear (i.e., tackle) prescriptions, the Areas 8-1 and 8-2 test fisheries are presently conducted in a manner that results in samplers fishing *how* the private fleet does.

Emulating the Fleet: Outcomes from Sampling

A second way to determine whether or not our test fishery adequately emulates the private fleet is to compare estimates for parameters that can be obtained from both angling groups. For this reason, we compared mark rates (i.e., total marked encounters / total encounters) for all Chinook encounters with a known mark-status between test-fishing and dockside datasets (i.e., based on observed landed and reported released Chinook). For legal-marked Chinook observed in dockside samples and encountered and released in the test fishery, we also compared size (total length) and age attributes. Three caveats inherent to this approach towards making inferences about the adequacy of the test fishery should be noted in advance. First, for mark-rate comparisons it is assumed that anglers accurately report information (number and mark-status) about released Chinook encounters (see the following subsection for a treatment of this issue). Second, for comparisons of legal-marked Chinook between test fishing and dockside programs to be meaningful, certain conditions must be met; under ideal circumstances, private anglers must accurately identify and retain all legal-marked Chinook. As characterized in the following subsection, both of these conditions are imperfectly met. Finally, a lack of difference between the test-fishery and fleet for observable encounter components (i.e., the harvest) may suggest but by no means guarantees similarity for unseen components.

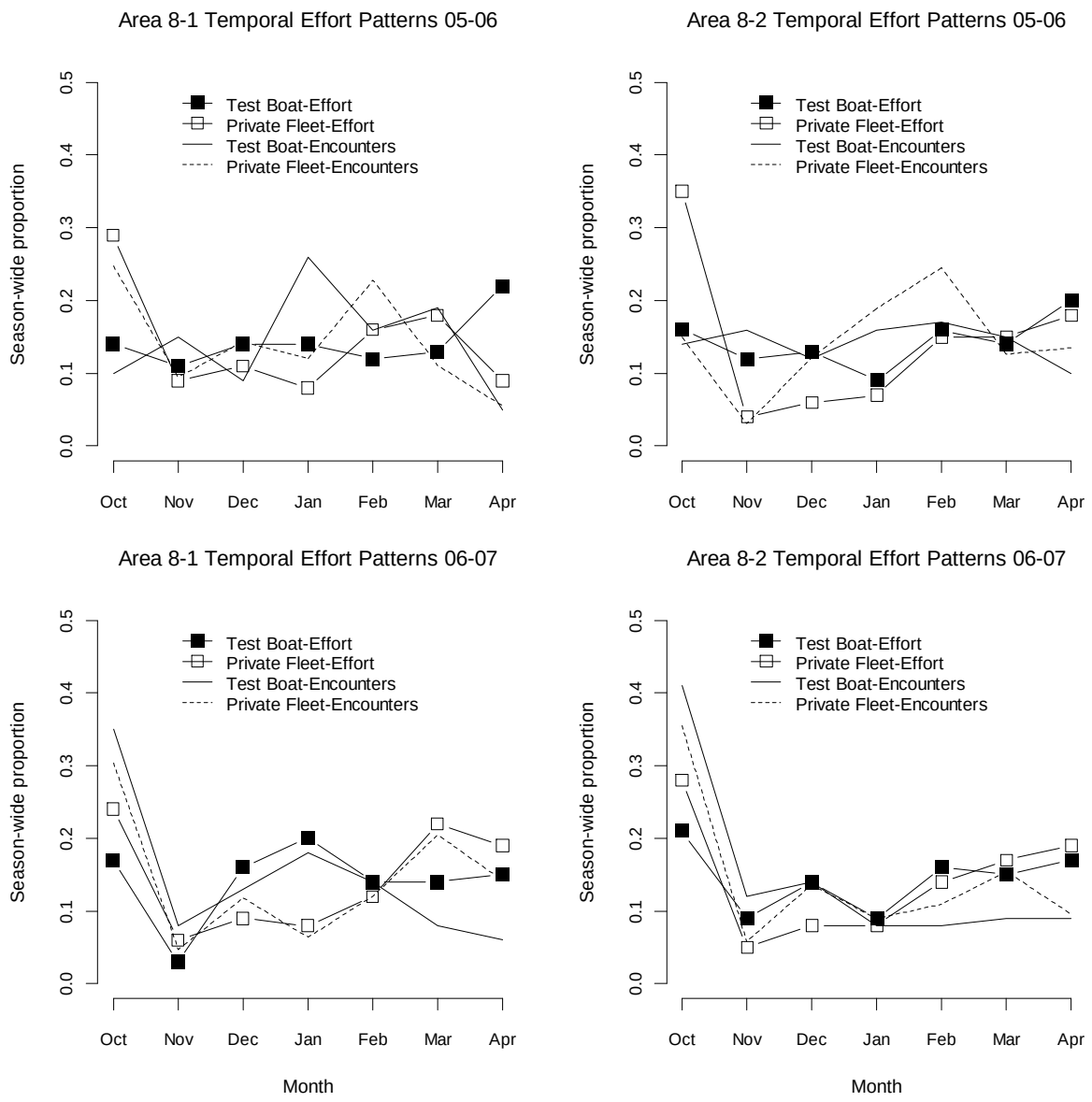

Figure 22. Seasonal patterns in private-fleet and test-boat angling effort and Chinook encounters for the Areas 8-1 and 8-2 fisheries. Values displayed reflect monthly proportions of season-wide totals for effort (as angler trips) and Chinook encounters.

Mark-rate comparisons

For known mark-status fish, test-fishery and dockside-based estimates of overall mark rates were virtually identical for both areas during 2005-06 (**Table 12, Section I**). In Area 8-1, the test-boat estimate of mark rate (0.58) did not differ significantly from that estimated from dockside interview data (0.56; $\chi^2 = 0.2$, $P = 0.682$); similar results were observed for Area 8-2 (test fishery = 0.62, dockside = 0.60; $\chi^2 = 0.2$, $P = 0.630$). In contrast, test fishery and creel estimates of mark rates differed for 2006-07 for both areas. In this season, the Areas 8-1 and 8-2 test-fishery mark rates were 0.65 and 0.67, respectively, which were slightly lower (by an absolute 5%) than their respective dockside estimates (8-1 dockside: 0.70, 8-2 dockside: 0.73); differences were

statistically significant in both cases (8-1: $\chi^2 = 8.8$, $P = 0.003$; 8-2: $\chi^2 = 13.4$, $P < 0.001$). One possible cause for differences being observed during 2006-07 but not 2005-06 is the difference in unknown mark-status Chinook proportions reported during interviews (06-07, 51% vs. 05-06, 36%). Additionally, as discussed in the following sub-section, we suspect that the released portion of Chinook encounters is reported with a positive recall bias that may have been more pervasive during the latter of the two seasons in question. Overall, however, these results illustrate that both private-fleet and test-fishery angling efforts have the potential to yield comparable mark-rate estimates.

Table 22. Total length (cm) summary statistics and statistical test results [i.e., *t*-tests comparing between data sources (Test Fishery vs. Dockside Sampling) within areas and seasons] for test-fishery and dockside legal-marked Chinook comparisons. Tests were conducted assuming unequal variance (i.e., using a Welch/Sattherwaite df approximation) and using $\log_e$-transformed total length values.

Season, Area, Source	*n*	Mean TL (cm)	Median TL (cm)	SD	*P*-value
2005-6, 8-1, dockside	147	67.5	66.5	8.3	0.007 *
2005-6, 8-1, test fish.	85	65.2	65.3	16.2	
2005-6, 8-2, dockside	408	66.0	65.0	6.9	0.009 *
2005-6, 8-2, test fish.	69	63.9	64.0	14.9	
2006-7, 8-1, dockside	142	67.5	65.3	10.0	0.010 *
2006-7, 8-1, test fish.	200	65.1	63.2	13.9	
2006-7, 8-2, dockside	413	62.5	60.2	6.8	0.215 (ns)
2006-7, 8-2, test fish.	60	64.1	61.1	10.9	

Legal-marked Chinook size comparisons

We separately compared mean sizes (log-transformed total length, TL, in cm, using *t*-tests) and length-frequency distributions (using Kolmogorov-Smirnov tests) between test-fishery legal-marked Chinook encounters and those retained by anglers that were inspected during dockside creel interviews for each area-season combination. Though length-frequency distributions appeared qualitatively similar (e.g., location of modes, shape, etc.; **Figure 23**), *t*-tests of mean $\log_e$-TL yielded significant differences for all test-fishery vs. dockside comparisons except for Area 8-2 in 2006-07 (**Table 22; Figure 23**). Overall, median test-fishery TLs (i.e., back-transformed mean $\log_e$-TL) were 1-2 cm smaller than those estimated from dockside samples. Non-parametric (K-S tests) comparisons of length-frequency distributions also yielded significant departures from the null case (i.e., identical distributions) for both years for Area 8-1 but neither year in Area 8-2 (**Figure 24**, test results provided in caption). Thus, there was evidence of a small but consistent size difference between legal-marked Chinook encounters seen in the test fishery and those retained by the private fleet and sampled at dockside. Possible causes for this pattern could be: *i*) the occurrence of intentional or unintentional release of small but legally harvestable Chinook by private anglers, *ii*) size-related gear biases in test-fishery relative to private-fleet encounters, or *iii*) spatial or temporal biases in fishing behavior that would lead to test fishers encountering smaller legal-marked Chinook at a higher frequency than private-fleet anglers. Given private-angler accounts of intentional legal-marked Chinook release (reviewed in the following subsection) and their higher likelihood of measurement error for fish

near the length limit (i.e., leading to unintentional legal-marked Chinook release), we suspect the first to be the most plausible explanation.

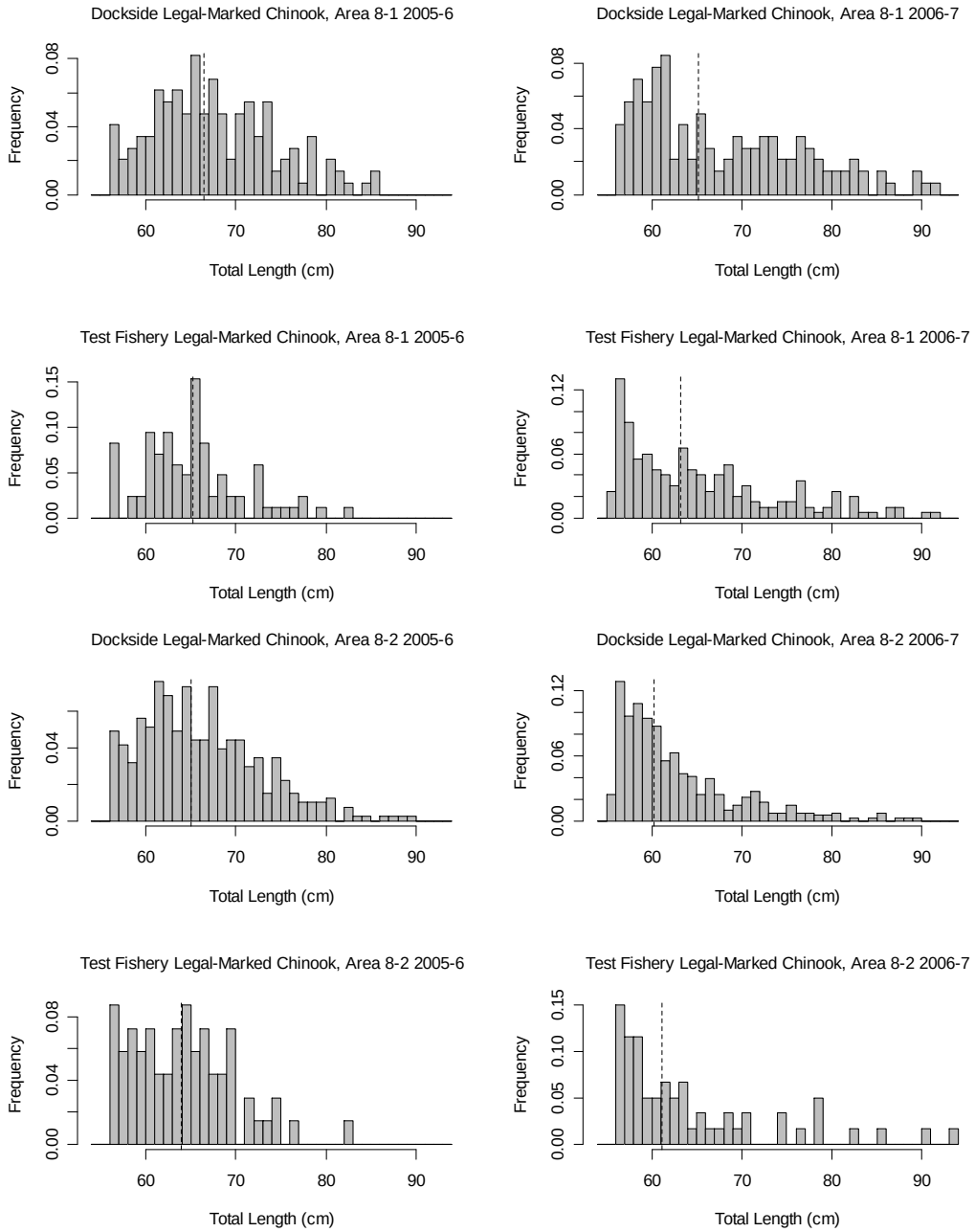

Figure 23. Length-frequency histograms for dockside (*1st and 3rd rows*) and test-fishery observations (*2nd and 4th rows*) of legal-marked Chinook salmon in Areas 8-1 (*upper half*) and 8-2 (*lower half*) during 2005-6 (*left column*) and 2006-7 (*right column*). Vertical lines represent medians of distributions (i.e., the mean of the log-transformed distribution).

Legal-marked Chinook age comparisons

Using χ^2 tests, we also compared the age composition of legal-marked Chinook observed at dockside and sampled in the test-fishery where possible (i.e., where scales were taken and could

be read). In three of four possible test fishery vs. fleet comparisons (i.e., 8-1 and 8-2, 05-06 and 06-07 seasons), there were no detectable differences in age composition (**Figure 25**, **Table 23**). For Area 8-1 in 2006-07, however, there was a significant ($\alpha = 0.05$) lack of homogeneity for the two groups. This was due entirely to there being higher- and lower-than-expected frequencies of age-2 individuals in test fishery (22%) and dockside samples (10%), respectively, than the null hypothesis of homogeneity predicted (post-hoc age-class specific comparisons: $\chi^2 = 7.6$, df = 1, $P = 0.006$); age-3 and age-4 frequencies were similar for both groups. Thus, based on age composition, it appears that both test-boat and private-fleet anglers encountered the same pool of Chinook salmon in similar proportions. Where differences were seen (Area 8-1 in 06-07), they were consistent with the legal-marked release issues outlined in length comparisons above and discussed in the following sub-section.

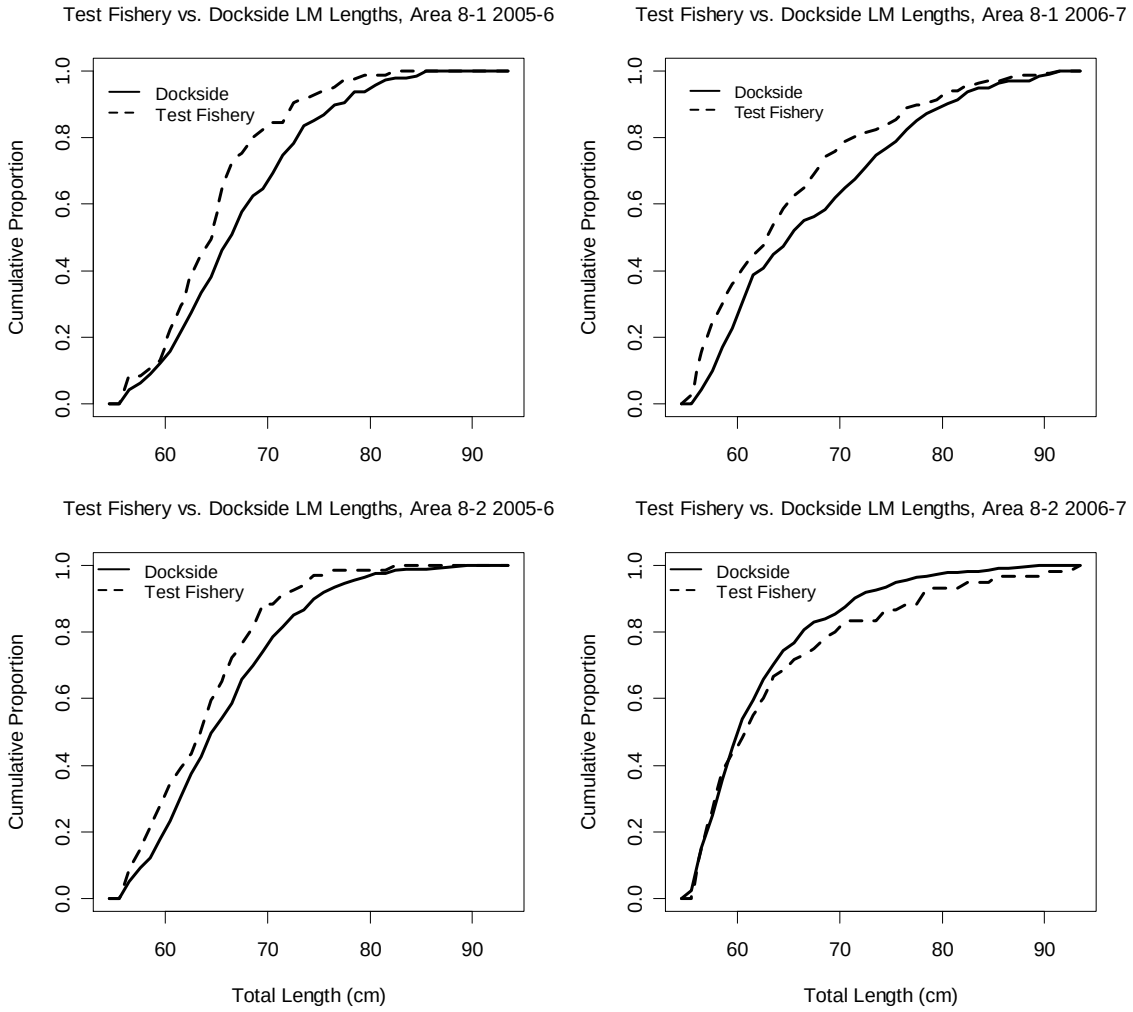

Figure 24. Cumulative distribution functions for total lengths (in cm) measured on legal-marked Chinook observed in dockside samples (*solid line*) and test fishery encounters (*dashed line*) during the Areas 8-1 (*upper row*) and 8-2 (*lower row*) 2005-6 (*left column*) and 2006-7 (*right column*) winter blackmouth seasons. Kolmogorov-Smirnov 2-sample test results indicate that distributions differed significantly ($\alpha = 0.05$) between test-fishery and dockside observations during both seasons in Area 8-1 (05-06: $D = 0.23$, $P = 0.007$; 06-07: $D = 0.16$, $P = 0.024$); distributions were similar for both seasons (05-06: $D = 0.15$, $P = 0.13$; 06-07: $D = 0.09$, $P = 0.74$) for Area 8-2. Note, sample sizes are the same as those reported in Table 20 for *t*-tests.

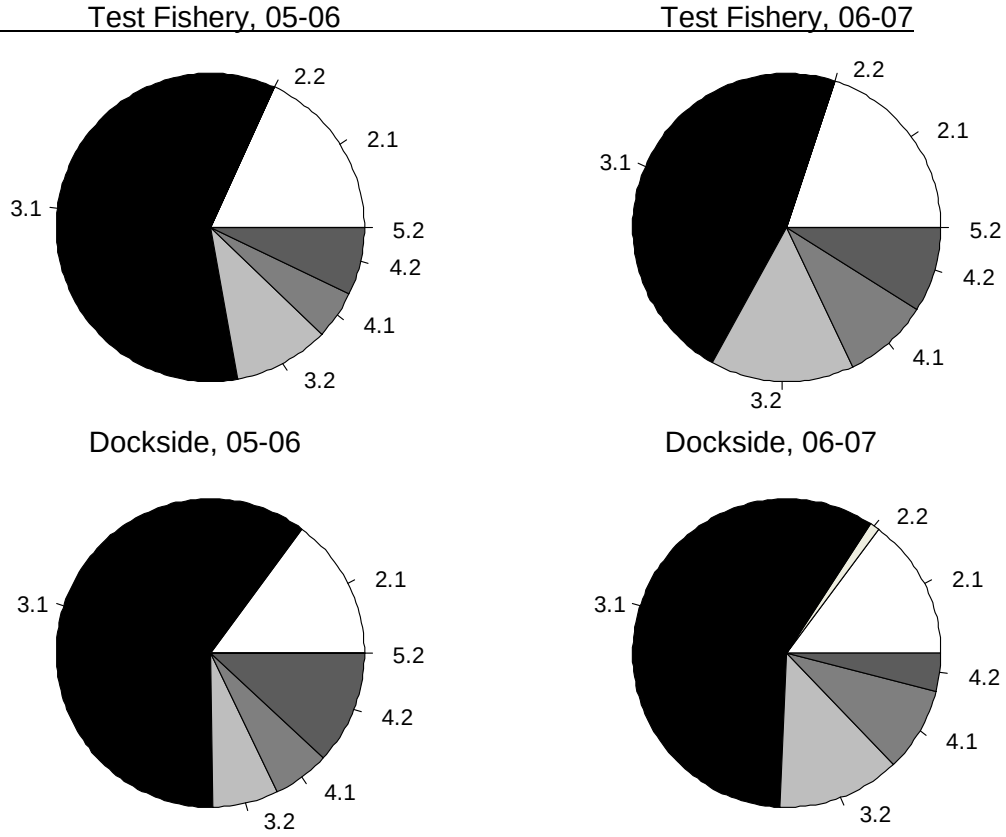

Figure 25. Pooled (Areas 8-1 and 8-2 combined) age composition data for legal-marked test fishery encounters and dockside legal-marked observations for the 05-06 and 06-07 seasons.

Table 23. Age (Gilbert-Rich) composition of dockside and test fishery legal-marked Chinook encounters.

			Count by age (proportion)									
Season	**Area**	**Sampling Method**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.2**	**df[a]**	**χ^2**	***P*-Value**
2005-06	8-1	Dockside	21	0	74	14	5	21	1			
			(0.15)	(0.00)	(0.54)	(0.10)	(0.04)	(0.15)	(0.01)	3	5.16	0.161 (ns)
		Test Fishery	15	0	51	7	3	4	0			
			(0.19)	(0.00)	(0.64)	(0.09)	(0.04)	(0.05)	(0.00)			
	8-2	Dockside	50	0	237	19	26	42	0			
			(0.13)	(0.00)	(0.63)	(0.05)	(0.07)	(0.11)	(0.00)	2	1.00	0.606 (ns)
		Test Fishery	12	0	36	8	4	7	0			
			(0.18)	(0.00)	(0.54)	(0.12)	(0.06)	(0.10)	(0.00)			
2006-07	8-1	Dockside	13	0	69	21	22	9	0			
			(0.10)	(0.00)	(0.51)	(0.16)	(0.16)	(0.07)	(0.00)	4	14.42	0.006**
		Test Fishery	38	1	78	25	14	20	0			
			(0.22)	(0.01)	(0.44)	(0.14)	(0.08)	(0.11)	(0.00)			
	8-2	Dockside	53	0	254	39	33	12	0			
			(0.14)	(0.00)	(0.65)	(0.10)	(0.08)	(0.03)	(0.00)	3	4.04	0.257 (ns)
		Test Fishery	9	0	30	10	6	1	0			
			(0.16)	(0.00)	(0.54)	(0.18)	(0.11)	(0.02)	(0.00)			

a. df differs across area-year tests because pooling was required in some cases (i.e., expected cell frequencies < 5).

Conclusions and Recommendations

Based on our evaluation of the reliability of test-fishing data for acquiring information about the pool of Chinook encountered and impacted by the private fleet, we conclude and recommend the following:

- Whether or not the Areas 8-1 and 8-2 test fisheries *perfectly* mimic the private fleet in terms of angling behavior and Chinook encounters remains equivocal. We characterized the ability of test-boat anglers to fish like the fleet and demonstrated similarity in some fishery parameters (i.e., mark rates and age composition) where contrasts were possible. However, we also found evidence of small but statistically significant size-related departures for the legal-marked component of test fishery and private-fleet (observed at dockside) encounters.
- Opportunities for improved and more efficient collection of test fishing data should be considered in the future. For example, as instituted in November 2007, spatial evaluations of test-fishery and private-fleet effort patterns should be pursued for both in-season guidance and post-season evaluation.
- Given that it is the most reliable (i.e., in terms of control over how data are collected, logged, etc.) dataset on Chinook encounters available and the lack of strong evidence suggesting otherwise, we recommend that the analytical assumptions associated with test fishery data be accepted at the present time. If discrepancies are detected in future analyses, appropriate measures should be taken to modify sampling and/or correct for biases.

Question 3: Which Method (1 or 2) Provides the Best Estimate of Chinook Encounters?

In previous post-season selective fishery reports (e.g., WDFW 2007a and 2007b) and in Section I of the present document, WDFW has noted that Method-1 (M1) and Method-2 (M2) estimates of total Chinook encounters (and quantities that are estimated from total encounters; see Appendix A for details) sometimes differ substantially. In particular, M1 estimates of Chinook releases (and associated mortality) have been on average 50% higher (range: 11% lower to 238% higher) than M2 estimates over the suite of selective seasons monitored to date (i.e., 2003-2007 in Areas 5 and 6, 2004-5 and 2006-7 in 8-1 and 8-2, and 2007 in Areas 9, 10, and 11; **Figure 26A** and **26B**). While M2 was originally added to the creel estimation process to provide a lower bound to encounters (i.e., because angler-reported releases were perceived as inaccurate at times), the simultaneous reporting of two estimates introduces ambiguity to the fishery-evaluation process. In particular, it can be difficult to draw precise, quantitative post-season conclusions about the success of fisheries relative to pre-season objectives (e.g., FRAM-predicted vs. observed impact comparisons) when multiple impact estimates are available for consideration.

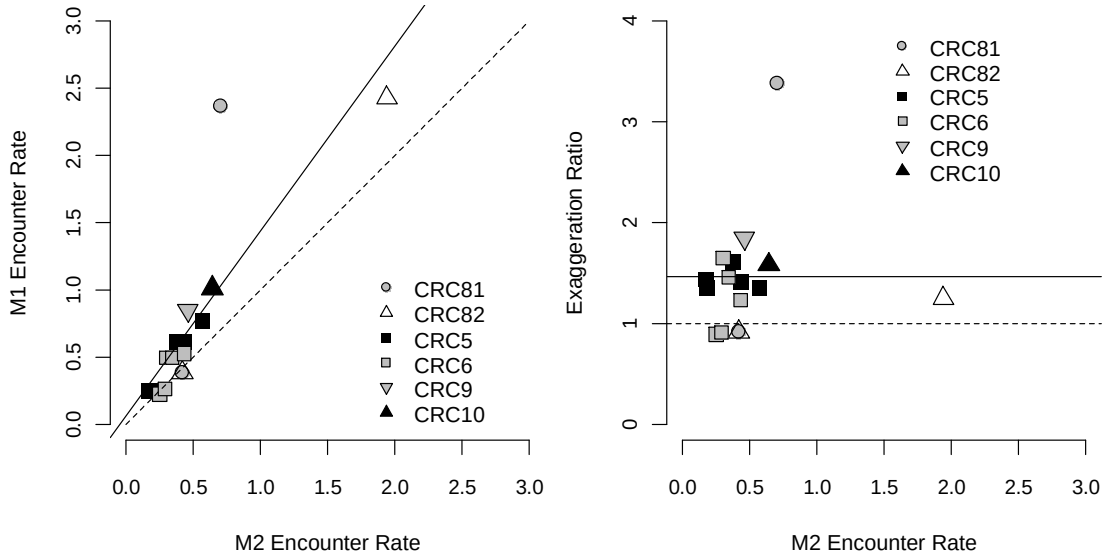

Figure 26. (**A**) (*left*) Season-wide Method-1 (M1) vs. Method-2 (M2) encounter rates (total encounters / total angler trips) for all Puget Sound/Strait of Juan de Fuca selective fisheries monitored using the Murthy design, 2003-2007. The dashed line reflects a 1:1 relationship; the solid line is the fitted relationship. (**B**) (*right*) The ratio of M1 to M2 total encounter estimates ("Exaggeration Ratio") as a function of M2 encounter rates for all selective fisheries (by catch record card, CRC, area) monitored using the Murthy design with test fishing, 2003-2007. The dashed horizontal line represents the line of estimator equality whereas the solid horizontal line reflects the overall mean for fisheries and seasons considered.

For these reasons and with the encouragement of tribal technical staff, we sought to resolve which estimation scheme (M1 and M2) is most appropriate for selective fishery evaluation. Our specific goal was to discern which approach is most likely to yield unbiased estimates of fishery impacts relative to actual (*unknown*) impacts. To do this, we evaluated: *i*) M1 and M2 estimators and their associated assumptions, *ii*) the sensitivity of estimators to assumption violations, and *iii*) the validity of assumptions based on indirect evaluations using empirical data. Based on these efforts, we propose and recommend alternatives for data collection and parameter estimation in selective Chinook fisheries monitored using our standard Murthy design.

M1 and M2 Estimators: Assumptions and Sensitivity Analysis

Though M1 and M2 estimators (and their variances) are detailed in Section I and Appendix A, we review them briefly here to set the stage for the present evaluation. M1 and M2 rely on the same information for the harvested Chinook component (dockside-based Murthy total estimates) but differ computationally and in terms of the data inputs needed for released Chinook (and therefore total encounters) estimation. M1 Chinook encounters (E_{TOT}) are obtained by summing dockside-based total estimates (N) of retained and released Chinook encounters for six estimation categories [subscripts: marked-kept (MK), unmarked-kept (UK), marked-released (MR), unmarked-released (UR), unknown mark status-released (unkR), and apportioned unidentified salmon (AUS)]:

$$E_{TOT} = N_{MK} + N_{UK} + N_{MR} + N_{UR} + N_{unkR} + N_{AUS} \quad (1)$$

Given its reliance on creel data, the validity of M1 release estimates (relative to M2) relies on the ability and/or willingness of anglers to accurately recall and report caught-and-released Chinook during the interview process (i.e., **Assumption 3** from Section I; see also Appendix B for a list of all assumptions).

Accepting the potential for Assumption-3 violation, M2 approaches encounters estimation by combining sampler observations on landed fish only (i.e., Murthy estimates for legal-marked Chinook in particular), assumptions about angler behavior (i.e., they harvest all legal-marked Chinook encountered), and auxiliary information (collected via test fishing) about the size/mark-status composition of the at-large "fishable" (i.e., vulnerable to encounter with hook-and-line angling gear) Chinook population. Expanding up by the proportion of legal-size and marked fish in the test fishery, M2 encounters are estimated as follows:

$$E_{TOT} = K_{LM} / p_{LM} \quad (2)$$

where K_{LM} is the dockside estimate of legal-marked Chinook retention (apportioned Murthy estimate based on size composition of dockside samples) and p_{LM} is the proportion of test-fishery encounters that were legal-sized and marked. Thus, the accuracy of M2 estimates is unaffected by the reliability of angler-reported releases and instead depends on whether or not anglers report all legal-marked Chinook encountered (**Assumption 5**, Appendix B) and the extent to which the size/mark-status composition of test-fishery encounters mirrors that seen by private anglers (**Assumption 6**, Appendix B).

To understand which estimator (M1 or M2) is most appropriate for estimating total encounters in selective Chinook fisheries with accuracy, we considered the sensitivity of the estimators to departures from Assumptions 3, 5, and 6.

We evaluated bias in total encounter estimates ($E_{TOT\text{-}est}$) generated by M1 and M2 estimators under known harvest, release, and size/mark-status (p_{LM} in particular) conditions given a range of proportional departures from assumptions 3, 5, and 6 independently. We considered an "average" case where 3,500 Chinook were encountered in total ($E_{TOT\text{-}true}$) of which 10% were legal in size and marked ($p_{LM\text{-}true}$) and thus available for harvest (i.e., $E_{LM\text{-}true}$ = 350; this analysis

assumes only LM Chinook are harvested). The sensitivity [assessed in terms of relative bias, i.e., *Relative Bias* = ($E_{TOT\text{-}est}$ - $E_{TOT\text{-}true}$) / $E_{TOT\text{-}true}$] of the M1 estimator to departures from Assumption 3 (i.e., accurate release reporting occurs) was assessed using the encounters estimates:

(3) $E_{TOT\text{-}est} = N_K + N_R*D$, and
$E_{TOT\text{-}true} = N_K + N_R$,

where N_R*D is the release value estimated through sampling and D is the modeled departure between reality and assumptions (i.e., D = reported / true, or in the case of Assumption 3 the misreporting rate for released fish); D was assessed from 0.05 to 1.95 [i.e., +/- 95% deviations from Assumption 3 being perfectly met (D = 1)]. N_K (the number of fish kept) was assumed to be 350 (all legal-marked fish were harvested) and N_R (the number of fish released) was taken as the remainder (3,150 fish).

The sensitivity (~*Relative Bias*) of M2 estimates to Assumptions 5 (all legal-marked Chinook are retained) and 6 (test fishery and fleet encounters are the same) departures was similarly quantified. However, for assumption 5, $E_{TOT\text{-}est}$ and $E_{TOT\text{-}true}$ were estimated as:

(4) $E_{TOT\text{-}est} = [E_{LM\text{-}true}*(1–D)] / p_{LM\text{-}true}$
$E_{TOT\text{-}true} = E_{LM\text{-}true} / p_{LM\text{-}true}$,

where the quantity $E_{LM\text{-}true}*(1–D)$ is what is observed through dockside sampling and D represents the legal-marked release rate, which was evaluated for a range of 0-0.95 (i.e., it is bound to the range 0 and 1). For Assumption-6 sensitivity, $E_{TOT\text{-}est}$ and $E_{TOT\text{-}true}$ were estimated as:

(5) $E_{TOT\text{-}est} = E_{LM\text{-}true} / (p_{LM\text{-}true}*D)$
$E_{TOT\text{-}true} = E_{LM\text{-}true} / p_{LM\text{-}true}$,

where $p_{LM\text{-}true}*D$ yields the value that is observed in test fishery samples and D is the degree of departure between true test fishery legal-marked and fleet legal-marked encounters (D values from 0.05 to 1.95 were assessed).

Based on this cursory sensitivity analysis, four issues about the effects of assumption violations on M1 and M2 estimates became apparent. First, for Assumptions 3 and 5, discrepancies of similar magnitude affect the accuracy of estimates to a similar extent (on an ~1:1 basis; **Figure 27**). Incremental under- and over-reporting of actual releases (i.e., Assumption 3) leads to proportional negative and positive biases in M1 estimates; the relative bias in M2 estimates varies inversely and proportionally with the rate at which legal-marked Chinook encounters are released by anglers (i.e., Assumption 5). Second, M2 bias varies non-linearly (via a hyperbolic function) with the degree of departure between test-fishery and fleet legal-marked encounters; thus, estimates are more (and positively) biased if test fishers have fewer legal-marked encounters than the private fleet than if the opposite scenario is true [e.g., a 20% discrepancy towards test-fishers having fewer legal-marked encounters leads to a 25% relative bias (overestimate) in encounters whereas the opposite (i.e., test fishers having more legal-marked encounters) yields only a 17% bias (underestimate)]. Third, although we did not evaluate

estimator sensitivity to simultaneous assumption violations, it is clear that M2 could yield accurate estimates of total encounters if both Assumption 5 and 6 are not well met. For example, compensation might occur if anglers released legal-marked Chinook encounters (leading to negative bias) and fewer legal-marked Chinook were caught by test fishers than private-fleet anglers (leading to positive bias). Finally, while estimators were equally sensitive to the three different assumption violations on average, departures in Assumption 6 (test-fishery assumption) yielded the maximum level of bias across all levels considered.

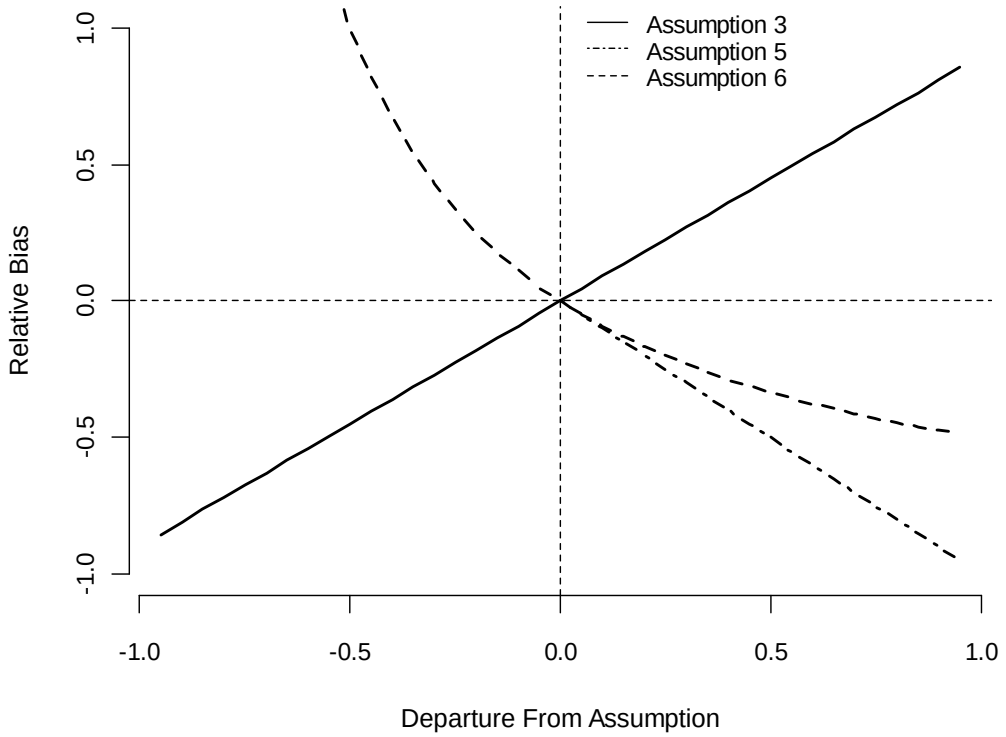

Figure 27. Relationship between relative bias in total encounter estimates [i.e., (estimate – actual) / actual] and assumption violations of proportionally varying degrees (*D*) for Assumptions 3 (anglers accurately report all released fish), 5 (anglers keep all legal-marked Chinook encountered), and 6 (the test fishery and fleet encounter Chinook in the same size/mark-status composition).

Evaluating the Validity of Estimator Assumptions

Assumption 3: Do anglers accurately report released salmon encounters?

To gauge the plausibility of Assumption 3, we conducted a brief literature review, considered patterns in empirical estimates, and inspected raw interview data (i.e., release–frequency distributions). From this, we concluded that Assumption 3 is unlikely to be perfectly met and that in general anglers probably over-report released encounters. While the rate at which anglers over-report released encounters is unknown, original 8-1/8-2 data and previous studies suggest that it could be anywhere between 20-200%.

In Washington (Noviello 1998) and elsewhere (e.g., NRC 2006; Bailey 2007), interview-based catch information (inclusive of harvested and released components) is generally accepted as being vulnerable to several forms of response error. Whether due to innate human tendencies towards recalling/reporting catch in prototype quantities (i.e., digit bias, where even numbered and multiples-of-five responses are favored; e.g., Beaman et al. 2005), intentional over-reporting of catch for status purposes (i.e., prestige bias), or other reasons, the misreporting of encounters occurs often and can significantly bias interview-based estimates of catch (Malvestuto 1996; Pollock et al. 1994). For example, in a comparison of angler-based and "true" total catch estimates for Alberta walleye fisheries, Sullivan (2003) found that anglers reported sublegal releases at a rate 2.2 times the release level which actually occurred. Applying Sullivan's methodology (i.e., he based "true" encounters on an M2-like estimator, i.e., with landed catch expanded by test-fishery proportions) to Washington's selective fisheries suggests an over-reporting rate of similar magnitude (i.e., M1 is 1.5 times M2 on average; **Figure 26B**).

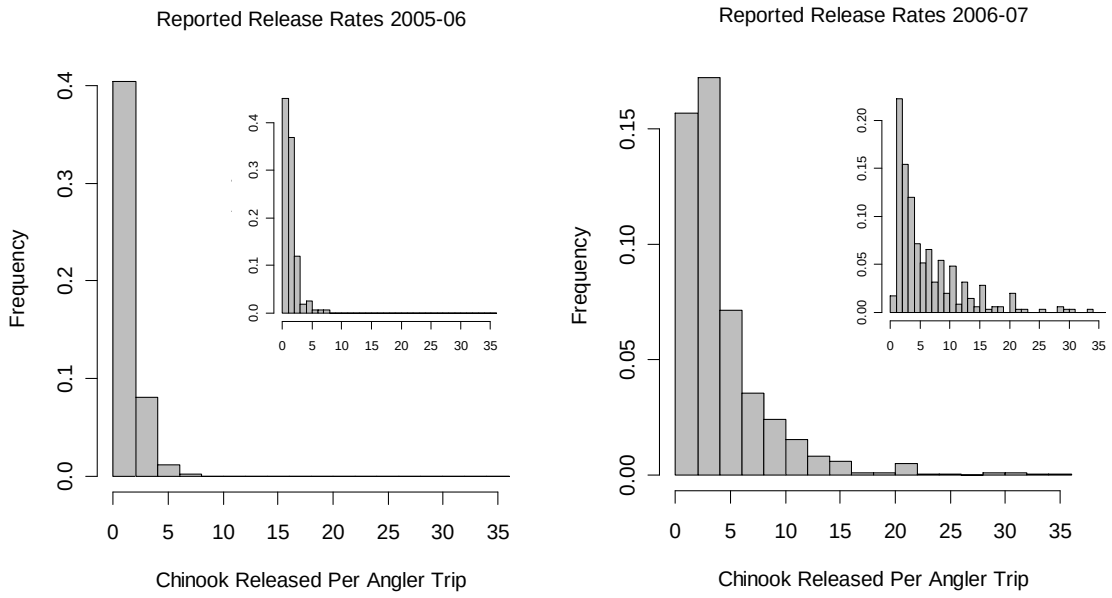

Figure 28. Histograms of reported Chinook releases from pooled 8-1 and 8-2 interviews, 2005-06. The plotted frequency is the proportion of all anglers interviewed reporting Chinook releases falling within a given interval. Samples sizes are n = 989 for 05-06 and n = 1,917 for 06-07. For perspective, in 05-06 97% of all anglers reported releasing from 1-4 Chinook; in 06-07, this same class constituted 66% of the distribution. One and 20% of all anglers included in the histograms above reported releasing 7 or more Chinook in 05-06 and 06-07, respectively. The insets depict frequency data for October, the month with the highest encounters in the fishery for both seasons.

Specific to marine recreational salmon fisheries, Noviello (1998) demonstrated that anglers do over-report the released component of their catch in some fisheries. In this study, the overall (i.e., across 7 season-area strata) angler-reported release proportion was +18% [range: -19% (Area 4 pink salmon) to +353% (Area 10 all salmon)] biased compared to the actual value documented via on-the-water observation methods. By inspecting release–frequency distributions, Noviello (1998) also showed that anglers tend to report releases in prototype quantities (e.g., 10, 12, 15, 20) and therefore suggested a role of digit bias in the over-reporting process. We observed similar reporting tendencies in the Areas 8-1 and 8-2 selective winter blackmouth fisheries; evidence suggesting digit bias was especially pronounced for high-

encounter periods (e.g., October in the 06-07 season; **Figure 28**). Although digit bias is likely the result of complex cognitive processes that are beyond the scope of selective fisheries monitoring, its presence can be an impediment to the accurate estimation of population parameters from interview data (Huttenlocher et al. 1990; Beaman et al. 2005).

In combination, these observations lead us to speculate that: *i*) anglers misreport actual releases by recalling/reporting in prototypical bins, *ii*) misreporting likely involves erring towards over-estimation, and *iii*) Assumption 3 is poorly met in some cases (e.g., during periods of high encounters).

Assumption 5: Do anglers keep all of the legal-marked Chinook they encounter?

Though the data needed to rigorously evaluate Assumption 5 are limited, available information suggests that it is likely violated but only to a minor extent. To arrive at this conclusion, we considered all available direct [empirical estimates of legal-marked release rates from voluntary trip reports, VTRs] and indirect evidence relating to its occurrence.
The availability of empirical data for evaluating the plausibility of Assumption 5 is limited for multiple reasons. Foremost, to discourage the over-handling of fish in protected size/mark-status classes (marked or unmarked), WDFW has historically avoided asking anglers about the size of released individuals; thus, legal-marked release rate estimates cannot be obtained for the private recreational fleet. Second, even if interviews included questions about the release of legal-marked fish, however, an unknown (and non-estimable) proportion of the legal-marked Chinook release that occurs in a fishery could be due to misidentification (i.e., mark-status determination, length measurement, or both). Third, VTRs – our only direct means for estimating legal-marked release rates in a fishery – are the result of a self-selected sample coming from a more skilled segment of the angling population (see Section I for justification); legal-marked release rates estimated from VTRs are therefore potentially biased (and most likely in the positive direction).

Table 24. Intentional legal-marked Chinook release rate estimates from voluntary trip reports (VTRs) for areas and seasons where private and/or charter anglers submitted VTRs summarizing adequate legal-marked (~10+) Chinook encounters (See **Table 9** in Section I for a complete tabulation of VTR data).

Season	Area	VTR source	Total LM	Kept LM	Released LM	L-M Rel. Rate
2005-06	8-1	Private Anglers	4	3	1	0.250[a]
	8-2	Private Anglers	17	16	1	0.059
	8-2	Charter Anglers	83	76	7	0.084
2006-07	8-1	Private Anglers	9	8	1	0.111
	8-2	Private Anglers	4	3	1	0.250[a]
	8-2	Charter Anglers	43	39	4	0.093
		Pooled	**160**	**145**	**15**	**0.094**

a. Due to the small number of LM encounters (n = 4) for this group of VTRs, by itself this estimate is considered unreliable.

Given appropriate caveats about the potential for bias in VTR-based samples, data collected and returned by private and charter anglers fishing in Areas 8-1 and 8-2 yield a legal-marked release rate estimate of approximately 6-11% (overall estimate, 9.4%) for the combination of seasons and areas (**Table 24**). We found VTR estimates of legal-marked release rates to be similarly low and consistent for season-area-source combinations where sufficient legal-marked encounters were reported. Further, though anglers did not specify their reasoning for releasing legally harvestable fish on VTRs, size differences between retained (median: 61.0 cm) and released (median: 58.4 cm) legal-marked Chinook groups suggest that size-related sorting may have been a motivation.

In addition to self-reported accounts of legal-marked Chinook releases supplied on VTRs, indirect evidence suggest that legal-marked release – intentional or otherwise – occurs for private anglers interviewed during dockside creel surveys. In particular, we found a modest size discrepancy whereby the average legal-marked Chinook *landed* by private-fleet anglers was on average 1 cm larger than what was *encountered* in the test fishery, despite similarities in estimates of Chinook age composition and mark rates derived for both groups (See previous subsection for details). These patterns could result from a combination of intentional (i.e., geared towards catching and retaining larger fish) and unintentional (i.e., due to measurement error at or near the length limit) legal-marked Chinook release at a low rate.

Overall, VTR observations and test-boat vs. fleet comparisons of legal-marked Chinook size suggest that Assumption 5 is unlikely to be perfectly met in the 8-1 and 8-2 fishery. However, VTRs provide starting point for adjusting M2 estimates so that they may more accurately reflect reality (i.e., by expanding legal-marked Chinook retention by ~10% prior to using this value in the M2 estimator). If a more defensible estimate of the private fleet legal-marked release rate could be obtained (e.g., based on reported intentional legal-marked release activity supplied during an interview, Assumption-3 issues notwithstanding), this could also be used in modifying future estimates.

Assumption 6: Is the size/mark-status composition of test fishery encounters the same as that seen by the private recreational fleet?

In the previous subsection of the present document, we addressed this assumption in detail both in terms of how test fishing proceeds in implementation (i.e., measures taken to help test-boat anglers emulate the fleet) and based on comparisons of parameter estimates that could be obtained from both the test-boat and the private-fleet datasets (i.e., overall mark rates and size/age composition for legal-marked Chinook). Though our evaluation did not provide uniform support indicating that that test-boat and private-fleet anglers are identical in their angling behavior and resultant Chinook encounters, findings suggest that this assumption is reasonably approximated. We refer the reader to the previous subsection for more on our treatment Assumption 6.

Conclusions and Recommendations

Though it is impossible to know with certainty the true number of Chinook salmon encountered in a particular fishery, the preceding considerations suggest that both Method 1 and Method 2 have the potential to yield biased estimates of this important fishery parameter. For this reason, it may be more productive to define the set of conditions under which one method is expected to yield better (i.e., less biased) estimates than the other and/or determine defensible means for adjusting for measurable biases when they occur. With this in mind, we offer the following conclusions and recommendations:

- With the existing sampling program and Methods 1 and 2 as starting points, WDFW and tribal co-managers should work towards a mutually agreeable encounters and mortalities estimation framework.
- The dockside interview process should be modified to quantify the extent of intentional legal-marked Chinook release activity for the entire recreational fleet. This assessment will yield additional insight on the utility of the Method-2 estimator and may provide a representative means for adjusting M2 estimates for release-related bias. A caveat to this approach is that it adds a new assumption to the M2 approach (i.e., that angler-reported legal-marked Chinook releases are accurate; as legal-marked Chinook release is a low frequency but memorable event, this may be of minor consequence).

Question 4: Comparing FRAM vs. Observed Estimates of Selective Fishery Parameters

In this section we evaluate how well FRAM predicted several key parameters used to model selective fisheries compared to creel survey-based estimates (hereafter referred to as "observed" values) of these parameters, over two seven-month seasons (2005-06 and 2006-07) of the Areas 8-1 and 8-2 selective Chinook fishery. These data parameters, which we evaluate specifically for Chinook, include: *i*) encounters by size (legal-size and sublegal-size) and mark status (marked and unmarked) and associated mortalities; *ii*) landed catch (i.e., Chinook that are kept); *iii*) unmarked retention error (legal unmarked kept/legal-unmarked encounters); *iv*) mark release error (legal-marked released/legal-marked encounters); *v*) unmarked sublegal retention error (sublegal unmarked kept/sublegal-unmarked encounters); and *vi*) marked sublegal retention error (sublegal marked kept/sublegal-marked encounters).

FRAM vs. Observed Encounters

For Areas 8-1 and 8-2 combined, FRAM estimated a total of 17,082 (4,395 marked and 12,687 unmarked) Chinook encounters for the 2005-06 season and 19,062 (9,621 marked and 9,441 unmarked) Chinook encounters for the 2006-07 season (**Table 25**). FRAM's prediction of total Chinook encounters during the 2005-06 season was more than three-fold higher than the creel survey estimate of 4,796 total Chinook encounters derived via Method 1 (i.e., estimated from creel surveys only) and also higher than the 5,271 Chinook encounters estimated via Method 2 (i.e., creel survey estimates of legal-marked retained Chinook expanded by test fishery proportions). For the 2006-07 season, the FRAM estimate of 19,062 total Chinook encounters fell within the range of total Chinook encounters estimated via Method 1 (27,233) and Method 2 (17,635).

Over both seasons, FRAM overestimated unmarked Chinook encounters when compared to the Method 1- and Method 2-based total estimates of unmarked Chinook encounters (**Figure 29**). For the 2005-06 season, FRAM overestimated marked Chinook encounters across all categories (legal, sublegal, and landed-only) compared to both Method 1 and Method 2 estimates. In contrast, FRAM underestimated marked Chinook encounters compared to both Method 1 and Method 2 estimates during the 2006-07 season, with the exception of the landed-only category (in which both Method 1- and Method 2-based estimates were slightly less than FRAM) and the legal-size marked category (Method 2-based estimates only were less than FRAM) (**Figure 29**).

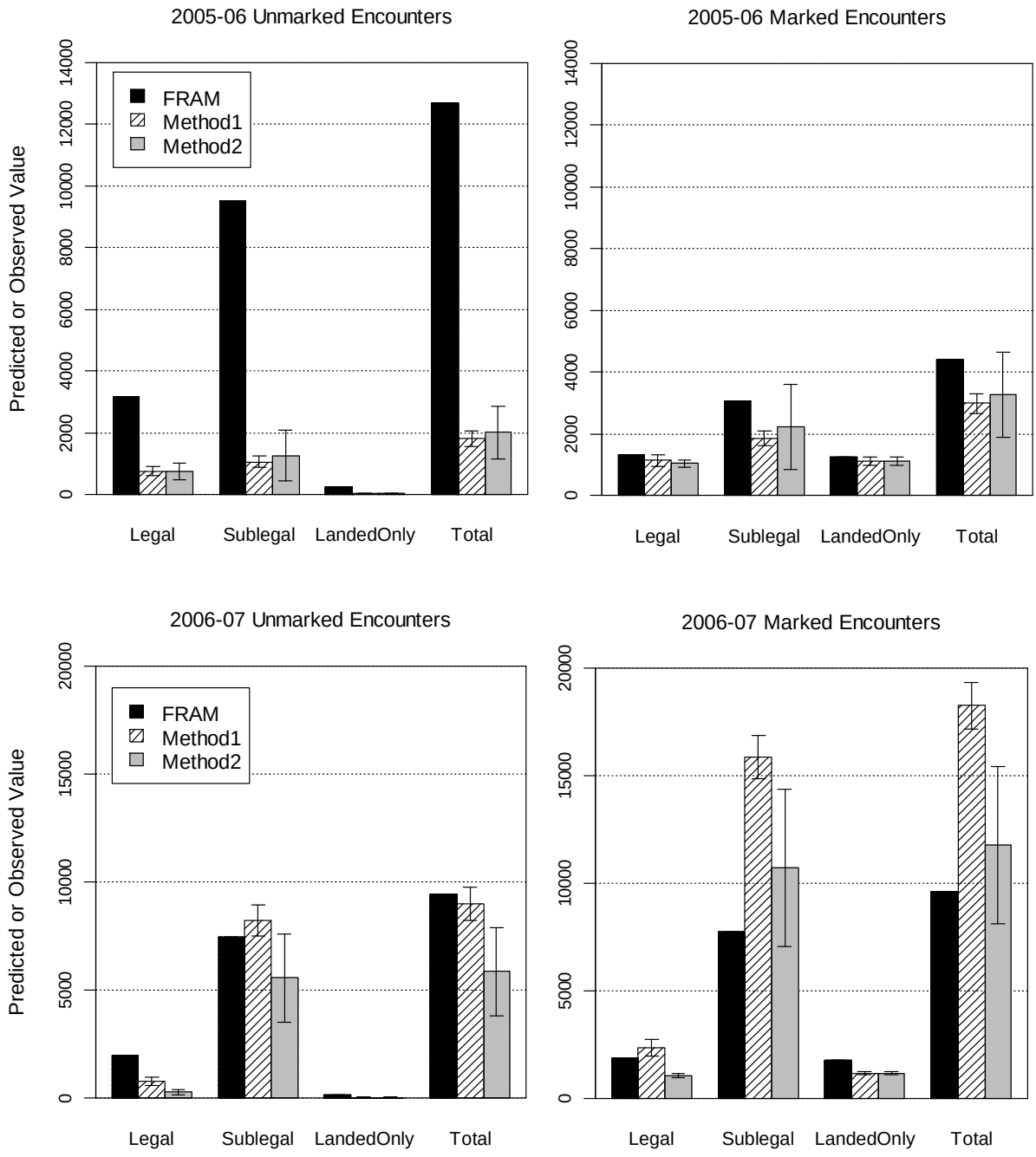

Figure 29. Modeled (FRAM) and estimated ['observed', i.e., estimated using Methods 1 (creel only) and 2 (creel legal-marked expanded by test fishery proportions)] unmarked (*left column*) and marked Chinook (*right column*) encounters due to the combined Areas 8-1 and 8-2 selective Chinook fisheries during 2005-06 (*upper row*) and 2006-07 (*lower row*). Error bars represent 95% confidence intervals around Method-1 and Method-2 estimates. FRAM predictions do not include confidence bounds.

FRAM vs. Observed Mortalities

The estimated mortalities associated with Method 1- and Method 2-based estimates of Chinook encounters are shown in **Table 13** (Section I) and are compared with FRAM predictions in **Tables 26** and **27**. Over both seasons, FRAM overestimated unmarked Chinook mortalities compared to the Method 1- and Method 2-based total estimates of unmarked Chinook mortalities. During the 2005-06 season, FRAM predicted 2,608 total unmarked mortalities (705 legal and 1,903 sublegal), over seven-fold higher than the Method 1-based estimate of 359 total unmarked mortalities (147 legal and 211 sublegal) and over six-fold higher than the Method 2-based estimate of 349 total unmarked mortalities (145 legal and 253 sublegal) (**Table 26** and **27**).

During the 2006-07 season, FRAM predicted 1,931 total unmarked mortalities (439 legal and 1,492 sublegal), which was slightly higher overall than the Method 1-based estimate of 1,787 total unmarked mortalities (138 legal and 1,649 sublegal), and also higher overall compared to the Method 2-based estimate of 1,184 total unmarked mortalities (61 legal and 1,123 sublegal) (**Table 26**). Thus, for the 2006-07 season FRAM overestimated legal- and sublegal-size unmarked mortalities compared to both Method 1 and Method 2-based creel estimates, with the one exception of Method 1-based estimates of sublegal-size unmarked mortalities. The total estimate of legal-size unmarked mortalities ranged from 14% to 31% of the modeled number (61 to 138 actual versus 439 modeled).

In the 2005-06 season, FRAM overestimated total marked Chinook mortalities (1,933 predicted) compared to both Method 1 (1,481) and Method 2 (1,542) estimates of marked mortalities. Similarly, during the 2006-07 season, FRAM slightly overestimated total marked Chinook mortalities (3,417 predicted; 1,868 legal and 1,549 sublegal) compared to Method 2 estimates (3,297 total; 1,059 legal and 2,239 sublegal). In contrast, FRAM underestimated marked Chinook mortalities compared to Method 1 estimates (4,524; 1,257 legal and 3,266 sublegal), and this difference was primarily due to FRAM underestimating the marked sublegal-size Chinook encounters and associated mortalities while overestimating the marked legal-size Chinook encounters and mortalities (**Table 27**).

Table 25. Modeled (FRAM) and estimated [i.e., using Methods 1 (creel only) and 2 (creel legal-marked expanded by test fishery proportions)] Chinook *encounters* due to the combined Areas 8-1 and 8-2 selective Chinook fisheries during the 2005-06 and 2006-07 seasons. 95% confidence bounds do not apply FRAM predictions.

		Unmarked Encounters			Marked Encounters			Total Encounters		
Season	**Size Class**	**FRAM**	**Method 1**	**Method 2**	**FRAM**	**Method 1**	**Method 2**	**FRAM**	**Method 1**	**Method 2**
2005-06	**Legal**	3,172	756	742	1,325	1,135	1,038	4497	1891	1780
	95% CI		596-917	480-1,005		946-1,323	916-1,160		1,643-2,139	1,491-2,069
	Sublegal	9,515	1,056	1,267	3,070	1,849	2,224	12585	2905	3491
	95% CI		873-1,240	456-2,079		1,607-2,091	854-3,594		2,602-3,209	1,899-5,083
	All	12,687	1,813	2,010	4,395	2,983	3,262	17082	4796	5271
	95% CI		1,569-2,057	1,157-2,862		2,676-3,290	1,886-4,637		4,404-5,188	3,653-6,890
2006-07	**Legal**	1,981	772	289	1,876	2,383	1,059	3857	3155	1347
	95% CI		569-975	165-412		1,996-2,770	975-1,142		2,718-3,592	1,198-1,496
	Sublegal	7,460	8,217	5,564	7,745	15,861	10,723	15205	24078	16287
	95% CI		7,491-8,942	3,522-7,607		14,860-16,862	7,075-14,371		22,842-25,314	12,106-20,468
	All	9,441	8,988	5,853	9,621	18,244	11,781	19062	27233	17635
	95% CI		8,235-9,742	3,807-7,899		17,171-19,317	8,132-15,430		25,921-28,544	13,451-21,818

Table 26. Modeled (FRAM) and estimated Chinook *harvest* (i.e., landed mortalities) due to the combined Areas 8-1 and 8-2 selective Chinook fisheries during the 2005-06 and 2006-07 seasons. *Note*: Method-1 and Method-2 landed catch estimates are identical. 95% confidence bounds do not apply FRAM predictions.

		Unmarked Landed		Marked Landed		Total Landed	
Season	Size Class	FRAM	Method 1 & Method 2	FRAM	Method 1 & Method 2	FRAM	Method 1 & Method 2
2005-06	Legal	254	40	1,245	1,038	1499	1078
	95% CI		26-54		916-1,160		955-1,200
	Sublegal	0	0	0	74	0	74
	95% CI		0-0		59-89		59-89
	All	254	40	1,245	1,112	1499	1152
	95% CI		26-54		989-1,235		1,028-1,276
2006-07	Legal	158	26	1,763	1,059	1921	1085
	95% CI		17-36		975-1,142		1,001-1,169
	Sublegal	0	7	0	118	0	125
	95% CI		2-12		102-133		115-150
	All	158	33	1,763	1,176	1921	1210
	95% CI		22-44		1,092-1,261		1,124-1,295

Table 27. Modeled (FRAM) and estimated [i.e., using Methods 1 (creel only) and 2 (creel legal-marked expanded by test fishery proportions)] Chinook *mortalities* (i.e., harvest + release mortality) due to the combined Areas 8-1 and 8-2 selective Chinook fisheries during the 2005-06 and 2006-07 seasons. 95% confidence bounds do not apply FRAM predictions.

		Unmarked Mortality			Marked Mortality			Total Mortality		
Season	**Size Class**	**FRAM**	**Method 1**	**Method 2**	**FRAM**	**Method 1**	**Method 2**	**FRAM**	**Method 1**	**Method 2**
2005-06	**Legal**	705	147	145	1,319	1,052	1,038	2,024	1,200	1,183
	95% CI		119-176	103-187		926-1,179	916-1,160		1,070-1,329	1,054-1,312
	Sublegal	1,903	211	253	614	429	504	2,517	640	758
	95% CI		175-248	91-416		378-480	230-779		578-703	439-1,076
	All	2,608	359	399	1,933	1,481	1,542	4,541	1,840	1,941
	95% CI		312-405	231-566		1,345-1,618	1,242-1,842		1,696-1,984	1,597-2,285
2006-07	**Legal**	439	138	61	1,868	1,257	1,059	2,307	1,396	1,119
	95% CI		106-170	40-82		1,155-1,360	975-1,142		1,288-1,503	1,033
	Sublegal	1,492	1,649	1,123	1,549	3,266	2,239	3,041	4,915	3,362
	95% CI		1,504-1,794	715-1,532		3,066-3,467	1,509-2,969		4,668-5,163	2,526-4,199
	All	1,931	1,787	1,184	3,417	4,523	3,298	5,348	6,311	4,481
	95% CI		1,638-1,936	775-1,593		4,298-4,749	2,563-4,032		6,041-6,581	3,641-5,322

Historical Variability of FRAM's Predictions of Encounters

To evaluate FRAM's ability to predict total Chinook encounters, the historical variability of this parameter was examined. Encounters (retained plus released) are not reported in the catch record card (CRC) estimates; thus, we computed historical estimates of Chinook encounters in Areas 8-1 and 8-2 by combining monthly CRC estimates of catch with ratios of released-to-retained Chinook obtained from angler surveys conducted during baseline sampling (see **Appendix H** for explanation of method). The average number of monthly Chinook encounters was computed via the above method for years from 1994 through 2005 for Areas 8-1 and 8-2 combined. Months that were closed or partially closed to Chinook fishing in any given year were excluded from the estimate. The average number of monthly encounters was summed over the October through April time period to obtain an encounter estimate for the entire season. In a final step, the variance was computed to obtain the 95% confidence interval. We used this CRC-based method to estimate Chinook encounters for the October through April period from 1994 through 2005, while creel survey-based estimates of encounters (Method 1 and Method 2) were used for the October through April period of the Areas 8-1 and 8-2 selective Chinook fishery during the 2005-06 and 2006-07 seasons.

FRAM estimates were lower than the average number of CRC-based estimates of encounters of 23,829 but well within the 95% confidence interval for average encounters (**Figure 30**). The creel estimates from the 2005-06 selective Chinook fishery were approximately five-fold lower than the average estimate of Chinook encounters, whereas the Method 1 and Method 2-based estimates of encounters during the 2006-07 season straddle the average.

Lower than average FRAM encounters could be due to chance, lower abundances, or to a problem with the way FRAM estimates encounters. The scalars are computed using landed catch under the assumption that all legal Chinook are landed. Releasing legal Chinook could lead to underestimating the number of encounters. However, reductions in angler effort would counteract this effect.

Overall, FRAM performed relatively well in predicting total Chinook encounters for average years. The creel survey-based estimates of encounters for the two seasons of the Areas 8-1 and 8-2 selective Chinook fishery diverged significantly, with the 2006-07 season estimates falling within the expected bounds of average encounters, while the 2005-06 season estimates were far below the average. Given this variability, we believe adjustments to the inputs and methods by which FRAM predicts encounters are unwarranted at his time.

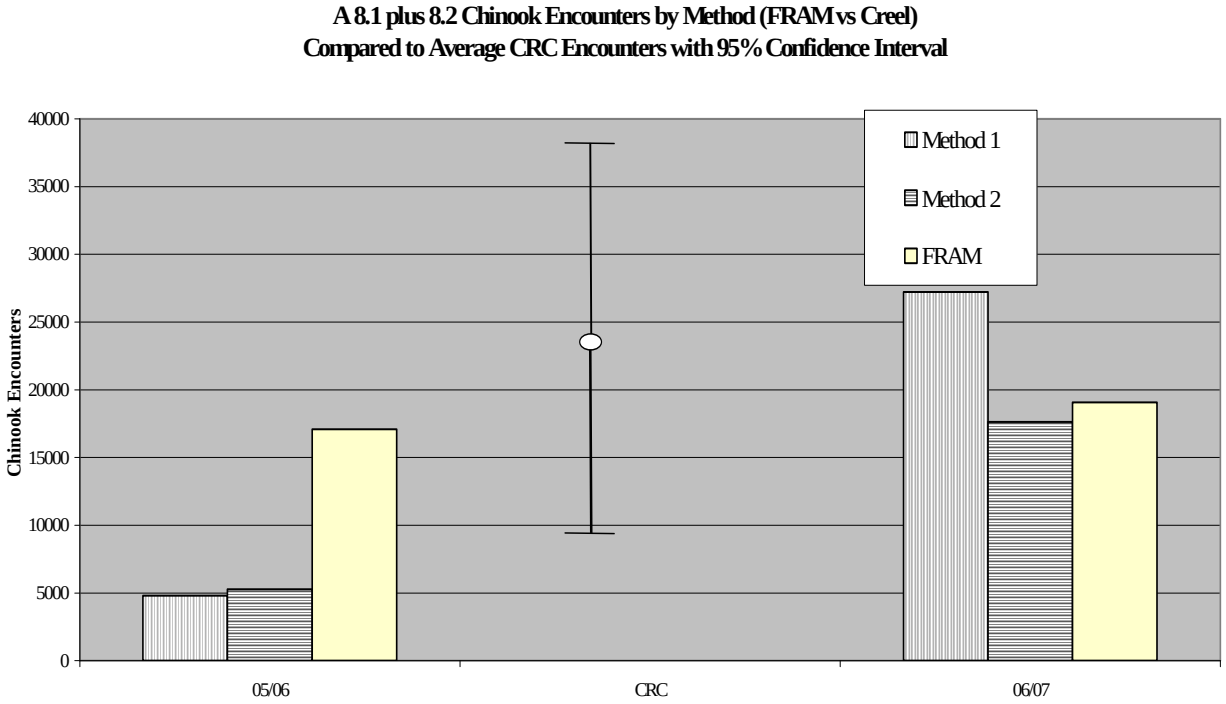

Figure 30. Modeled (FRAM) and estimated total Chinook encounters ['observed', i.e., estimated using Methods 1 (creel only) and 2 (creel legal-marked expanded by test fishery proportions)] due to the combined Areas 8-1 and 8-2 selective Chinook fisheries during 2005-06 and 2006-07, compared to average Catch Record Card-based estimates of Chinook encounters for years from 1994 through 2005. Error bars represent 95% confidence intervals around the average CRC-based estimate of Chinook encounters.

Landed Catch

FRAM overestimated the landed Chinook catch during both the 2005-06 and 2006-07 seasons of the Areas 8-1 and 8-2 selective Chinook fishery (**Table 26** and **Figure 31**). During the 2005-06 season, the creel survey estimate of 1,152 total landed Chinook was exceeded by the FRAM estimate of 1,499. For the 2006-07 season, FRAM predicted a landed Chinook catch of 1,921, which was considerably higher than the creel survey-based catch estimate of 1,210 landed Chinook.

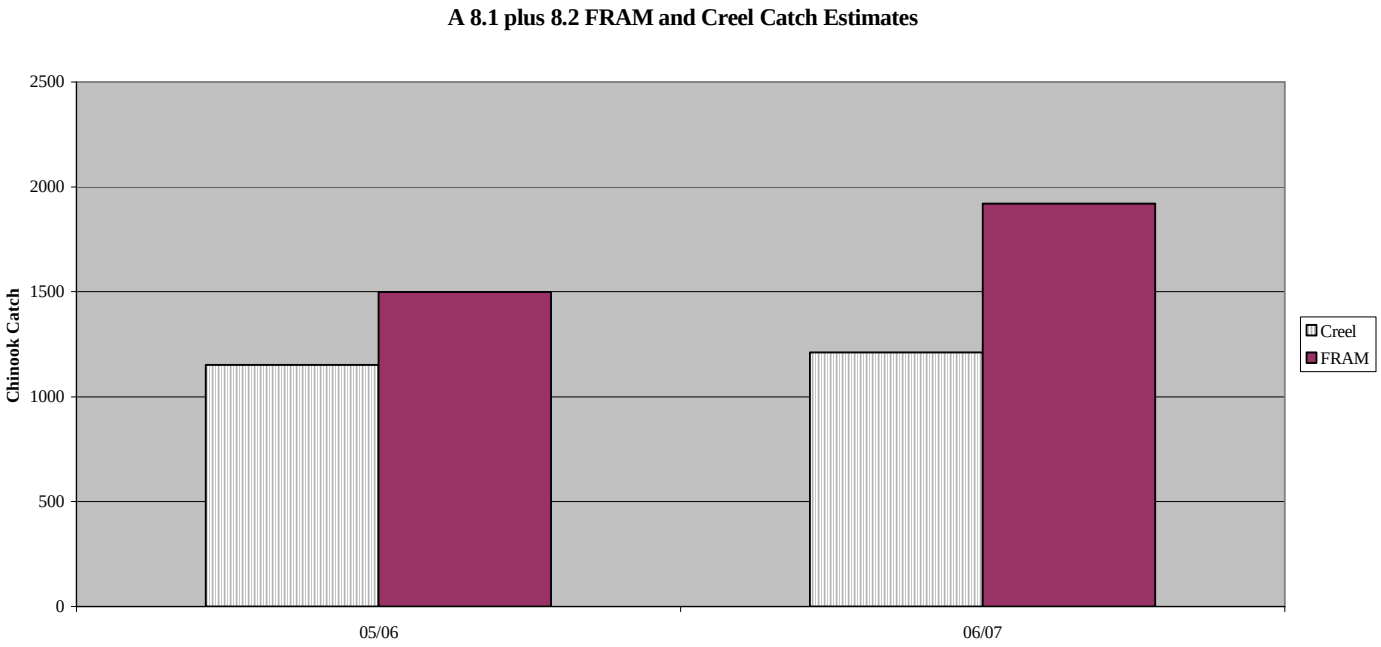

Figure 31. FRAM versus observed (i.e., creel survey estimates) landed Chinook catch during the 2005-06 and 2006-07 seasons of the Areas 8-1 and 8-2 (combined) selective Chinook fishery. (Note: Method 1 and Method 2-based creel estimates of landed Chinook catch are equal).

Evaluation of Historical Landed Catch Estimates

As with encounters, FRAM was evaluated against historical landed catch estimates. We computed the average CRC-based estimates of landed Chinook catch for the period from October through April, for the years from 1989 through 2005. Months with Chinook closures were excluded from the average. Months with partial-month Chinook openings were expanded according to FRAM rules. The average monthly catch was then summed over the October though April time period to obtain a catch estimate for the entire season. In a final step, the variance was computed to obtain the 95% confidence interval (see **Appendix H**).

To compare the FRAM catch estimates from the selective fisheries with the historical estimates from non-selective fisheries, the FRAM estimate of selective catch was converted to a non-selective estimate. This was simply done by summing the legal-marked and legal-unmarked encounters. In FRAM the number of legal-size encounters is equivalent to the estimate of landed catch.

The FRAM estimates of landed Chinook catch (i.e., legal-size encounters) exceeded the average landed Chinook catch of 3,797 during both the 2005-06 and 2006-07 seasons of the selective Chinook fishery in Areas 8-1 and 8-2, but were fairly close to the average and well within the 95% confidence interval for both selective seasons (**Figure 32**).

It is noteworthy that the FRAM estimates of legal-size encounters also exceeded the creel estimates of legal encounters for both seasons and both methods. Unlike the FRAM estimate,

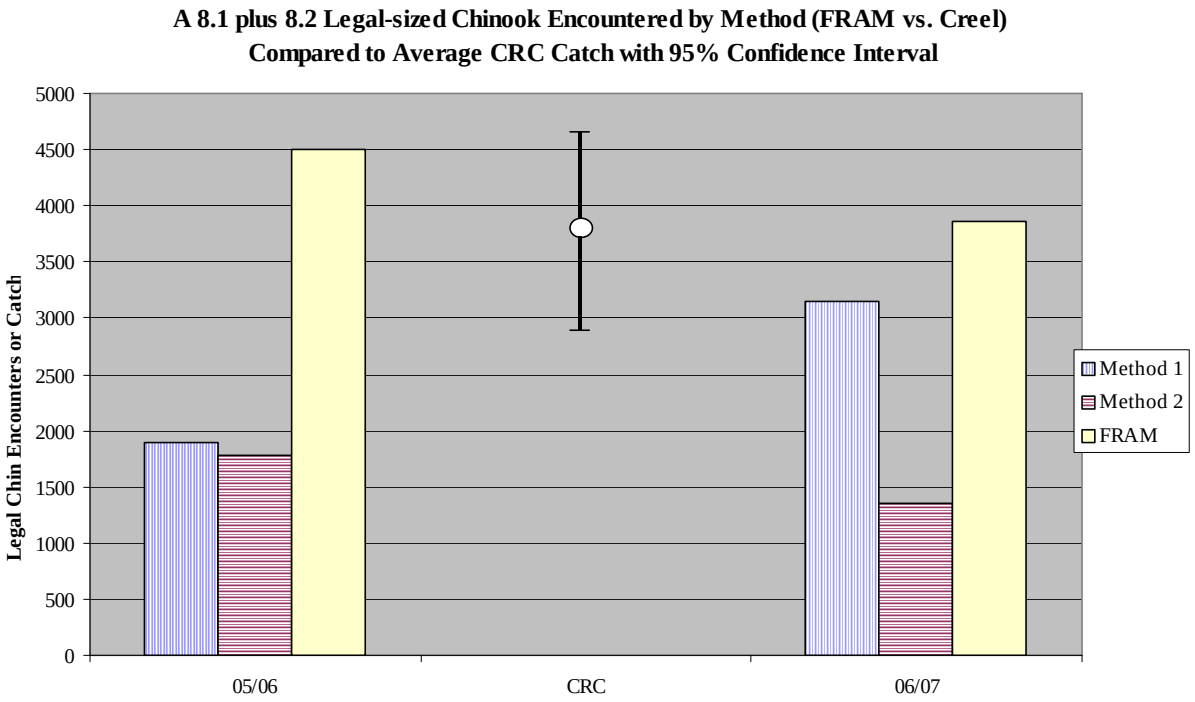

Figure 32. FRAM versus observed (i.e., Method 1 and Method 2 creel survey-based estimates) values for legal-size Chinook encountered during the 2005-06 and 2006-07 seasons of the Areas 8-1 and 8-2 (combined) selective Chinook fishery, compared to the average Catch Record Card-based estimates of legal Chinook encountered for years 1989 through 2005.

legal encounters are not equivalent to landed catch for creel survey-based Method 1. Landed catch for Method 1 can be significantly lower than legal encounters, depending on the percentage of legal-size Chinook released (e.g., 56% estimated based on Method 1 in the 2006-07 season). This provides additional evidence that the FRAM estimate of landed catch is high.

Unmarked Retention Error

Unmarked retention error is defined as the number of legal unmarked Chinook kept divided by legal unmarked Chinook encounters. FRAM uses a rate of 8% to calculate the number of unmarked legal-size fish that are retained in a selective fishery. This rate is applied to the number of unmarked legal-size fish encountered.

Creel survey-based estimates of unmarked retention error varied based on whether Method 1 or Method 2 was used to estimate encounters. Encounter estimates were similar for Method 1 and Method 2 during the 2005-06 season, with a creel estimate of unmarked retention error of 5.3% and 5.4%, respectively (**Table 28**). For the 2006-07 season, unmarked retention error was estimated at 3.4% via Method 1 and 9.2% via Method 2.

The FRAM value of 8% unmarked retention error was higher than the creel survey-based estimate of this parameter for both the 2005-06 and 2006-07 seasons, regardless of which method was used to produce the estimate of Chinook encounters.

The FRAM estimate for unmarked retention error of 8% was selected to provide a generous estimate of this parameter until more data could be collected to substantiate this value. Creel survey data from two seven-month selective fishing seasons in Areas 8-1 and 8-2 suggest that the unmarked retention error is actually between 4% and 6%.

Mark Release Error

Mark release error is defined as the number of legal-marked Chinook released divided by legal-marked Chinook encounters. FRAM uses a value of 6% as the estimate of Chinook legal-marked release error in selective fisheries.

Estimates of legal-marked release error in the creel survey were produced via the Method 1 approach only because Method 2 assumes that anglers retain all legal-marked Chinook encountered. Based on Method 1, we estimated the legal-marked release error at 8.5% during the 2005-06 season and 55.6% during the 2006-07 season of the Areas 8-1 and 8-2 selective Chinook fishery (**Table 28**).

The 8.5% creel-based value for the 2005-06 season was similar to the 10% average value obtained from the voluntary trip reports. We believe the very high estimate of 56% legal-marked release error in the 2006-07 season was unrealistic in light of the low overall success rate in this fishery (1 kept per 9.3 angler trips). A high legal-marked release rate might be expected in a very successful fishery where many anglers catch the daily limit, but the 2006-07 fishery did not demonstrate a high success rate. We therefore propose to increase the mark release error to a value between 8.5% and 10%.

Unmarked and Marked Sublegal Retention Error

Unmarked sublegal retention error is defined as the ratio of sublegal-unmarked Chinook retained over sublegal-unmarked Chinook encountered. Likewise, marked sublegal retention error is defined as the ratio of sublegal-marked Chinook retained over sublegal-marked Chinook encountered.

FRAM algorithms assume no sublegal fish are retained, although the creel survey estimates produced from the 2005-06 and 2006-07 seasons in Areas 8-1 and 8-2 provided low estimates of unmarked sublegal retention error at 0.0% and 0.1% and of marked sublegal retention error at 0.7% and 4% (**Table 28**). These rates are considered to have a minor impact on exploitation rates, especially after being converted to adult-equivalency. To account for sublegal retention error in FRAM would require a major restructure to program catch algorithms, which we do not recommend at this time.

Table 28. Modeled (FRAM) and observed [using Method-1 (creel only) and Method-2 (creel legal-marked expanded by test fishery proportions) estimation approaches] selective fishery parameter values.

Season	Selective Fishery Parameter	FRAM Modeled	Method-1 Estimate	Method-2 Estimate
2005-06	Unmarked Retention Error (legal-unmarked kept / legal-unmarked enc.)	0.08	0.053	0.054
	Mark Release Error (legal-marked released / legal-marked enc.)	0.06	0.085	***0.0*** [a]
	Unmarked Sublegal Retention Error (sublegal-unmarked kept / sublegal-unmarked enc.)	***0.0*** [b]	0.00	0.00
	Marked Sublegal Retention Error (sublegal-marked kept / sublegal-marked enc.)	***0.0*** [b]	0.04	0.033
2006-07	Unmarked Retention Error (legal-unmarked kept / legal-unmarked enc.)	0.08	0.034	0.092
	Mark Release Error (legal-marked released / legal-marked enc.)	0.06	0.556	***0.0*** [a]
	Unmarked Sublegal Retention Error (sublegal-unmarked kept / sublegal-unmarked enc.)	***0.0*** [b]	0.001	0.001
	Marked Sublegal Retention Error (sublegal-marked kept / sublegal-marked enc.)	***0.0*** [b]	0.007	0.011

a. Method-2 Estimates are calculated assuming Mark Release Error is zero.

b. FRAM algorithms assume no sublegal fish are retained.

Test Fishing Encounters

Beginning with the third season (2007-08) of the Areas 8-1 and 8-2 selective fishery, we incorporated test fishing impacts into the FRAM model. Inputs were based on the monthly average Chinook encounters determined from test fishing data in Areas 8-1 and 8-2 during the 2005-06 and 2006-07 seasons (**Table 29**). For each test boat, 150 Chinook encounters were modeled per month. For each month of the Areas 8-1 and 8-2 selective fishery, 300 encounters (150*2) were input into the "Non-Retention" section of the FRAM.

Table 29. Average monthly Chinook encounters in the test fishery during the 2005-06 and 2006-07 seasons of the Areas 8-1 and 8-2 selective Chinook fishery.

Area	Average Monthly Test Fishing Encounters 2005-06 Season	Average Monthly Test Fishing Encounters 2006-07 Season	Average Both Seasons
8-1	64	253	159
8-2	42	172	107
Avg. Both Areas	**53**	**213**	**133**

The monthly average using data from both seasons was 133 Chinook per area or 266 Chinook for both areas combined. We are not proposing to change the modeled test fishing encounter estimate at this time.

Conclusions and Recommendations

Based on our evaluation of how well FRAM performed in predicting key selective fishery parameters during the 2005-06 and 2006-07 seasons of the Areas 8-1 and 8-2 selective Chinook fishery, we conclude and recommend the following:

- FRAM predicted total Chinook encounter estimates that were within the range of historical encounters. FRAM estimates of total Chinook encounters significantly exceeded estimated total Chinook encounters from the 2005-06 creel estimates. For the 2006-07 season, FRAM estimates were similar to Method 2 creel estimates, but lower than Method 1 creel estimates. Given this variability, we believe adjustments to the inputs and methods by which FRAM predicts encounters are unwarranted at his time.
- FRAM overestimated unmarked Chinook encounters during both seasons of the selective Chinook fishery in Areas 8-1 and 8-2, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM overestimated landed catch of unmarked and marked Chinook for both seasons, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM is not designed to estimate sublegal retained catch. However, creel survey estimates produced from the 2005-06 and 2006-07 seasons in Areas 8-1 and 8-2 provided low estimates of unmarked sublegal retention error, which are considered to have a minor impact on exploitation rates, especially after being converted to adult-equivalency. To account for sublegal retention error in FRAM would require a major restructure to program catch algorithms, which we do not recommend at this time.
- Currently the exploitation rate scalars in FRAM characterize fishing power during 1989-1993 as estimated in FRAM post-season runs relative to FRAM base period "catch" and stock abundances used in the 2002 and 2005 model calibrations. We recommend continuing the current method of developing fishery input scalars for at least one more year until a pattern is apparent.
- Based on two seasons of observed results produced from Method 1- and Method 2-based creel survey estimates, we recommend reducing the FRAM input parameter for unmarked retention error to a value of 6%, to calculate the predicted number of unmarked legal-size Chinook that are retained in a selective fishery.
- We recommend increasing the FRAM input parameter for mark release error to a value of 10%, based on the two seasons of observed results in Areas 8-1 and 8-2.
- FRAM currently models 150 encounters per test fishing boat and month. The average number of actual test fishing encounters per area and month was very close to the modeled number of encounters. We recommend continuing to model 150 Chinook encounters per test fishing boat and month.

SECTION II: CONCLUSIONS and RECOMMENDATIONS

Sampling Adequacy

- Dockside sampling and test-fishery components of the Areas 8-1 and 8-2 selective fishery monitoring programs were successful at achieving agreed-to sampling objectives.
- Dockside and test-fishing efforts yield precise estimates of key fishery parameters in both the 2005-06 season and the 2006-07 of the Areas 8-1 and 8-2 selective Chinook fishery.
- Sampling efficiencies should be pursued where possible, assuming such efficiencies do not affect the integrity/reliability of estimates. We recommend the following:
    - For the fourth year of the Areas 8-1 and 8-2 selective Chinook fishery, conduct baseline sampling only and rely on Catch Record Card estimates, instead of conducting intensive creel survey estimates.
    - Share a test fishing vessel between Areas 8-1 and 8-2 to achieve cost savings and sampling efficiencies, and yet retain precision levels that are similar to the former sampling levels for mark rate and encounter rate estimates.

Test Boats Emulating the Fleet?

- Whether or not the Areas 8-1 and 8-2 test fisheries *perfectly* mimic the private fleet in terms of angling behavior and Chinook encounters remains equivocal. We characterized the ability of test-boat anglers to fish like the fleet and demonstrated similarity in some fishery parameters (i.e., mark rates and age composition) where contrasts were possible. However, we also found evidence of small but statistically significant size-related departures for the legal-marked component of test fishery and private-fleet (observed at dockside) encounters.
- Opportunities for improved and more efficient collection of test fishing data should be considered in the future. For example, as instituted in November 2007, spatial evaluations of test-fishery and private-fleet effort patterns should be pursued for both in-season guidance and post-season evaluation.
- Given that it is the most reliable (i.e., in terms of control over how data are collected, logged, etc.) dataset on Chinook encounters available and the lack of strong evidence suggesting otherwise, we recommend that the analytical assumptions associated with test fishery data be accepted at the present time. If discrepancies are detected in future analyses, appropriate measures should be taken to modify sampling and/or correct for biases.

Evaluating Method 1 versus Method 2

- With the existing sampling program and Methods 1 and 2 as starting points, WDFW and tribal co-managers should work towards a mutually agreeable encounters and mortalities estimation framework.
- The actual percent of released marked legal-size fish remains an unknown parameter. We recommend modifying the dockside creel surveys to query anglers specifically about how many marked legal-size fish they intentionally released. This assessment will yield additional insight on the utility of the Method-2 estimator and may provide a representative means for adjusting M2 estimates for release-related bias. However, using data collected through this approach will add a new assumption to M2 estimates (i.e., that angler-reported legal-marked Chinook releases are accurate; as legal-marked Chinook release is a low frequency but memorable event, this may be of minor consequence).

Evaluating FRAM vs. Observed Estimates of Selective Fishery Parameters

- FRAM predicted total Chinook encounter estimates that were within the range of historical encounters. FRAM estimates of total Chinook encounters significantly exceeded estimated total Chinook encounters from the 2005-06 creel estimates. For the 2006-07 season, FRAM estimates were similar to Method 2 creel estimates, but lower than Method 1 creel estimates. Given this variability, we believe adjustments to the inputs and methods by which FRAM predicts encounters are unwarranted at his time.
- FRAM overestimated unmarked Chinook encounters during both seasons of the selective Chinook fishery in Areas 8-1 and 8-2, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM overestimated landed catch of unmarked and marked Chinook for both seasons, when compared with both Method 1 and Method 2-based creel estimates.
- FRAM is not designed to estimate sublegal retained catch. However, creel survey estimates produced from the 2005-06 and 2006-07 seasons in Areas 8-1 and 8-2 provided low estimates of unmarked sublegal retention error, which are considered to have a minor impact on exploitation rates, especially after being converted to adult-equivalency. To account for sublegal retention error in FRAM would require a major restructure to program catch algorithms, which we do not recommend at this time.
- Currently the exploitation rate scalars in FRAM characterize fishing power during 1989-1993 as estimated in FRAM post-season runs relative to FRAM base period "catch" and stock abundances used in the 2002 and 2005 model calibrations. We recommend continuing the current method of developing fishery input scalars for at least one more year until a pattern is apparent.
- Based on two seasons of observed results, we recommend reducing the FRAM input parameter for unmarked retention error to a value of 6%, to calculate the predicted number of unmarked legal-size Chinook that are retained in a selective fishery.

- We recommend increasing the FRAM input parameter for mark release error to a value of 10%, based on the two seasons of observed results in Areas 8-1 and 8-2.
- FRAM currently models 150 encounters per test fishing boat and month. The average number of actual test fishing encounters per area and month was very close to the modeled number of encounters. We recommend continuing to model 150 Chinook encounters per test fishing boat and month.

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APPENDICES

Appendix A. Estimating monthly and season-wide mark-selective fishery impacts

List A1. Variable definitions and equations associated with Figure A1.

Below are definitions and equations for all quantities used in estimating total mark-selective fishery impacts under "Method 1" (defined in the main report on p. 16). The sequence in the list builds from monthly estimators (and variances) of encounters-by-class (i.e., size/mark-status groups) to season-wide fishery-impact estimates. Where appropriate, the inclusion/treatment of charter-based encounters [kept plus released Chinook; assumed the result of a complete census (i.e., with zero variance)] in estimating particular quantities of interest is also provided (see p. 13 in the main report body for background on this topic); those instances are denoted by the symbol †. Further, estimation differences leading to "Method-2" estimates of fishery impacts are also identified where appropriate and are denoted by ‡. *Regarding notation*: i) symbols follow those in Figure A1; ii) estimated quantities appear in *italics*; and iii) constants (with an assumed variance of zero) are depicted in ***bold-faced, italicized*** font.

A. Total and class-specific encounters estimation:

The first step towards quantifying mark-selective fishery impacts by size/mark-status class is the apportioning of Murthy-based estimates of total Chinook encounters (the sum of retained and released fish; *Monthly Encounters*) in a given month *i* to the appropriate group using encounter-composition data collected in the WDFW test fishery (*Test-fishery Encounter Composition*).

Monthly Encounters

E_i = Estimated total Chinook encounters for month *i*, inclusive of retained and released individuals from all mark-status groups (N_{MKi} = marked-retained, N_{UKi} = unmarked-retained, N_{MRi} = marked-released, and N_{URi} = unmarked-released), released Chinook of unknown mark status (N_{unkRi}), and apportioned unidentified salmon [N_{AUSi}, i.e., unidentified (to species) released salmonids that may have been Chinook; apportioned by identified-released proportions] derived using the Murthy estimator. E_i and its variance are estimated as:

$$(1) \quad E_i = N_{MKi} + N_{UKi} + N_{MRi} + N_{URi} + N_{unkRi} + N_{AUSi}$$

$$(2) \quad var(E_i) = var(N_{MKi}) + var(N_{UKi}) + var(N_{MRi}) + var(N_{URi}) + var(N_{unkRi}) + var(N_{AUSi})$$ [3]

† If E_i is being estimated for the sake of characterizing encounters in month *i* (regardless of size-mark status) alone, all charter encounters $\boldsymbol{E_{charti}}$ (retained + released) should be incorporated into 1

[3] Variances for all quantities contributing to E_i under Method-1 are defined in the Methods section of the main body of the report.

above; otherwise, $\boldsymbol{E}_{\mathbf{charti}}$ is incorporated into class specific estimates (i.e., if class-specific encounters or mortalities are of interest).

‡ For Method-2, the total monthly encounter estimate, E_i, is obtained by: 1) combining the marked-legal retention estimate (K_{LMi}) and the test-fishery-based estimate of the proportion of at-large Chinook that are marked and of legal size (p_{LMi}; defined in 3 and 9 below) and 2) assuming that anglers retain all legal-size, marked Chinook [i.e., $E_i = K_{LMi} / p_{LMi}$, with $var(E_i) = (K_{LMi}{}^2 / p_{LMi}{}^2)*(var(K_{LMi}) / K_{LMi}{}^2 + var(p_{LMi}) / p_{LMi}{}^2)$]. This estimate is used in all subsequent Method-2 computations in a manner identical to Method-1 E_is unless specified otherwise.

Test-fishery Encounter Composition

p_{LMi} = the test-fishery estimate of Chinook catch proportion comprised of legal (L), marked (M) individuals during month *i*

p_{LUi} = the test-fishery estimate of Chinook catch proportion comprised of legal (L), unmarked (U) individuals during month *i*

p_{SMi} = the test-fishery estimate of Chinook catch proportion comprised of sublegal (S), marked (M) individuals during month *i*

p_{SUi} = the test-fishery estimate of Chinook catch proportion comprised of sublegal (S), unmarked (U) individuals during month *i*

For each *XY* combination (*X* = L and S and *Y* = M or U), test-fishery p_{XYi}s and their variances are estimated as:

(3) $p_{XYi} = N_{XYi} / \Sigma N_{XYi}$, and

(4) $var(p_{XYi}) = [p_{XYi}*(1- p_{XYi})] / (n_i-1)$,

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

Encounters by Size/Mark-status Class

E_{LMi} = estimated legal (L), marked (M) encounters during month *i*

E_{LUi} = estimated legal (L), unmarked (U) encounters during month *i*

E_{SMi} = estimated sublegal (S), marked (M) encounters during month *i*

E_{SUi} = estimated sublegal (S), marked (U) encounters during month *i*

For each *XY* combination (*X* = L and S and *Y* = M or U), apportioned encounters E_{XYi} and a conservative estimate of its variance (*assuming* p_{XYi} *and* E_{XYi} *are independent estimates*) are obtained from:

(5) $E_{XYi} = E_i*p_{XYi}$

(6) $var(E_{XYi}) = var(E_i)* p_{XYi}{}^2 + E_i{}^2*var(p_{XYi})$

† If E_{XYi} is being estimated for the purpose of characterizing class-specific encounters during month *i* alone, charter encounters broken down by class [i.e., $\boldsymbol{E}_{\mathbf{chart}XYi}$ (retained + released)] should be incorporated into 5 above; otherwise, $\boldsymbol{E}_{\mathbf{chart}XYi}$s are incorporated into estimators below (i.e., if class-specific mortalities are of interest).

‡ $var(E_{XYi})$ (i.e., equation 6) includes an additional covariance component [i.e., $var(E_i)*var(p_{XYi})$] for Method-2 estimates of apportioned encounters given that E_i is derived from test-fishery data.

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

Before mortality can be estimated for each class, the number of fish retained and released must be estimated. Class-specific retention estimates are obtained by apportioning Murthy estimates of marked and unmarked Chinook retained in each month *i* to size classes (*Apportioned Estimates of Retention to Size Classes*); this is achieved using proportions estimated during dockside creel surveys (*Dockside Observations for Apportioning Retained Catch to Class*). Releases are then estimated as the difference between class-specific total encounters and retention (*Estimating Release Numbers by Class*).

Dockside Observations for Apportioning Retained Catch to Class

d_{LMK} = the estimated proportion of retained (kept, K), marked (M) Chinook salmon that were legal (L); based on *season-wide* dockside observations of marked Chinook (as is d_{SMK})

d_{SMK} = the estimated proportion of retained (kept, K), marked (M) Chinook salmon that were sublegal (S)

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

(7) $d_{XMK} = n_{XMK} / \Sigma\, n_{XMK}$

(8) $var(d_{XMK}) = [d_{XMK}*(1- d_{XMK})] / (\Sigma n_{XMK}-1)$,

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

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 p_{SUK})

d_{SUK} = the estimated proportion of retained (kept, K), unmarked (U) Chinook salmon that are sublegal (S)

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

Apportioned Estimates of Retention to Size Classes

K_{LMi} = estimated number of legal (L), marked (M) Chinook kept in month *i*

K_{LUi} = estimated number of legal (L), unmarked (U) Chinook kept in month *i*

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

(9) $K_{X\mathrm{M}i} = d_{X\mathrm{MK}} * N_{\mathrm{MK}i}$

(10) $var(K_{XMi}) = var(N_{\mathrm{MK}i}) * d_{X\mathrm{MK}}{}^2 + N_{\mathrm{KM}i}{}^2 * var(d_{X\mathrm{MK}}) - var(N_{\mathrm{MK}i}) * var(d_{X\mathrm{MK}})$

where $d_{X\mathrm{MK}}$ and its variance are from 7 and 8 above and $N_{\mathrm{MK}i}$ is the Murthy estimate of retained marked fish for month *i* defined for 1 above.

$K_{\mathrm{SM}i}$ = estimated number of sublegal (S), marked (M) Chinook kept in month *i*
$K_{\mathrm{SU}i}$ = estimated number of sublegal (S), unmarked (U) Chinook kept in month *i*

The number of retained, unmarked fish belonging to legal and sublegal size classes is estimated as above (9 and 10) using unmarked fish proportions and monthly Murthy-based retention estimates (and variances).

Estimating Release Numbers by Class

$R_{\mathrm{LM}i}$ = estimated number of legal (L), marked (M) Chinook released in month *i*
$R_{\mathrm{LU}i}$ = estimated number of legal (L), unmarked (U) Chinook released in month *i*
$R_{\mathrm{SM}i}$ = estimated number of sublegal (S), marked (M) Chinook released in month *i*
$R_{\mathrm{SU}i}$ = estimated number of sublegal (S), unmarked (U) Chinook released in month *i*

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

(11) $R_{XYi} = E_{XYi} - K_{XYi}$

(12) $var(R_{XYi}) = var(E_{XYi}) + var(K_{XYi})$

† Charter-reported $\boldsymbol{R_{XYi}}$s are incorporated into equation 11 for complete R_{XYi} estimation.

‡‡ For Method-2, $R_{\mathrm{LM}i}$ is assumed to be zero with zero variance (i.e., anglers retain all legal-size, marked fish); all other R_{XYi}s are estimated using equations 11 and 12, but with Method-2-specific E_{XYi}s.

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

The final step towards quantifying mark-selective fishery impacts is the application of assumed mortality rates (*Assumed Mortality Rates for Retained and Released Chinook*) to class-specific retention and release estimates.

Assumed Mortality Rates for Retained and Released Chinook

$\boldsymbol{m_{\mathrm{K}}}$ = retention mortality rate, 100% for all retained Chinook
$\boldsymbol{sfm_{\mathrm{L}}}$ = release mortality rate for legal (L) Chinook, assumed to be a constant 15%
$\boldsymbol{sfm_{\mathrm{S}}}$ = release mortality rate for sublegal (S) Chinook, assumed to be a constant 20%

Retention-mortality Estimates

M_{LMKi} = estimated number of mortalities due to direct harvest of legal (*L*), marked (*M*) Chinook in month *i*; the point estimate and variance are equivalent to K_{LMi} given that $m_K = 1.00$ (i.e., $M_{LMKi} = K_{LMi} * \boldsymbol{m_K}$).

M_{LUKi} = estimated number of mortalities due to direct harvest of legal (*L*), unmarked (*U*) Chinook in month *i*; the point estimate and variance are equivalent to K_{LUi} given that $m_K = 1.00$ (i.e., $M_{LUKi} = K_{LUi} * \boldsymbol{m_K}$).

M_{SMKi} = estimated number of mortalities due to direct harvest of sublegal (*S*), marked (*M*) Chinook in month *i*; the point estimate and variance are equivalent to K_{SMi} given that $m_K = 1.00$ (i.e., $M_{SMKi} = K_{SMi} * \boldsymbol{m_K}$).

M_{SUKi} = estimated number of mortalities due to direct harvest of sublegal (*S*), unmarked (*U*) Chinook in month *i*; the point estimate and variance are equivalent to K_{SUi} given that $m_K = 1.00$ (i.e., $M_{SUKi} = K_{SUi} * \boldsymbol{m_K}$).

† Charter-reported $\boldsymbol{K_{XYi}}$s are added to the appropriate M_{XYi} for complete retention-mortality estimation.

Release-mortality Estimates

M_{LMRi} = estimated number of post-release, fishery-related mortalities of encountered legal (*L*), marked (*M*) Chinook in month *i*

M_{LURi} = estimated number of post-release, fishery-related mortalities of encountered legal (*L*), unmarked (*U*) Chinook in month *i*

M_{SMRi} = estimated number of post-release, fishery-related mortalities of encountered sublegal (*S*), marked (*M*) Chinook in month *i*

M_{SURi} = estimated number of post-release, fishery-related mortalities of encountered sublegal (*S*), unmarked (*U*) Chinook in month *i*

An estimate of release mortality for size/mark-status class *XY* (*X* = L or S, *Y* = M or U) in month *i* and its variance is obtained from:

(13) $M_{XYRi} = R_{XYi} * \boldsymbol{sfm_Y}$

(14) $var(M_{XYRi}) = \text{var}(R_{XYi}) * \boldsymbol{sfm_Y}^2$

Season-wide Total and Class-specific Mortality Estimation

M_{total} = season-wide Chinook mortality due to the selective fishery; this parameter and its variance [$var(M_{total})$] are computed as the sum of all monthly retention (M_{XYKi}) and release mortality (M_{XYRi}) estimates and variances, respectively, for the *XY* (*X* = L or S, *Y* = M or U) size/mark-status groups; similarly, mortality estimates and variances for subgroups of interest (*e.g.*, unmarked, sublegal Chinook, $M_{SU\text{-}total}$) are estimated by summing monthly estimates/variances across the season for that class.

The standard error (SE), coefficient of variation (CV), and 95% confidence interval about M_{total} (and all other parameters θ defined herein) are obtained from:

(15) $SE(\theta) = (\theta)^{1/2}$

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

(17) 95% CI = $\theta \pm 1.96 * SE(\theta)$

Figure A1. Graphical representation of the estimation approach used to quantify monthly encounters and mortalities by size/mark-status category for the Areas 8-1/8-2 mark-selective Chinook fishery. Boxes depict abundance estimates (encounters, mortalities) whereas the mathematical operations depicted on intermediate connector lines are estimator formulae for subsequent boxes (moving from left to right). Gray ovals represent points in the total encounter and mortality estimation sequence where Methods 1 and 2 diverge. Variable and parameter names, complete formulae, and variances (where appropriate) are defined in List A1. Bold-faced, italicized symbols are constants, all others are estimated quantities. Total monthly mortality is the sum of M_{Ki} and M_{Ri}; the season-wide estimate is the sum of all monthly estimates.

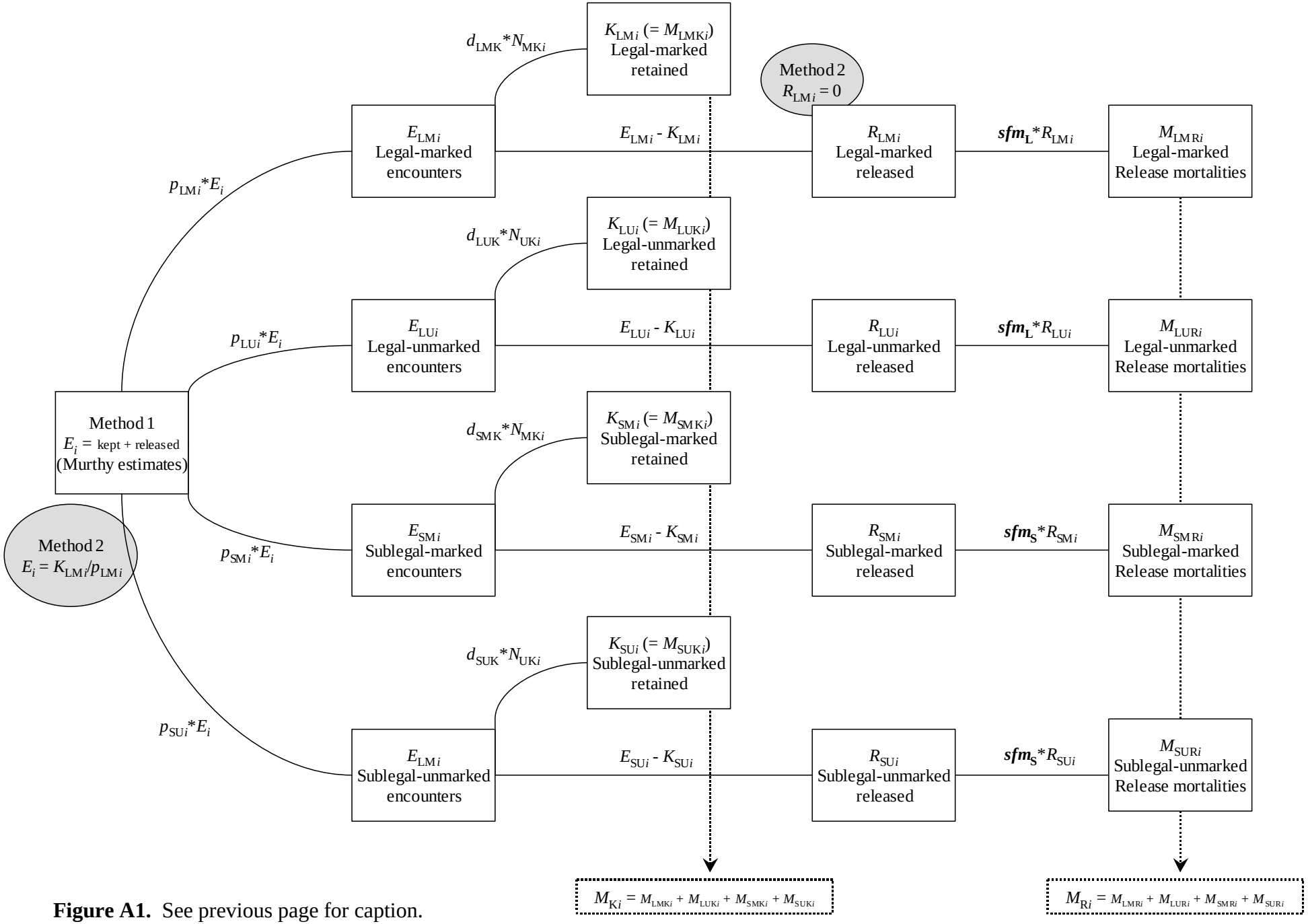

Figure A1. See previous page for caption.

Appendix B. Analytical assumptions required for estimating catch, effort, and mortality for the Areas 8-1 and 8-2 selective Chinook fishery under WDFW's selective fishery monitoring approach.

Assumption Number	Description	Tested previously	Likelihood of violation	Likely importance	Comments
Assumption 1	Boat surveys provide unbiased estimates of access-site size measures and out-of-frame effort proportions	N	Low	High	Indirect evaluations suggest the latter aspect of this assumption (i.e., regarding the out-of-frame proportion) is true in a relative sense (WDFW unpublished data).
Assumption 2	Relative angling effort originating from a particular site (i.e., site-size) is proportional to catch landed at that site	Y	Low	Moderate	Simulations by Conrad and Alexandersdottir (1993) demonstrate that mis-specification of size measures leads to precision but not bias issues.
Assumption 3	All anglers exiting the fishery are interviewed and accurately report retained and released encounters (missed boats are dealt with analytically assuming average values)	N	Moderate	High	The accuracy of angler-reported encounters, particularly releases during high-encounter periods, is uncertain but important
Assumption 4	CPUE does not differ between in-frame and out-of-frame access sites	N	Unknown	Unknown	Likely difficult, if not impossible, to test.
Assumption 5	Anglers retain all legal-marked Chinook encountered	N	High	Low	Empirical estimates for avid anglers suggest intentional legal-marked release rates are ~10%; unintentional legal-marked release is unknown.
Assumption 6	Test-fishery and private-fleet encounter composition (i.e., frequency by size/mark-status class) is identical.	N	Low	High	Preliminary analyses of length-frequency distributions, age-data, and overall mark rates suggest both test fishers and the private fleet are accessing a similar pool of fish (to evaluate in greater detail in the future).

Appendix C1. Monthly fishing effort and Chinook encounter estimates and variances for private-fleet anglers during the Areas 8-1 and 8-2 selective Chinook fishery in the 2005-06 and 2006-07 seasons.

				Fishing effort (total trips)				Chinook Retention (totals), by mark status				Chinook Releases (totals), by mark status							
Season	Area	Stat. Month	Date Range	boats	v(boats)	anglers	v(anglers)	marked	v(mark.)	unmarked	v(unmark.)	marked	v(mark.)	unmarked	v(unmark.)	unknown	v(unk.)	unID'd salmon	v(unID'd)
2005-6	8-1	Oct	Oct 1-30	637	30361	1154	93852	41	399	0	0	130	3725	88	1442	109	1802	8	58
		Nov	Oct 31-Nov 27	200	913	350	2387	44	705	0	0	26	148	49	224	25	44	0	0
		Dec	Nov 28-Dec 31	236	2368	427	9272	49	539	0	0	65	542	68	671	36	115	0	0
		Jan	Jan 1-29	185	1442	325	4556	43	260	0	0	39	769	36	192	59	457	0	0
		Feb	Jan 30-Feb 26	347	2879	640	12068	109	587	0	0	44	99	122	645	72	475	0	0
		Mar	Feb 26-Mar 26	411	13958	702	39675	35	195	0	0	19	38	51	164	64	965	0	0
		Apr	Mar 27-Apr 30	187	610	376	3284	21	50	0	0	19	37	24	42	21	17	0	0
	8-2	Oct	Oct 1-30	1486	16275	2911	65302	27	84	2	3	15	4	17	5	298	711	101	417
		Nov	Oct 31-Nov 27	183	1095	338	3347	21	2	2	0	0	0	14	21	49	63	4	5
		Dec	Nov 28-Dec 31	253	1581	465	4310	87	261	7	9	26	40	76	494	144	2248	0	0
		Jan	Jan 1-29	306	1176	575	3377	137	625	5	12	88	80	183	374	159	1997	0	0
		Feb	Jan 30-Feb 26	657	1045	1280	4491	203	590	11	23	150	387	201	744	227	228	0	0
		Mar	Feb 26-Mar 26	648	1516	1274	7526	84	67	6	6	65	217	120	714	109	103	7	2
		Apr	Mar 27-Apr 30	763	2020	1486	15227	133	233	7	2	55	241	89	118	113	353	0	0
2006-7	8-1	Oct	Oct 1-28	444	5188	829	17741	50	351	4	7	808	55398	332	10484	1289	122493	0	0
		Nov	Oct 29-Dec 3	110	721	195	2079	13	36	0	0	167	3846	61	259	147	3772	0	0
		Dec	Dec 4-Jan 1	174	440	310	1522	54	179	0	0	477	5377	221	1566	214	2331	0	0
		Jan	Jan 2-28	145	334	287	1955	22	69	0	0	235	3692	97	854	175	3823	0	0
		Feb	Jan 29-Feb 25	196	2768	405	13282	25	70	4	10	416	22432	167	5810	370	21409	0	0
		Mar	Feb 26-Apr 1	389	8266	762	32669	74	94	4	14	654	42527	340	26565	605	6293	0	0
		Apr	Apr 2-30	337	1804	667	8089	78	171	0	0	502	12016	221	783	361	1799	0	0
	8-2	Oct	Oct 1-28	1114	1089	2128	3424	49	19	4	0	793	30129	433	2549	2112	3814	3012	67055
		Nov	Oct 29-Dec 3	200	286	384	953	30	14	1	0	228	1674	98	1430	510	6366	197	2291
		Dec	Dec 4-Jan 1	359	239	632	1284	105	26	3	4	960	8659	494	2732	859	2712	9	29
		Jan	Jan 2-28	338	669	649	2404	127	53	3	0	574	3699	212	163	699	1240	64	780
		Feb	Jan 29-Feb 25	589	2835	1118	11156	114	231	2	2	588	15102	190	457	1167	16530	24	93
		Mar	Feb 26-Apr 1	686	3436	1334	11458	258	762	3	0	827	17418	281	2632	1480	15824	89	88
		Apr	Apr 2-30	759	1521	1490	5801	139	148	4	3	413	553	172	127	1059	5262	34	33

Appendix C2. Monthly fishing effort and Chinook encounter details for charter anglers fishing in the Areas 8-1 and 8-2 selective Chinook fishery during the 2005-06 and 2006-07 seasons.

				Fishing effort (total trips)		Chinook Retention (censused totals), by size/mark-status				Chinook Releases (censused totals), by size/mark-status			
Season	Area	Stat. Month	Date Range	boats	anglers	legal-marked	legal-unmarked	sublegal-marked	sublegal-unmarked	legal-marked	legal-unmarked	sublegal-marked	sublegal-unmarked
2005-6	8-1	Oct	Oct 1-30	0	0	0	0	0	0	0	0	0	0
		Nov	Oct 31-Nov 27	0	0	0	0	0	0	0	0	0	0
		Dec	Nov 28-Dec 31	0	0	0	0	0	0	0	0	0	0
		Jan	Jan 1-29	1	2	0	0	0	0	0	3	2	1
		Feb	Jan 30-Feb 26	0	0	0	0	0	0	0	0	0	0
		Mar	Feb 26-Mar 26	0	0	0	0	0	0	0	0	0	0
		Apr	Mar 27-Apr 30	0	0	0	0	0	0	0	0	0	0
	8-2	Oct	Oct 1-30	8	29	10	0	0	0	1	4	10	4
		Nov	Oct 31-Nov 27	5	15	6	0	0	0	0	2	3	3
		Dec	Nov 28-Dec 31	10	36	20	0	0	0	2	15	16	5
		Jan	Jan 1-29	3	11	21	0	0	0	0	9	14	4
		Feb	Jan 30-Feb 26	4	13	3	0	0	0	1	1	6	0
		Mar	Feb 26-Mar 26	4	11	2	0	0	0	1	3	15	4
		Apr	Mar 27-Apr 30	19	75	16	0	0	0	3	11	12	5
2006-7	8-1	Oct	Oct 1-28	0	0	0	0	0	0	0	0	0	0
		Nov	Oct 29-Dec 3	0	0	0	0	0	0	0	0	0	0
		Dec	Dec 4-Jan 1	0	0	0	0	0	0	0	0	0	0
		Jan	Jan 2-28	0	0	0	0	0	0	0	0	0	0
		Feb	Jan 29-Feb 25	0	0	0	0	0	0	0	0	0	0
		Mar	Feb 26-Apr 1	0	0	0	0	0	0	0	0	0	0
		Apr	Apr 2-30	0	0	0	0	0	0	0	0	0	0
	8-2	Oct	Oct 1-28	16	58	15	0	0	0	1	3	253	95
		Nov	Oct 29-Dec 3	2	8	1	0	0	0	3	1	31	9
		Dec	Dec 4-Jan 1	7	23	15	0	0	0	0	2	128	17
		Jan	Jan 2-28	2	6	5	0	0	0	0	1	29	4
		Feb	Jan 29-Feb 25	1	3	1	1	0	0	0	0	3	2
		Mar	Feb 26-Apr 1	0	0	0	0	0	0	0	0	0	0
		Apr	Apr 2-30	3	15	2	0	0	0	0	0	4	1

Appendix C3. Test fishery fishing effort and Chinook encounter details for the Areas 8-1 and 8-2 selective Chinook fishery, 2005-06 and 2006-07 seasons. Effort can be expressed in terms of angler trips by multiplying days fished by 2 (i.e., 2 samplers fished on all sample days).

				Fishing effort		Total Chinook encounters			
Season	Area	Stat. Month	Date Range	hours fished	days fished	legal-marked	legal-unmarked	sublegal-marked	sublegal-unmarked
2005-6	8-1	Oct	Oct 1-30	103	20	4	0	28	14
		Nov	Oct 31-Nov 27	84	16	11	12	27	19
		Dec	Nov 28-Dec 31	111	19	9	4	9	17
		Jan	Jan 1-29	89	19	17	18	43	37
		Feb	Jan 30-Feb 26	107	17	23	7	25	16
		Mar	Feb 27-Mar 26	85	18	14	5	40	27
		Apr	Mar 27-Apr 30	164	31	7	7	5	5
	8-2	Oct	Oct 1-30	95	17	1	3	24	14
		Nov	Oct 31-Nov 27	75	13	8	8	22	10
		Dec	Nov 28-Dec 31	82	14	14	9	5	9
		Jan	Jan 1-29	43	10	16	11	14	6
		Feb	Jan 30-Feb 26	89	17	14	11	19	6
		Mar	Feb 27-Mar 26	62	15	8	8	17	11
		Apr	Mar 27-Apr 30	135	22	8	4	13	4
2006-7	8-1	Oct	Oct 1-28	143	26	28	8	339	240
		Nov	Oct 29-Dec 3	16	5	13	3	79	44
		Dec	Dec 4-Jan 1	98	25	21	6	132	63
		Jan	Jan 2-28	122	30	35	18	179	80
		Feb	Jan 29-Feb 25	110	22	33	11	136	63
		Mar	Feb 26-Apr 1	69	21	43	14	49	28
		Apr	Apr 2-30	92	23	26	16	44	23
	8-2	Oct	Oct 1-28	111	20	9	5	306	172
		Nov	Oct 29-Dec 3	34	9	2	2	92	47
		Dec	Dec 4-Jan 1	68	13	7	0	114	49
		Jan	Jan 2-28	44	9	3	0	59	34
		Feb	Jan 29-Feb 25	76	15	9	2	56	26
		Mar	Feb 26-Apr 1	79	14	10	3	60	36
		Apr	Apr 2-30	89	16	19	4	63	17

Appendix D1. Within-area and -year age-composition results for dockside-sampled marked Chinook salmon caught in the Areas 8-1 and 8-2 selective Chinook fishery during the 2005-06 and 2006-07 seasons.

		2005-06 Age Composition							2006-07 Age Composition						
Area	**Month**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.2**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.2**
8-1	October	9	0	0	6	0	0	0	8	1	5	2	0	0	0
	November	8	0	0	2	0	0	0	4	0	1	2	0	0	0
	December	8	0	1	3	0	0	0	7	0	4	3	0	0	0
	January	0	0	22	1	2	5	0	0	0	10	0	4	0	0
	February	0	0	38	1	2	14	1	0	0	10	1	1	1	0
	March	0	0	19	1	0	1	0	1	0	23	7	11	2	0
	April	0	0	4	2	1	1	0	0	0	21	12	6	6	0
	Area Total	25	0	84	16	5	21	1	20	1	74	27	22	9	0
	% of total	16.6	0.0	55.6	10.6	3.3	13.9	0.7	13.1	0.7	48.4	17.6	14.4	5.9	0.0
8-2	October	16	0	3	2	0	0	0	18	1	9	2	0	2	0
	November	8	0	3	4	0	0	0	11	0	4	2	0	0	0
	December	32	0	1	12	0	0	0	39	1	9	5	0	0	0
	January	0	0	45	0	10	13	0	0	0	57	1	6	3	0
	February	0	0	97	1	9	18	0	0	0	50	7	5	2	0
	March	0	0	50	1	1	6	0	0	0	89	14	11	4	0
	April	0	0	49	2	6	5	0	0	0	53	16	11	1	0
	Area Total	56	0	248	22	26	42	0	68	2	271	47	33	12	0
	% of total	14.2	0.0	62.9	5.6	6.6	10.7	0.0	15.7	0.5	62.6	10.9	7.6	2.8	0.0
Combined Areas	**Grand Total**	**81**	**0**	**332**	**38**	**31**	**63**	**1**	**88**	**3**	**345**	**74**	**55**	**21**	**0**
	% of total	**14.9**	**0.0**	**60.9**	**7.0**	**5.7**	**11.6**	**0.2**	**15.0**	**0.5**	**58.9**	**12.6**	**9.4**	**3.6**	**0.0**

Appendix D2. Within-area and -year age-composition details for marked Chinook encounters sampled in the test fishery during the Areas 8-1 and 8-2 selective Chinook fishery, 2005-06 and 2006-07 seasons.

		2005-06 Age (Gilbert-Rich) Composition								2006-07 Age (Gilbert-Rich) Composition							
Area	**Month**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**
8-1	October	12	11	5	0	0	0	0	0	158	51	119	5	4	0	0	0
	November	3	15	4	0	3	0	0	0	26	7	9	0	2	0	1	0
	December	8	16	0	1	4	0	0	0	94	29	58	2	3	0	0	0
	January	0	33	0	23	4	1	0	0	0	95	0	34	99	3	7	0
	February	0	27	0	19	4	2	2	0	0	63	0	24	44	2	6	0
	March	0	20	0	11	4	0	1	0	0	16	0	19	28	4	2	0
	April	0	1	0	9	5	0	1	0	0	34	0	13	10	5	4	0
	Area Total	23	123	9	63	24	3	4	0	278	295	186	97	190	14	20	0
	% of total	9.2	49.4	3.6	25.3	9.6	1.2	1.6	0.0	25.7	27.3	17.2	9.0	17.6	1.3	1.9	0.0
8-2	October	12	9	3	1	0	0	0	0	192	21	125	3	3	0	0	0
	November	9	11	4	1	3	0	0	0	25	3	10	0	0	0	0	0
	December	2	10	1	2	4	0	0	0	81	17	39	0	1	0	0	0
	January	0	0	0	23	3	2	4	0	0	18	0	9	48	0	0	0
	February	0	6	0	13	7	0	1	0	0	22	0	9	23	3	0	0
	March	0	8	0	14	1	0	1	0	0	27	0	8	18	0	1	0
	April	0	2	0	6	4	2	1	0	0	47	0	17	11	3	0	0
	Area Total	23	46	8	60	22	4	7	0	298	155	174	46	104	6	1	0
	of total	13.5	27.1	4.7	35.3	12.9	2.4	4.1	0.0	38.0	19.8	22.2	5.9	13.3	0.8	0.1	0.0
Combined Areas	**Grand Total**	**46**	**169**	**17**	**123**	**46**	**7**	**11**	**0**	**576**	**450**	**360**	**143**	**294**	**20**	**21**	**0**
	of total	**11.0**	**40.3**	**4.1**	**29.4**	**11.0**	**1.7**	**2.6**	**0.0**	**30.9**	**24.1**	**19.3**	**7.7**	**15.8**	**1.1**	**1.1**	**0.0**

Appendix D3. Within-area and -year age-composition details for unmarked Chinook encounters sampled in the test fishery during the Areas 8-1 and 8-2 selective Chinook fishery, 2005-06 and 2006-07 seasons.

		2005-06 Age (Gilbert-Rich) Composition								2006-07 Age (Gilbert-Rich) Composition							
Area	**Month**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**	**1.1**	**2.1**	**2.2**	**3.1**	**3.2**	**4.1**	**4.2**	**5.1**
8-1	October	7	3	3	0	0	0	0	0	150	12	68	2	1	0	0	0
	November	6	10	2	0	2	0	0	0	13	2	8	0	1	0	0	0
	December	13	11	1	0	0	0	0	0	56	11	21	0	0	0	0	0
	January	0	29	0	20	0	0	0	0	0	55	0	17	30	6	1	0
	February	0	20	0	9	5	0	0	0	0	34	0	11	12	2	0	0
	March	0	11	0	4	1	0	0	0	0	14	0	3	11	3	3	1
	April	0	2	0	8	3	0	0	0	0	19	0	10	2	6	1	0
	Area Total	26	86	6	41	11	0	0	0	219	147	97	43	57	17	5	1
	% of total	15.3	50.6	3.5	24.1	6.5	0.0	0.0	0.0	37.4	25.1	16.6	7.3	9.7	2.9	0.9	0.2
8-2	October	12	3	1	0	0	0	0	0	125	8	44	1	0	0	0	0
	November	4	8	0	2	0	0	0	0	18	0	2	0	0	0	0	0
	December	5	11	1	0	1	0	0	0	44	2	10	0	0	0	0	0
	January	0	1	0	13	1	1	0	0	0	19	0	2	14	1	0	0
	February	0	4	0	11	1	0	0	0	0	21	0	1	7	0	0	0
	March	0	4	0	8	4	0	1	0	0	21	0	3	7	0	0	0
	April	0	0	0	2	1	0	0	0	0	14	0	4	1	0	0	0
	Area Total	21	31	2	36	8	1	1	0	187	85	56	11	29	1	0	0
	of total	21.0	31.0	2.0	36.0	8.0	1.0	1.0	0.0	50.7	23.0	15.2	3.0	7.9	0.3	0.0	0.0
Combined Areas	**Grand Total**	**47**	**117**	**8**	**77**	**19**	**1**	**1**	**0**	**406**	**232**	**153**	**54**	**86**	**18**	**5**	**1**
	of total	**17.4**	**43.3**	**3.0**	**28.5**	**7.0**	**0.4**	**0.4**	**0.0**	**42.5**	**24.3**	**16.0**	**5.7**	**9.0**	**1.9**	**0.5**	**0.1**

Appendix E1. Method-1 Chinook encounters apportioned to size/mark-status groups, Areas 8-1 and 8-2 selective Chinook fishery in the 2005-06 and 2006-07 seasons.

Note: We did not adjust apportioned estimates when negative releases were estimated; this phenomenon was assumed to be the result of sampling error that is negligible on a full-season basis.

2005-06 Season			M1 Chinook Encounters, by size/mark-status class										M1 Harvested Chinook (= retention mortality), by size/mark-status class										Released Chinook, by size/mark-status class									
Area	Stat Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
8-1	Oct	Oct_1-30	33	306	0	0	229	3500	114	1353	376	7426	37	317	0	0	5	6	0	0	41	322	-4	622	0	0	224	3505	114	1353	335	5481
	Nov	Oct_31-Nov_27	23	69	25	78	56	244	40	146	144	1122	39	560	0	0	5	9	0	0	44	569	-16	629	25	78	52	254	40	146	100	1106
	Dec	Nov_28-Dec_31	50	321	22	135	50	321	95	662	218	1867	44	428	0	0	5	8	0	0	49	436	7	749	22	135	45	329	95	662	169	1875
	Jan	Jan_1-29	26	71	31	77	68	299	58	234	183	1678	38	207	0	0	5	4	0	0	43	211	-12	278	31	77	63	303	58	234	140	892
	Feb	Jan_30-Feb_26	112	566	34	170	122	616	78	392	347	1805	97	472	0	0	12	14	0	0	109	486	15	1038	34	170	110	630	78	392	238	2231
	Mar	Feb_27-Mar_26	28	82	10	23	79	378	53	207	169	1362	31	155	0	0	4	3	0	0	35	158	-4	237	10	23	75	381	53	207	134	848
	Apr	Mar_27-Apr_30	25	77	25	77	18	58	18	58	85	146	19	40	0	0	2	1	0	0	21	41	6	118	25	77	15	59	18	58	64	312
	Season	**Total**	**297**	**1493**	**147**	**561**	**622**	**5417**	**456**	**3052**	**1522**	**15406**	**304**	**2179**	**0**	**0**	**38**	**44**	**0**	**0**	**342**	**2223**	**-8**	**3672**	**147**	**561**	**585**	**5461**	**456**	**3052**	**1180**	**12746**
8-2	Oct	Oct_1-30	22	121	37	349	273	1666	157	1285	489	1224	36	76	2	3	1	0	0	0	39	79	-14	197	35	352	272	1666	157	1285	450	3500
	Nov	Oct_31-Nov_27	21	26	17	26	44	62	22	32	104	91	26	2	2	0	1	0	0	0	29	2	-5	28	15	26	43	62	22	32	75	149
	Dec	Nov_28-Dec_31	151	1192	98	772	62	431	88	772	398	3052	102	235	7	9	5	2	0	0	114	246	48	1427	91	781	57	433	88	772	284	3413
	Jan	Jan_1-29	216	1955	143	1444	184	1762	77	842	620	3088	151	563	5	12	7	4	0	0	163	578	65	2518	138	1456	177	1766	77	842	457	6581
	Feb	Jan_30-Feb_26	226	2735	175	2292	307	3301	95	1380	803	1973	195	534	11	23	11	7	0	0	217	564	31	3269	164	2316	296	3307	95	1380	586	10272
	Mar	Feb_27-Mar_26	74	566	74	566	166	1008	102	736	416	1108	82	61	6	6	4	1	0	0	92	68	-7	627	68	571	162	1009	102	736	324	2943
	Apr	Mar_27-Apr_30	129	1196	66	687	190	1582	60	687	444	947	142	211	7	2	7	3	0	0	156	215	-13	1407	59	689	183	1585	60	687	288	4369
	Season	**Total**	**838**	**7792**	**610**	**6137**	**1227**	**9812**	**600**	**5735**	**3274**	**11482**	**733**	**1681**	**40**	**55**	**37**	**16**	**0**	**0**	**810**	**1752**	**104**	**9473**	**570**	**6191**	**1190**	**9828**	**600**	**5735**	**2464**	**31227**

2006-07 Season			M1 Chinook Encounters, by size/mark-status class										M1 Harvested Chinook (= retention mortality), by size/mark-status class										Released Chinook, by size/mark-status class									
Area	Stat Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
8-1	Oct	Oct_1-28	113	828	32	161	1369	59829	969	31132	2483	188733	44	274	3	4	6	6	1	2	54	287	69	1102	29	165	1363	59836	968	31134	2429	92237
	Nov	Oct_29-Dec_3	36	161	8	27	220	2823	123	1028	387	7914	11	28	0	0	2	1	0	0	13	29	25	189	8	27	219	2823	123	1028	375	4068
	Dec	Dec_4-Jan_1	91	446	26	118	574	4359	274	1619	966	9453	47	141	0	0	6	4	0	0	54	146	44	587	26	118	568	4364	274	1619	912	6688
	Jan	Jan_2-28	59	196	30	77	303	2997	136	726	529	8438	19	54	0	0	3	1	0	0	22	56	40	250	30	77	301	2998	136	726	507	4051
	Feb	Jan_29-Feb_25	133	1385	44	274	550	16559	255	4108	982	49732	22	55	3	5	3	1	1	2	29	63	111	1440	42	279	547	16561	253	4109	953	22389
	Mar	Feb_26-Apr_1	538	12377	175	2800	613	14994	350	6788	1676	75493	65	77	3	7	9	5	1	2	78	90	473	12454	172	2807	604	14999	349	6790	1598	37050
	Apr	Apr_2-29	277	3112	171	1884	469	5417	245	2740	1162	14768	69	137	0	0	9	6	0	0	78	143	208	3248	171	1884	460	5423	245	2740	1084	13295
	Season	**Total**	**1248**	**18504**	**487**	**5341**	**4098**	**106979**	**2351**	**48140**	**8185**	**354529**	**278**	**767**	**8**	**16**	**37**	**25**	**4**	**6**	**328**	**813**	**970**	**19271**	**479**	**5357**	**4061**	**107004**	**2347**	**48146**	**7857**	**179778**
8-2	Oct	Oct_1-28	133	1534	68	851	4235	59692	2333	31641	6770	103566	59	16	3	0	5	1	1	0	67	17	74	1550	65	851	4230	59693	2333	31641	6702	93735
	Nov	Oct_29-Dec_3	19	113	16	113	716	6708	359	3035	1110	11776	28	11	1	0	3	0	0	0	33	12	-9	124	15	113	713	6708	359	3035	1078	9980
	Dec	Dec_4-Jan_1	115	1403	2	0	1757	14085	717	8343	2592	14163	109	24	3	3	10	2	0	0	123	30	6	1427	-1	3	1747	14088	717	8343	2469	23861
	Jan	Jan_2-28	57	904	1	0	1061	9273	599	7534	1718	5936	119	47	3	0	12	4	0	0	135	51	-62	951	-2	0	1049	9277	598	7534	1583	17762
	Feb	Jan_29-Feb_25	203	4433	46	1009	1258	23069	585	12048	2092	32414	104	190	3	1	11	5	0	0	118	196	99	4623	43	1010	1247	23074	585	12048	1973	40754
	Mar	Feb_26-Apr_1	270	6973	81	2168	1618	30917	971	21695	2939	36724	233	633	3	0	25	20	0	0	261	653	36	7606	78	2169	1592	30937	970	21695	2677	62406
	Apr	Apr_2-29	338	5095	71	1222	1117	10008	301	4644	1827	6126	127	124	3	3	14	5	1	0	144	132	211	5219	68	1224	1104	10013	301	4644	1683	21101
	Season	**Total**	**1135**	**20455**	**284**	**5362**	**11763**	**153752**	**5865**	**88939**	**19048**	**210705**	**780**	**1045**	**18**	**8**	**81**	**37**	**3**	**1**	**882**	**1091**	**354**	**21499**	**266**	**5371**	**11683**	**153789**	**5862**	**88941**	**18166**	**269600**

Appendix E2. Method-2 Chinook encounters apportioned to size/mark-status groups, Areas 8-1 and 8-2 selective Chinook fishery in the 2005-06 and 2006-07 seasons.

Note: We did not adjust apportioned estimates when negative releases were estimated; this phenomenon was assumed to be the result of sampling error that is negligible on a full-season basis.

2005-06 Season			M2 Chinook Encounters, by size/mark-status class										M2 Harvested Chinook (= retention mortality), by size/mark-status class										Released Chinook, by size/mark-status class									
Area	Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
8-1	Oct	Oct_1-30	37	317	0	0	256	31682	128	8516	420	82992	37	317	0	0	5	6	0	0	41	322	0	0	0	0	251	31688	128	8516	379	40204
	Nov	Oct_31-Nov_27	39	560	43	935	96	4300	68	2202	246	26704	39	560	0	0	5	9	0	0	44	569	0	0	43	935	91	4310	68	2202	202	7447
	Dec	Nov_28-Dec_31	44	428	19	204	44	762	82	2354	189	11172	44	428	0	0	5	8	0	0	49	436	0	0	19	204	38	769	82	2354	140	3328
	Jan	Jan_1-29	38	207	44	393	99	1936	84	1460	265	12864	38	207	0	0	5	4	0	0	43	211	0	0	44	393	94	1940	84	1460	222	3793
	Feb	Jan_30-Feb_26	97	472	30	184	105	1182	68	588	300	7173	97	472	0	0	12	14	0	0	109	486	0	0	30	184	94	1196	68	588	191	1967
	Mar	Feb_27-Mar_26	31	155	11	51	89	1854	60	889	191	8077	31	155	0	0	4	3	0	0	35	158	0	0	11	51	85	1857	60	889	156	2797
	Apr	Mar_27-Apr_30	19	40	19	114	13	69	13	69	64	907	19	40	0	0	2	1	0	0	21	41	0	0	19	114	11	70	13	69	43	253
	Season	**Total**	**304**	**2179**	**165**	**1881**	**702**	**41786**	**503**	**16078**	**1674**	**149889**	**304**	**2179**	**0**	**0**	**38**	**44**	**0**	**0**	**342**	**2223**	**0**	**0**	**165**	**1881**	**664**	**41830**	**503**	**16078**	**1332**	**59789**
8-2	Oct	Oct_1-30	36	76	81	8431	624	427098	362	149238	1102	1286891	36	76	2	3	1	0	0	0	39	79	0	0	79	8434	622	427098	362	149238	1063	584771
	Nov	Oct_31-Nov_27	26	2	22	86	58	408	28	119	133	1585	26	2	2	0	1	0	0	0	29	2	0	0	20	86	57	408	28	119	104	613
	Dec	Nov_28-Dec_31	102	235	68	468	45	223	58	468	274	3806	102	235	7	9	5	2	0	0	114	246	0	0	61	477	41	225	58	468	160	1170
	Jan	Jan_1-29	151	563	98	1167	128	1634	53	530	429	10973	151	563	5	12	7	4	0	0	163	578	0	0	93	1179	120	1638	53	530	266	3347
	Feb	Jan_30-Feb_26	195	534	152	3178	267	6822	82	1470	697	31546	195	534	11	23	11	7	0	0	217	564	0	0	141	3201	256	6828	82	1470	480	11499
	Mar	Feb_27-Mar_26	82	61	83	1386	184	4322	113	2202	462	21884	82	61	6	6	4	1	0	0	92	68	0	0	77	1391	180	4323	113	2202	370	7917
	Apr	Mar_27-Apr_30	142	211	74	1310	217	6325	68	1310	501	22310	142	211	7	2	7	3	0	0	156	215	0	0	67	1311	210	6327	68	1310	345	8948
	Season	**Total**	**733**	**1681**	**577**	**16025**	**1522**	**446832**	**764**	**155337**	**3597**	**1378995**	**733**	**1681**	**40**	**55**	**37**	**16**	**0**	**0**	**810**	**1752**	**0**	**0**	**537**	**16080**	**1485**	**446848**	**764**	**155337**	**2787**	**618265**

2006-07 Season			M2 Chinook Encounters, by size/mark-status class										M2 Harvested Chinook (= retention mortality), by size/mark-status class										Released Chinook, by size/mark-status class									
Area	Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
8-1	Oct	Oct_1-28	44	274	13	48	536	50394	379	25434	972	164603	44	274	3	4	6	6	1	2	54	287	0	0	10	52	530	50400	378	25436	918	75888
	Nov	Oct_29-Dec_3	11	28	3	4	69	1393	38	447	121	4231	11	28	0	0	2	1	0	0	13	29	0	0	3	4	67	1393	38	447	108	1844
	Dec	Dec_4-Jan_1	47	141	13	49	297	9670	142	2370	499	26583	47	141	0	0	6	4	0	0	54	146	0	0	13	49	290	9674	142	2370	446	12093
	Jan	Jan_2-28	19	54	10	22	100	1696	44	352	173	5080	19	54	0	0	3	1	0	0	22	56	0	0	10	22	97	1697	44	352	151	2072
	Feb	Jan_29-Feb_25	22	55	7	12	91	1176	42	267	162	3669	22	55	3	5	3	1	1	2	29	63	0	0	5	17	88	1177	41	269	133	1464
	Mar	Feb_26-Apr_1	65	77	21	44	74	259	42	112	203	1401	65	77	3	7	9	5	1	2	78	90	0	0	18	51	65	264	41	114	125	429
	Apr	Apr_2-29	69	137	42	202	117	981	61	346	289	4877	69	137	0	0	9	6	0	0	78	143	0	0	42	202	108	988	61	346	211	1536
	Season	**Total**	**278**	**767**	**110**	**382**	**1282**	**65569**	**749**	**29329**	**2419**	**210444**	**278**	**767**	**8**	**16**	**37**	**25**	**4**	**6**	**328**	**813**	**0**	**0**	**101**	**398**	**1245**	**65593**	**745**	**29334**	**2091**	**95325**
8-2	Oct	Oct_1-28	59	16	27	188	1746	265038	934	85535	2767	678031	59	16	3	1	5	1	1	1	67	18	0	0	25	189	1741	265039	933	85536	2699	350763
	Nov	Oct_29-Dec_3	28	11	28	757	1291	819043	653	218104	2001	1963824	28	11	1	0	3	0	1	0	33	13	0	0	28	757	1288	819043	652	218105	1968	1037905
	Dec	Dec_4-Jan_1	109	24	2	0	1666	339012	678	67747	2455	738593	109	24	2	3	10	2	1	1	123	30	0	0	0	3	1656	339014	677	67748	2332	406765
	Jan	Jan_2-28	119	47	1	0	2275	1696778	1298	584570	3693	4404115	119	47	0	0	12	4	3	0	135	50	0	0	1	0	2262	1696781	1295	584570	3558	2281351
	Feb	Jan_29-Feb_25	104	190	24	322	645	52098	300	13080	1073	135528	104	190	3	1	11	5	0	0	118	196	0	0	21	324	634	52103	300	13080	955	65506
	Mar	Feb_26-Apr_1	233	633	70	2106	1399	216933	839	85995	2541	667112	233	633	0	0	25	20	3	0	261	653	0	0	70	2106	1373	216953	836	85995	2280	305054
	Apr	Apr_2-29	127	124	26	204	419	9898	113	1265	685	23593	127	124	3	3	14	5	0	0	144	132	0	0	23	207	405	9904	113	1265	541	11375
	Season	**Total**	**780**	**1045**	**179**	**3577**	**9440**	**3398800**	**4815**	**1056295**	**15215**	**8610796**	**780**	**1045**	**12**	**9**	**81**	**37**	**9**	**2**	**882**	**1092**	**0**	**0**	**167**	**3586**	**9360**	**3398837**	**4806**	**1056297**	**14333**	**4458720**

Appendix E3. Method-1 Chinook mortality apportioned to size/mark-status groups**,** Areas 8-1 and 8-2 selective Chinook fishery in the 2005-06 and 2006-07 seasons**.** Although estimated release mortality and total mortality are presented only, harvest mortality appears in Appendix E1 (i.e., 'Harvested Chinook'). We did not adjust apportioned estimates when negative releases mortality was estimated; this phenomenon was assumed to be the result of sampling error that became negligible on a full-season basis.

				M1: Chinook Release Mortality, by size/mark-status class									M1: Chinook Total Mortality (harvest+release), by class								
Season	Area	Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
2005-6	8-1	Oct	Oct_1-30	-1	14	0	0	45	140	23	54	67	208	36	331	0	0	49	146	23	54	108	531
		Nov	Oct_31-Nov_27	-2	14	4	2	10	10	8	6	20	32	37	574	4	2	15	19	8	6	64	601
		Dec	Nov_28-Dec_31	1	17	3	3	9	13	19	26	32	60	45	445	3	3	14	21	19	26	81	495
		Jan	Jan_1-29	-2	6	5	2	13	12	12	9	27	29	36	213	5	2	17	16	12	9	70	241
		Feb	Jan_30-Feb_26	2	23	5	4	22	25	16	16	45	68	99	495	5	4	34	39	16	16	154	554
		Mar	Feb_27-Mar_26	-1	5	1	1	15	15	11	8	26	29	31	161	1	1	19	18	11	8	61	188
		Apr	Mar_27-Apr_30	1	3	4	2	3	2	4	2	11	9	20	43	4	2	5	3	4	2	32	50
		Season	**Total**	**-1**	**83**	**22**	**13**	**117**	**218**	**91**	**122**	**229**	**436**	**303**	**2262**	**22**	**13**	**154**	**263**	**91**	**122**	**571**	**2659**
	8-2	Oct	Oct_1-30	-2	4	5	8	54	67	31	51	89	130	34	80	7	11	56	67	31	51	128	209
		Nov	Oct_31-Nov_27	-1	1	2	1	9	2	4	1	14	5	25	3	4	1	10	3	4	1	43	7
		Dec	Nov_28-Dec_31	7	32	14	18	11	17	18	31	50	98	110	267	21	27	16	19	18	31	164	344
		Jan	Jan_1-29	10	57	21	33	35	71	15	34	81	194	160	619	26	44	43	75	15	34	244	772
		Feb	Jan_30-Feb_26	5	74	25	52	59	132	19	55	107	313	200	607	36	75	70	139	19	55	324	877
		Mar	Feb_27-Mar_26	-1	14	10	13	32	40	20	29	62	97	80	75	16	19	37	41	20	29	154	165
		Apr	Mar_27-Apr_30	-2	32	9	16	37	63	12	27	55	138	140	242	16	17	44	66	12	27	211	353
		Season	**Total**	**16**	**213**	**85**	**139**	**238**	**393**	**120**	**229**	**459**	**975**	**749**	**1894**	**125**	**194**	**275**	**409**	**120**	**229**	**1269**	**2727**
2006-7	8-1	Oct	Oct_1-28	10	25	4	4	273	2393	194	1245	481	3667	55	299	7	8	278	2400	195	1247	535	3954
		Nov	Oct_29-Dec_3	4	4	1	1	44	113	25	41	73	159	15	32	1	1	45	114	25	41	86	188
		Dec	Dec_4-Jan_1	7	13	4	3	114	175	55	65	179	255	54	155	4	3	120	179	55	65	232	401
		Jan	Jan_2-28	6	6	5	2	60	120	27	29	98	156	25	60	5	2	63	121	27	29	120	212
		Feb	Jan_29-Feb_25	17	32	6	6	109	662	51	164	183	865	39	87	9	11	112	664	52	166	212	928
		Mar	Feb_26-Apr_1	71	280	26	63	121	600	70	272	287	1215	136	357	29	70	130	605	71	274	365	1305
		Apr	Apr_2-29	31	73	26	42	92	217	49	110	198	442	100	210	26	42	101	223	49	110	276	585
		Season	**Total**	**146**	**434**	**72**	**121**	**812**	**4280**	**469**	**1926**	**1499**	**6760**	**424**	**1200**	**80**	**137**	**849**	**4305**	**474**	**1932**	**1827**	**7573**
2006-7	8-2	Oct	Oct_1-28	11	35	10	19	846	2388	467	1266	1333	3707	70	51	13	19	851	2388	467	1266	1401	3725
		Nov	Oct_29-Dec_3	-1	3	2	3	143	268	72	121	215	395	27	14	3	3	146	269	72	121	248	407
		Dec	Dec_4-Jan_1	1	32	0	0	349	564	143	334	493	929	110	56	3	3	360	566	144	334	617	959
		Jan	Jan_2-28	-9	21	0	0	210	371	120	301	320	694	110	68	3	0	222	375	120	302	455	745
		Feb	Jan_29-Feb_25	15	104	6	23	249	923	117	482	388	1532	119	294	9	24	261	928	117	482	506	1728
		Mar	Feb_26-Apr_1	5	171	12	49	318	1237	194	868	530	2325	239	804	14	49	344	1258	194	868	791	2979
		Apr	Apr_2-29	32	117	10	28	221	401	60	186	323	731	159	241	13	30	234	406	61	186	467	863
		Season	**Total**	**53**	**484**	**40**	**121**	**2337**	**6152**	**1172**	**3558**	**3602**	**10314**	**834**	**1528**	**58**	**129**	**2417**	**6188**	**1175**	**3559**	**4484**	**11405**

Appendix E4. Method-2 Chinook mortality apportioned to size/mark-status groups, Areas 8-1 and 8-2 selective Chinook fishery in the 2005-06 and 2006-07 seasons. Although estimated release mortality and total mortality are presented only, harvest mortality appears in Appendix E1 (i.e., 'Harvested Chinook'). We did not adjust apportioned estimates when negative releases mortality was estimated; this phenomenon was assumed to be the result of sampling error that became negligible on a full-season basis.

				M2: Chinook Release Mortality, by size/mark-status class										M2: Chinook Total Mortality (harvest+release), by class									
Season	Area	Month	Date Range	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)	LM	v(LM)	LU	v(LU)	SM	v(SM)	SU	v(SU)	Total	v(Total)
2005-6	8-1	Oct	Oct_1-30	0	0	0	0	50	1268	26	341	76	1608	37	317	0	0	55	1273	26	341	117	1930
		Nov	Oct_31-Nov_27	0	0	6	21	18	172	14	88	38	282	39	560	6	21	23	182	14	88	82	850
		Dec	Nov_28-Dec_31	0	0	3	5	8	31	16	94	27	130	44	428	3	5	13	38	16	94	76	565
		Jan	Jan_1-29	0	0	7	9	19	78	17	58	42	145	38	207	7	9	24	82	17	58	85	356
		Feb	Jan_30-Feb_26	0	0	4	4	19	48	14	24	37	75	97	472	4	4	31	62	14	24	146	561
		Mar	Feb_27-Mar_26	0	0	2	1	17	74	12	36	31	111	31	155	2	1	21	77	12	36	66	269
		Apr	Mar_27-Apr_30	0	0	3	3	2	3	3	3	8	8	19	40	3	3	5	4	3	3	29	49
		Season	**Total**	**0**	**0**	**25**	**42**	**133**	**1673**	**101**	**643**	**258**	**2359**	**304**	**2179**	**25**	**42**	**170**	**1717**	**101**	**643**	**600**	**4582**
2005-6	8-2	Oct	Oct_1-30	0	0	12	190	124	17084	72	5970	209	23243	36	76	14	193	126	17084	72	5970	248	23322
		Nov	Oct_31-Nov_27	0	0	3	2	11	16	6	5	20	23	26	2	5	2	12	16	6	5	49	25
		Dec	Nov_28-Dec_31	0	0	9	11	8	9	12	19	29	38	102	235	16	20	13	11	12	19	143	285
		Jan	Jan_1-29	0	0	14	27	24	66	11	21	49	113	151	563	19	38	31	69	11	21	212	692
		Feb	Jan_30-Feb_26	0	0	21	72	51	273	16	59	89	404	195	534	32	95	62	280	16	59	306	968
		Mar	Feb_27-Mar_26	0	0	11	31	36	173	23	88	70	292	82	61	17	37	40	174	23	88	162	360
		Apr	Mar_27-Apr_30	0	0	10	30	42	253	14	52	66	335	142	211	17	31	49	256	14	52	222	550
		Season	**Total**	**0**	**0**	**81**	**362**	**297**	**17874**	**153**	**6213**	**530**	**24449**	**733**	**1681**	**121**	**416**	**334**	**17890**	**153**	**6213**	**1340**	**26201**
2006-7	8-1	Oct	Oct_1-28	0	0	1	1	106	2016	76	1017	183	3035	44	274	4	6	112	2022	77	1019	237	3322
		Nov	Oct_29-Dec_3	0	0	0	0	13	56	8	18	21	74	11	28	0	0	15	56	8	18	34	102
		Dec	Dec_4-Jan_1	0	0	2	1	58	387	28	95	88	483	47	141	2	1	64	391	28	95	142	628
		Jan	Jan_2-28	0	0	2	0	19	68	9	14	30	82	19	54	2	0	22	69	9	14	52	138
		Feb	Jan_29-Feb_25	0	0	1	0	18	47	8	11	26	58	22	55	3	5	21	48	9	12	55	121
		Mar	Feb_26-Apr_1	0	0	3	1	13	11	8	5	24	16	65	77	6	8	22	15	10	7	102	107
		Apr	Apr_2-29	0	0	6	5	22	40	12	14	40	58	69	137	6	5	31	46	12	14	118	201
		Season	**Total**	**0**	**0**	**15**	**9**	**249**	**2624**	**149**	**1173**	**413**	**3806**	**278**	**767**	**24**	**25**	**286**	**2648**	**153**	**1179**	**741**	**4619**
2006-7	8-2	Oct	Oct_1-28	0	0	4	4	348	10602	187	3421	539	14027	59	16	6	5	353	10602	188	3422	606	14046
		Nov	Oct_29-Dec_3	0	0	4	17	258	32762	130	8724	392	41503	28	11	5	17	261	32762	131	8725	425	41516
		Dec	Dec_4-Jan_1	0	0	0	0	331	13561	135	2710	466	16271	109	24	2	3	341	13563	136	2711	590	16300
		Jan	Jan_2-28	0	0	0	0	452	67871	259	23383	712	91254	119	47	0	0	465	67875	262	23383	847	91305
		Feb	Jan_29-Feb_25	0	0	3	7	127	2084	60	523	190	2615	104	190	6	9	138	2089	60	523	308	2811
		Mar	Feb_26-Apr_1	0	0	10	47	275	8678	167	3440	452	12165	233	633	10	47	300	8698	170	3440	714	12818
		Apr	Apr_2-29	0	0	3	5	81	396	23	51	107	451	127	124	7	8	95	401	23	51	251	584
		Season	**Total**	**0**	**0**	**25**	**81**	**1872**	**135953**	**961**	**42252**	**2858**	**178286**	**780**	**1045**	**37**	**89**	**1953**	**135990**	**970**	**42254**	**3740**	**179378**

Appendix F1. 2005-06 Area 8-1/8-2 FRAM selective fishery report.

```
Species: CHINOOK   Version#:5.22          CMD File: 2705.cmd                Date: 04-07-2005
Report : Selective Fishery Report         DRV File: chinSelf.DRV            Time: 13:00:24
Title  : Final April PFMC 86.5K NT; 48K T

Fishery:NT Area 8-1,2 Sport             TimeStep:Oct-Apr-Yr2
```

Stock Name	Age	UnMark Handled	UnMark Catch	UnMark NonRete	UnMark Dropoff	UnMark SubLegl	Marked Handled	Marked Catch	Marked NonRete	Marked Dropoff	Marked SubLegl
NkSm FF	2	0	0	0	0	2	0	0	0	0	26
NkSm FF	3	6	0	1	0	1	71	67	0	4	14
NkSm FF	4	7	1	1	0	0	83	78	0	4	0
Skag FF	2	0	0	0	0	57	0	0	0	0	2
Skag FF	3	0	0	0	0	30	0	0	0	0	1
Skag FF	4	0	0	0	0	3	0	0	0	0	0
Skag FY	3	1	0	0	0	2	0	0	0	0	0
Skag FY	4	408	33	38	20	4	0	0	0	0	0
Skag FY	5	171	14	16	9	0	0	0	0	0	0
Skag SY	3	19	2	2	1	20	17	16	0	1	18
Skag SY	4	102	8	9	5	0	85	80	1	4	0
Skag SY	5	9	1	1	0	0	5	5	0	0	0
Snoh FF	2	0	0	0	0	177	0	0	0	0	91
Snoh FF	3	364	29	33	18	91	188	177	1	9	47
Snoh FF	4	152	12	14	8	2	82	77	0	4	1
Snoh FY	3	22	2	2	1	13	14	13	0	1	8
Snoh FY	4	470	38	43	23	4	300	282	2	15	2
Snoh FY	5	69	5	6	3	0	44	41	0	2	0
Stil FF	2	0	0	0	0	26	0	0	0	0	7
Stil FF	3	53	4	5	3	13	14	13	0	1	4
Stil FF	4	49	4	5	2	1	3	3	0	0	0
Tula FF	2	0	0	0	0	224	0	0	0	0	24
Tula FF	3	146	12	13	7	119	16	15	0	1	13
Tula FF	4	42	3	4	2	2	6	6	0	0	0
MiPS FF	2	0	0	0	0	5	0	0	0	0	23
MiPS FF	3	11	1	1	1	2	53	50	0	3	12
MiPS FF	4	0	0	0	0	0	0	0	0	0	1
UWAc FF	2	0	0	0	0	0	0	0	0	0	9
UWAc FF	3	0	0	0	0	0	27	25	0	1	2
UWAc FF	4	0	0	0	0	0	19	18	0	1	0
SPSo FF	2	0	0	0	0	20	0	0	0	0	175
SPSo FF	3	29	2	3	1	10	256	240	2	13	92
SPSo FF	4	0	0	0	0	0	0	0	0	0	3
Whte SpFi	2	0	0	0	0	3	0	0	0	0	0
Whte SpFi	3	3	0	0	0	2	0	0	0	0	0
Whte SpFi	4	8	1	1	0	0	0	0	0	0	0
Whte SpFi	5	3	0	0	0	0	0	0	0	0	0
HdCl FF	2	0	0	0	0	254	0	0	0	0	14
HdCl FF	3	687	55	63	34	133	38	36	0	2	7
HdCl FF	4	0	0	0	0	3	0	0	0	0	0
SJDF FF	2	0	0	0	0	10	0	0	0	0	1
SJDF FF	3	0	0	0	0	5	0	0	0	0	1
BPH Tu	2	0	0	0	0	77	0	0	0	0	1
BPH Tu	3	239	19	22	12	14	3	3	0	0	0
Fraser Lt	2	0	0	0	0	351	0	0	0	0	7
Fraser Lt	3	0	0	0	0	187	0	0	0	0	4
Fraser Lt	4	100	8	9	5	5	2	2	0	0	0
Fraser Er	2	0	0	0	0	26	0	0	0	0	1
Fraser Er	3	0	0	0	0	5	0	0	0	0	0
WhtSPYr	2	0	0	0	0	1	0	0	0	0	0
WhtSPYr	3	0	0	0	0	1	0	0	0	0	0
WhtSPYr	4	2	0	0	0	0	0	0	0	0	0
FRAM Stocks		3172	254	292	159	1903	1325	1245	8	66	614

Appendix F2. 2006-07 Area 8-1/8-2 FRAM selective fishery report.

```
Species: CHINOOK   Version#:5.24          CMD File: 3006.cmd                Date: 04-07-2006
Report : Selective Fishery Report         DRV File: chinSelf.DRV            Time: 12:06:19
Title  : final April PFMC Apr 7 am; NT 65K; T 42.2K

Fishery:NT Area 8-1,2 Sport             TimeStep:Oct-Apr-Yr2
```

Stock Name	Age	UnMark Handled	UnMark Catch	UnMark NonRete	UnMark Dropoff	UnMark SubLegl	Marked Handled	Marked Catch	Marked NonRete	Marked Dropoff	Marked SubLegl
NkSm FF	2	0	0	0	0	3	0	0	0	0	29
NkSm FF	3	5	0	1	0	1	63	60	0	3	16
NkSm FF	4	10	1	1	1	0	72	68	0	4	0
Skag FF	2	0	0	0	0	168	0	0	0	0	4
Skag FF	3	0	0	0	0	89	0	0	0	0	2
Skag FY	3	3	0	0	0	7	0	0	0	0	0
Skag FY	4	47	4	4	2	0	0	0	0	0	0
Skag FY	5	271	22	25	14	0	0	0	0	0	0
Skag SY	3	11	1	1	1	14	9	9	0	0	12
Skag SY	4	62	5	6	3	0	46	43	0	2	0
Skag SY	5	6	0	1	0	0	4	3	0	0	0
Snoh FF	2	0	0	0	0	148	0	0	0	0	112
Snoh FF	3	290	23	27	14	76	221	207	1	11	58
Snoh FF	4	54	4	5	3	1	37	35	0	2	1
Snoh FY	3	11	1	1	1	8	9	9	0	0	7
Snoh FY	4	375	30	35	19	4	316	297	2	16	3
Snoh FY	5	39	3	4	2	0	24	23	0	1	0
Stil FF	2	0	0	0	0	22	0	0	0	0	7
Stil FF	3	43	3	4	2	11	14	13	0	1	4
Stil FF	4	12	1	1	1	0	2	2	0	0	0
Tula FF	2	0	0	0	0	140	0	0	0	0	319
Tula FF	3	77	6	7	4	75	176	166	1	9	171
Tula FF	4	74	6	7	4	2	8	7	0	0	0
MiPS FF	2	0	0	0	0	8	0	0	0	0	28
MiPS FF	3	15	1	1	1	4	52	49	0	3	15
MiPS FF	4	0	0	0	0	1	0	0	0	0	1
UWAc FF	2	0	0	0	0	0	0	0	0	0	48
UWAc FF	3	0	0	0	0	0	112	105	1	6	12
UWAc FF	4	0	0	0	0	0	42	40	0	2	0
SPSo FF	2	0	0	0	0	26	0	0	0	0	301
SPSo FF	3	30	2	3	1	14	353	331	2	18	161
SPSo FF	4	0	0	0	0	1	0	0	0	0	5
Whte SpFi	2	0	0	0	0	8	0	0	0	0	0
Whte SpFi	3	2	0	0	0	4	0	0	0	0	0
Whte SpFi	4	9	1	1	0	0	0	0	0	0	0
HdCl FF	2	0	0	0	0	144	0	0	0	0	144
HdCl FF	3	311	25	29	16	76	310	291	2	15	75
HdCl FF	4	0	0	0	0	2	0	0	0	0	1
SJDF FF	2	0	0	0	0	7	0	0	0	0	1
SJDF FF	3	15	1	1	1	4	1	1	0	0	0
BPH Tu	2	0	0	0	0	52	0	0	0	0	1
BPH Tu	3	128	10	12	6	9	2	1	0	0	0
Fraser Lt	2	0	0	0	0	222	0	0	0	0	5
Fraser Lt	3	0	0	0	0	118	0	0	0	0	2
Fraser Lt	4	76	6	7	4	3	2	2	0	0	0
Fraser Er	2	0	0	0	0	16	0	0	0	0	0
Fraser Er	3	0	0	0	0	3	0	0	0	0	0
FRAM Stocks		1981	158	182	99	1492	1876	1763	11	94	1549

Appendix G1. Details on coded-wire tag recoveries in the Areas 8-1 and 8-2 mark-selective Chinook fishery during the 2005-06 (October-April) season.

Area	Recovery Date	Tag Code	Mark	Brood Yr	FKLcm	Label	DIT	Release Site	Rearing Hatchery	Release Agency
81	Jan 27 2006	210519	AD Fin Clp	2003	61	14719		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
81	Mar 11 2006	210519	AD Fin Clp	2003	68	14769		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Oct 20 2005	210519	AD Fin Clp	2003	57	39507		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Oct 23 2005	210519	AD Fin Clp	2003	56	14749		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Dec 11 2005	210519	AD Fin Clp	2003	54	39677		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Dec 29 2005	210519	AD Fin Clp	2003	61	39522		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Jan 22 2006	210519	AD Fin Clp	2003	54	39209		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
81	Dec 11 2005	210520	AD Fin Clp	2003	61	39676		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
82	Apr 30 2006	210520	AD Fin Clp	2003	63	39568		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
81	Nov 20 2005	631867	AD Fin Clp	2002	65	14357		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Jan 22 2006	631867	AD Fin Clp	2002	67	39691		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Feb 18 2006	631867	AD Fin Clp	2002	66	39703		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Feb 26 2006	631867	AD Fin Clp	2002	57	39537		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Mar 19 2006	631867	AD Fin Clp	2002	67	39711		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
81	Dec 8 2005	210558	AD Fin Clp	2003	63	14750		SKAGIT R 03.0176	COUNTY LINE PONDS	WDFW
81	Feb 18 2006	631552	AD Fin Clp	2002	65	14742		SKOKOMISH R 16.0001	ENDICOTT PD (LLTK)	WREG
81	Nov 6 2005	631880	AD Fin Clp	2003	63	14701		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Apr 4 2006	631880	AD Fin Clp	2003	56	39714		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Mar 18 2006	632166	AD Fin Clp	2003	63	26722		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Mar 11 2006	632277	AD Fin Clp	2003	59	14767		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Nov 8 2005	631553	AD Fin Clp	2002	63	39510		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Jan 21 2006	632278	AD Fin Clp	2003	57	14718		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Nov 6 2005	632279	AD Fin Clp	2003	60	14744		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Feb 3 2006	632583	AD Fin Clp	2003	50	39704		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Jan 8 2006	210479	AD Fin Clp	2002	77	39524	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
81	Dec 11 2005	632283	AD Fin Clp	2003	54	39678	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
81	Jan 20 2006	632283	AD Fin Clp	2003	64	14745	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
81	Feb 11 2006	632283	AD Fin Clp	2003	53	14702	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Oct 21 2005	632283	AD Fin Clp	2003	53	14714	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Dec 29 2005	632283	AD Fin Clp	2003	60	39523	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Jan 8 2006	632283	AD Fin Clp	2003	61	39683	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Jan 21 2006	632283	AD Fin Clp	2003	55	39526	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Feb 12 2006	632283	AD Fin Clp	2003	65	39531	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Feb 12 2006	632283	AD Fin Clp	2003	64	39702	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Feb 25 2006	632283	AD Fin Clp	2003	56	39535	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Feb 10 2006	185530	AD Fin Clp	2003	59	39528		R-CHEMAINUS R	H-CHEMAINUS R	CDFO
81	Nov 20 2005	185161	AD Fin Clp	2003	57	39674	DIT	R-CHILLIWACK R	H-CHILLIWACK R	CDFO
82	Oct 22 2005	631798	AD Fin Clp	2002	59	39679		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Dec 16 2005	631798	AD Fin Clp	2002	70	39680		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Feb 12 2006	631798	AD Fin Clp	2002	72	39701		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Feb 18 2006	631798	AD Fin Clp	2002	66	14741		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
81	Feb 9 2006	631864	AD Fin Clp	2002	68	14740		GREEN R 09.0001	ICY CR HATCHERY	WDFW

Area	Recovery Date	Tag Code	Mark	Brood Yr	FKLcm	Label	DIT	Release Site	Rearing Hatchery	Release Agency
82	Nov 5 2005	631864	AD Fin Clp	2002	64	39508		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Nov 27 2005	631864	AD Fin Clp	2002	61	39675		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Dec 10 2005	631864	AD Fin Clp	2002	66	14716		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Dec 10 2005	631864	AD Fin Clp	2002	69	39519		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Jan 15 2006	631864	AD Fin Clp	2002	65	39687		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Jan 22 2006	631864	AD Fin Clp	2002	71	39690		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Mar 20 2006	631864	AD Fin Clp	2002	60	39563		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Apr 6 2006	631864	AD Fin Clp	2002	77	39564		GREEN R 09.0001	ICY CR HATCHERY	WDFW
81	Jan 22 2006	632388	AD Fin Clp	2003	59	39692		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Feb 9 2006	632388	AD Fin Clp	2003	68	14739		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Feb 19 2006	632388	AD Fin Clp	2003	63	39215		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Mar 12 2006	632388	AD Fin Clp	2003	56	14760		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Apr 29 2006	632388	AD Fin Clp	2003	65	39566		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
81	Feb 11 2006	210541	AD Fin Clp	2003	52	14732		BAKER R 03.0435	MARBLEMOUNT HATCHERY	WDFW
81	Oct 29 2005	631414	AD Fin Clp	2002	72	32560	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Jan 22 2006	631414	AD Fin Clp	2002	76	39693	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Jan 22 2006	631414	AD Fin Clp	2002	79	39694	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Feb 26 2006	631414	AD Fin Clp	2002	81	14766	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Oct 15 2005	631414	AD Fin Clp	2002	62	14712	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Oct 21 2005	631414	AD Fin Clp	2002	72	14713	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Jan 15 2006	631414	AD Fin Clp	2002	69	39685	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Feb 11 2006	631414	AD Fin Clp	2002	73	14733	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Feb 11 2006	631414	AD Fin Clp	2002	77	39698	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Mar 4 2006	631414	AD Fin Clp	2002	82	39026	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Dec 11 2005	632284	AD Fin Clp	2003	66	14717		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Jan 22 2006	632284	AD Fin Clp	2003	55	39210		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Mar 4 2006	632284	AD Fin Clp	2003	60	39706		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Mar 4 2006	632284	AD Fin Clp	2003	61	39707		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Apr 29 2006	632284	AD Fin Clp	2003	67	39716		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Dec 8 2005	210547	AD Fin Clp	2003	57	39516	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
82	Dec 10 2005	210547	AD Fin Clp	2003	57	14751	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
81	Jan 13 2006	632490	AD Fin Clp	2003	52	39684		PORTAGE BAY/SHIP CNL	PORTAGE BAY HATCHERY	UW
82	Feb 11 2006	632490	AD Fin Clp	2003	58	14765		PORTAGE BAY/SHIP CNL	PORTAGE BAY HATCHERY	UW
82	Oct 15 2005	631774	AD Fin Clp	2002	59	39671	DIT	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW
82	Feb 11 2006	632383	AD Fin Clp	2003	61	39529	DIT	FRIDAY CR 03.0017	SAMISH HATCHERY	WDFW
82	Jan 24 2006	51576	AD Fin Clp	2003	58	39527		SPRING CR 29.0159	SPRING CR NFH	FWS
81	Dec 29 2005	631964	AD Fin Clp	2002	73	39682		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
82	Feb 18 2006	631971	AD Fin Clp	2002	68	39532		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
81	Dec 13 2005	632385	AD Fin Clp	2003	58	39520		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Dec 19 2005	632385	AD Fin Clp	2003	56	39521		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Jan 15 2006	632385	AD Fin Clp	2003	58	39686		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Feb 8 2006	632385	AD Fin Clp	2003	60	39696		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Mar 12 2006	632385	AD Fin Clp	2003	58	39709		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Apr 26 2006	632385	AD Fin Clp	2003	62	39565		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
81	Jan 29 2006	630993	AD Fin Clp	2002	65	14720	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW

Area	Recovery Date	Tag Code	Mark	Brood Yr	FKLcm	Label	DIT	Release Site	Rearing Hatchery	Release Agency
81	Feb 8 2006	631799	AD Fin Clp	2002	77	39697		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Jan 19 2006	631799	AD Fin Clp	2002	76	39688		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Jan 20 2006	631799	AD Fin Clp	2002	59	39525		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Jan 21 2006	631799	AD Fin Clp	2002	71	14715		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Jan 30 2006	631799	AD Fin Clp	2002	73	14730		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Feb 11 2006	631799	AD Fin Clp	2002	73	39530		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Mar 4 2006	631799	AD Fin Clp	2002	79	39705		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Apr 22 2006	631799	AD Fin Clp	2002	69	39027		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Feb 9 2006	631897	AD Fin Clp	2003	53	28506		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Mar 11 2006	631897	AD Fin Clp	2003	52	14768		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Apr 29 2006	631897	AD Fin Clp	2003	52	39567		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Jan 29 2006	632281	AD Fin Clp	2003	52	14729	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Mar 18 2006	632281	AD Fin Clp	2003	64	14316	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Oct 29 2005	210542	AD Fin Clp	2003	61	14743		WHITEHORSE SPRINGS	WHITEHORSE POND	STIL
82	Dec 10 2005	210542	AD Fin Clp	2003	55	39518		WHITEHORSE SPRINGS	WHITEHORSE POND	STIL

Appendix G2. Details on coded-wire tag recoveries in the Areas 8-1 and 8-2 mark-selective Chinook fishery during the 2006-07 (October-April) season.

Area	Recovery Date	Tag Code	Mark	Brood Yr	FL (cm)	Label	DIT	Release Site	Rearing Hatchery	Release Agency
82	Apr 24 2007	210570	AD Fin Clp	2004	63	40276		TULALIP CR 07.0001	BERNIE GOBIN HATCH	TULA
81	Jan 21 2007	632786	AD Fin Clp	2004	59	39745		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Jan 27 2007	632786	AD Fin Clp	2004	52	25277		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Jan 24 2007	632786	AD Fin Clp	2004	52	40485		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
82	Apr 1 2007	632786	AD Fin Clp	2004	55	50058		CHAMBERS CR 12.0007	CHAMBERS CR HATCHERY	WDFW
81	Oct 5 2006	210546	AD Fin Clp	2003	56	40446		CLARKS CRK HATCHERY	CLARKS CRK HATCHERY	PUYA
82	Dec 30 2006	210546	AD Fin Clp	2003	56	25276		CLARKS CRK HATCHERY	CLARKS CRK HATCHERY	PUYA
82	Oct 1 2006	210546	AD Fin Clp	2003	51	39234		CLARKS CRK HATCHERY	CLARKS CRK HATCHERY	PUYA
81	Jan 28 2007	632468	AD Fin Clp	2003	59	32772		SKOKOMISH R 16.0001	ENDICOTT PD (LLTK)	WDFW
82	Jan 20 2007	632468	AD Fin Clp	2003	62	39743		SKOKOMISH R 16.0001	ENDICOTT PD (LLTK)	WDFW
82	Feb 2 2007	632468	AD Fin Clp	2003	53	40494		SKOKOMISH R 16.0001	ENDICOTT PD (LLTK)	WDFW
82	Mar 31 2007	632874	AD Fin Clp	2004	55	50055		SKOKOMISH R 16.0001	ENDICOTT PD (LLTK)	WDFW
81	Jan 20 2007	631880	AD Fin Clp	2003	63	32769		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Dec 31 2006	632472	AD Fin Clp	2003	75	39740		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Jan 27 2007	632870	AD Fin Clp	2004	53	25278		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Mar 31 2007	632870	AD Fin Clp	2004	61	39365		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Jan 27 2007	632870	AD Fin Clp	2004	54	39748		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Jan 30 2007	632870	AD Fin Clp	2004	55	40291		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
81	Apr 15 2007	632871	AD Fin Clp	2004	63	32681		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
81	Nov 24 2006	632871	AD Fin Clp	2004	53	32829		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
81	Mar 18 2007	632871	AD Fin Clp	2004	57	32831		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Dec 22 2006	632871	AD Fin Clp	2004	58	32825		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Dec 28 2006	632871	AD Fin Clp	2004	66	32827		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Dec 28 2006	632871	AD Fin Clp	2004	55	39736		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Dec 31 2006	632871	AD Fin Clp	2004	52	39741		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Apr 3 2007	632871	AD Fin Clp	2004	60	40266		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Feb 3 2007	632871	AD Fin Clp	2004	52	50002		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Mar 10 2007	632871	AD Fin Clp	2004	57	50027		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Mar 13 2007	632871	AD Fin Clp	2004	59	50031		CHAMBERS CR 12.0007	GARRISON HATCHERY	WDFW
82	Oct 7 2006	632375	AD Fin Clp	2003	62	32826	DIT	PURDY CR 16.0005	GEORGE ADAMS HATCHRY	WDFW
82	Apr 7 2007	632880	AD Fin Clp	2004	55	39379		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Feb 10 2007	632880	AD Fin Clp	2004	59	50006		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Mar 18 2007	632880	AD Fin Clp	2004	53	50034		GORST CR 15.0216	GORST CR REARING PND	SUQ
82	Mar 18 2007	632880	AD Fin Clp	2004	54	50037		GORST CR 15.0216	GORST CR REARING PND	SUQ
81	Oct 8 2006	210592	AD Fin Clp	2004	49	32765	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
81	Apr 20 2007	210592	AD Fin Clp	2004	67	32961	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Apr 21 2007	210592	AD Fin Clp	2004	73	40274	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Oct 5 2006	210592	AD Fin Clp	2004	52	40481	DIT	GROVERS CR HATCHERY	GROVERS CR HATCHERY	SUQ
82	Oct 18 2006	631798	AD Fin Clp	2002	82	40449		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
81	Mar 17 2007	632471	AD Fin Clp	2003	70	39043		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Apr 1 2007	632879	AD Fin Clp	2004	51	39367		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Mar 16 2007	632879	AD Fin Clp	2004	54	39561		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Jan 28 2007	632879	AD Fin Clp	2004	52	39750		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Mar 4 2007	632879	AD Fin Clp	2004	57	50021		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW

Area	Recovery Date	Tag Code	Mark	Brood Yr	FL (cm)	Label	DIT	Release Site	Rearing Hatchery	Release Agency
82	Apr 2 2007	632879	AD Fin Clp	2004	55	50050		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
81	Oct 1 2006	632973	Unmarked	2004	49	32654		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
81	Mar 18 2007	632973	AD Fin Clp	2004	58	40011		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Feb 17 2007	632973	AD Fin Clp	2004	60	39322		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Dec 17 2006	632973	AD Fin Clp	2004	52	40483		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Feb 3 2007	632973	AD Fin Clp	2004	54	40497		FINCH CR 16.0222	HOODSPORT HATCHERY	WDFW
82	Mar 18 2007	632464	AD Fin Clp	2003	64	39045		GREEN R 09.0001	ICY CR HATCHERY	WDFW
82	Dec 30 2006	632388	AD Fin Clp	2003	73	39738		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
81	Feb 11 2007	632972	AD Fin Clp	2004	63	32690		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Dec 31 2006	632972	AD Fin Clp	2004	63	39739		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
82	Apr 7 2007	632972	AD Fin Clp	2004	69	40264		ISSAQUAH CR 08.0178	ISSAQUAH HATCHERY	WDFW
81	Apr 21 2007	632582	AD Fin Clp	2003	69	39393		CHAMBERS CR 12.0007	LAKEWOOD HATCHERY	WDFW
82	Apr 28 2007	210541	AD Fin Clp	2003	76	40279		BAKER R 03.0435	MARBLEMOUNT HATCHERY	WDFW
81	Oct 8 2006	632273	AD Fin Clp	2003	76	32764	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Nov 5 2006	632273	AD Fin Clp	2003	65	39728	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Feb 11 2007	632391	AD Fin Clp	2004	61	32691		CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Nov 25 2006	632391	AD Fin Clp	2004	53	32849		CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Jan 24 2007	632391	AD Fin Clp	2004	54	40487		CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Jan 21 2007	632875	AD Fin Clp	2004	52	39744		CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Apr 21 2007	632889	AD Fin Clp	2004	56	32833	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Apr 2 2007	632889	AD Fin Clp	2004	52	39370	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
81	Apr 29 2007	632889	AD Fin Clp	2004	63	40280	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Feb 11 2007	632889	AD Fin Clp	2004	56	32689	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Apr 6 2007	632889	AD Fin Clp	2004	54	40261	DIT	CASCADE R 03.1411	MARBLEMOUNT HATCHERY	WDFW
82	Nov 18 2006	632284	AD Fin Clp	2003	70	32768		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Mar 4 2007	632284	AD Fin Clp	2003	67	50024		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Jan 25 2007	632372	AD Fin Clp	2004	53	40488		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Jan 28 2007	632965	AD Fin Clp	2004	61	32771		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Mar 31 2007	632965	AD Fin Clp	2004	59	39366		MINTER CR 15.0048	MINTER HATCHERY	WDFW
82	Dec 28 2006	632965	AD Fin Clp	2004	58	39735		MINTER CR 15.0048	MINTER HATCHERY	WDFW
81	Nov 25 2006	210547	AD Fin Clp	2003	68	32904	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
82	Jan 27 2007	632783	AD Fin Clp	2004	62	32688	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
82	Mar 17 2007	632783	AD Fin Clp	2004	52	39031	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
82	Jan 28 2007	632783	AD Fin Clp	2004	55	40491	DIT	CLEAR CR 11.0013C	NISQUALLY HATCHERY	NISQ
82	Oct 21 2006	632379	Unmarked	2003	61	40450	DIT	BIG SOOS CR 09.0072	SOOS CREEK HATCHERY	WDFW
82	Feb 10 2007	632873	AD Fin Clp	2004	59	50007		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
82	Mar 15 2007	632873	AD Fin Clp	2004	52	50032		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
82	Mar 18 2007	632873	AD Fin Clp	2004	51	50054		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
82	Feb 10 2007	633089	AD Fin Clp	2004	53	39343		DESCHUTES R 13.0028	TUMWATER FALLS HATCH	WDFW
81	Feb 10 2007	632964	AD Fin Clp	2004	55	39347		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Mar 18 2007	632964	AD Fin Clp	2004	62	25285		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Apr 29 2007	632964	AD Fin Clp	2004	58	39400		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Dec 30 2006	632964	AD Fin Clp	2004	52	39737		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Mar 15 2007	632964	AD Fin Clp	2004	57	50029		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
82	Apr 21 2007	632964	AD Fin Clp	2004	63	50060		VOIGHT CR 10.0414	VOIGHTS CR HATCHERY	WDFW
81	Feb 16 2007	631897	AD Fin Clp	2003	72	14815		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Oct 21 2006	631897	AD Fin Clp	2003	68	32767		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW

Area	Recovery Date	Tag Code	Mark	Brood Yr	FL (cm)	Label	DIT	Release Site	Rearing Hatchery	Release Agency
81	Jan 27 2007	631897	AD Fin Clp	2003	78	32770		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Dec 30 2006	631897	AD Fin Clp	2003	69	32830		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Apr 21 2007	631897	AD Fin Clp	2003	71	40013		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Mar 4 2007	631897	AD Fin Clp	2003	74	39028		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Dec 3 2006	631897	AD Fin Clp	2003	67	39734		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Feb 16 2007	632280	Unmarked	2003	79	14814	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Feb 10 2007	632789	AD Fin Clp	2004	56	39346	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Jan 21 2007	632789	AD Fin Clp	2004	55	40484	DIT	WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Mar 30 2007	632876	AD Fin Clp	2004	56	32871		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
81	Apr 28 2007	632876	AD Fin Clp	2004	59	40277		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Apr 18 2007	632876	AD Fin Clp	2004	54	40273		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Apr 22 2007	632876	AD Fin Clp	2004	57	40275		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Oct 13 2006	632876	AD Fin Clp	2004	42	40448		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Jan 24 2007	632876	AD Fin Clp	2004	52	40486		WALLACE R 07.0940	WALLACE R HATCHERY	WDFW
82	Mar 17 2007	210594	Unmarked	2004	57	25284		WHITE R 10.0031	WHITE RIVER HATCHERY	MUCK
82	Jan 16 2007	210588	AD Fin Clp	2004	57	39742		WHITEHORSE SPRINGS	WHITEHORSE POND	COOP
82	Oct 5 2006	210588	AD Fin Clp	2004	57	40447		WHITEHORSE SPRINGS	WHITEHORSE POND	COOP

Appendix H. Estimation methods used in Section II, FRAM vs. Observed parameters subsection.

Computation of Average Encounters

1.Compile CRC catch by year and month.

Areas 8-1 and 8-2 CRC Catch of Chinook

Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	553	322	593	224	265	599	674	487	663	255	32	17	6	0	64	30	4	231	275
2	804	570	890	527	427	126	343	535	934	167	229	115	903	564	438	392	373	288	150
3	359	626	212	668	185	346	592	460	330	245	375	211	1200	563	577	409	337	154	284
4	348	1086	160	329	265	219	402	300	571	417	279	206	328	269	159	190	174	162	
10	623	571	459	186	493	32	1021	596	929	26	105	4	229	302	84	3	132	221	
11	920	67	231	517	337	1079	2000	596	71	220	71	586	763	180	514	294	168	77	
12	1245	66	177	227	525	1206	805	609	155	0	5	71	0	17	0	33	191	225	
	4852	**3308**	**2722**	**2678**	**2497**	**3607**	**5837**	**3583**	**3653**	**1330**	**1096**	**1210**	**3429**	**1895**	**1836**	**1351**	**1379**	**1358**	

2.Compile sampling data.

Compile the numbers of Chinook retained and the numbers of Chinook released by year and month from creel data.

Areas 8-1 and 8-2 Sampling Data of Chinook Retained and Released

	1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007	
Month	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel	Ret	Rel
1	47	391	143	254	33	247	0	0	0	0	0	0			0	0	0	0			206	597	157	2090
2	122	502	174	293	20	153	16	38	33	179	130	605			98	906	60	368			326	824	147	2927
3	77	474	45	71	27	203	69	70	47	332	132	408			87	991	33	178			127	458	340	4275
4	43	120	77	116	31	265	42	27	41	161	25	83			37	230	12	50			177	352	223	2767
10	13	128	61	476	6	391	1	247	1	665	14	359	1	234	1	254	0	76	80	785.4	122	9131		
11	55	154	7	64	12	65	18	92	102	1068	71	271	51	1098	91	585	42	664	73	174.9	45	1452		
12	29	63	31	248	0	0	2	2	6	49	0	0			0	0	0	0	163	453.0	177	3381		

3.Compute the ratio of released to retained Chinook for month with full Chinook retention.

Areas 8-1/8-2 Released to Retained Ratios for Months with Full Chinook Retention

Month	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	8.9	3.4	8.3	1.8	7.5									
2	16.2	3.6	4.1	1.7	7.7					9.2	6.1			
3	17.6	3.1	6.2	1.6	7.5	1.0	7.1	3.1		11.4	5.4			
4	9.7	3.0	2.8	1.5										
10				7.8										
11	3.6	6.3	2.8	9.1			10.5	3.8	21.5	6.4	15.8			
12	3.3	7.4	2.2	8.0										

4. Apply this ratio to CRC catch to compute the number of Chinook released and add this value to the CRC catch for an estimate of encounters.

Areas 8-1/8-2 Estimate of Chinook encounters for months open to Chinook fishing

Month	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	5927	2993	4538	1841	2164								803	2247
2	2162	1569	2736	2507	1445					4487	2796		1150	3074
3	6450	2456	3292	851	2087	755	1701	4909		7149	2615		585	4615
4	2346	1598	1137	1431									529	2989
10				8178								865	9253	
11	4923	14697	2265	720			6722	3675	4055	3818	4942	248	1498	
12	5202	6771	1932	1395								616	3557	

5. Compute average monthly encounters and variance:

Average:

$$\bar{x}_m = \frac{\sum_y x_{ym}}{n}$$

Where,

x = Chinook Encounters
n = number of observations in the sample
m = month
y=year
$\bar{x}_m$ *= average monthly encounters*

Variance:

$$Var_m = \frac{\sum_y (x_{ym} - \bar{x})^2}{n-1}$$

Where,
Var_m = *Variance of monthly encounters*

6. Compute encounters and variance for the entire October – April period:

$$a = \sum_m \bar{x}_m$$
$$v = \sum_m Var_m$$

Where,
a = Average monthly encounters summed over months
v = Variance of monthly encounters summed over months

7. Compute the 95% confidence interval

95% Confidence Interval = +/- 1.96* $\sqrt{v}$

Computation of Average CRC Catches, 95% Confidence Interval, and FRAM Encounters

1.Compile CRC catch by year and month:

Areas 8-1 and 8-2 CRC Catch of Chinook.

Month	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
1	553	322	593	224	265	599	674	487	663	255	32	17	6	0	64	30	4
2	804	570	890	527	427	126	343	535	934	167	229	115	903	564	438	392	373
3	359	626	212	668	185	346	592	460	330	245	375	211	1200	563	577	409	337
4	348	1086	160	329	265	219	402	300	571	417	279	206	328	269	159	190	174
10	623	571	459	186	493	32	1021	596	929	26	105	4	229	302	84	3	132
11	920	67	231	517	337	1079	2000	596	71	220	71	586	763	180	514	294	168
12	1245	66	177	227	525	1206	805	609	155	0	5	71	0	17	0	33	191
	4852	**3308**	**2722**	**2678**	**2497**	**3607**	**5837**	**3583**	**3653**	**1330**	**1096**	**1210**	**3429**	**1895**	**1836**	**1351**	**1379**

2. Adjust catch to full month Chinook opening using FRAM rules.

Areas 8.1 plus 8.2 Chinook FRAM Regulation Adjustments

Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.72	0.72	0.64	0.63	1.00	1.00	1.00
3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.47	0.47	0.47	0.47	0.00	0.00	0.00
10	1.00	1.00	1.00	0.00	0.75	0.00	0.75	0.75	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.51	0.51	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Adjustments came from agreed upon effort transfer scalars for partial month openings; i.e., a 15-day closure in a 28-day month produces a scalar of 0.63.

Adjusted Catch = CRC Catch/Adjustment

Areas 8.1 plus 8.2 Adjusted
CRC Catch of Chinook

Month	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Jan	553	322	593	224	265	599	674	487	663	255							
Feb	804	570	890	527	427	126	343	535	934	167	317	159	1412	889	438	392	373
Mar	359	626	212	668	185	346	592	460	330	245	375	211	1200	563	577	409	337
Apr	348	1086	160	329	265	219	402	300	571	471	592	437	696	571			
Oct	623	571	459		657		1361	795	929								132
Nov	920	67	231	517	337	1079	2000	596	71	430	139	586	763	180	514	294	168
Dec	1245	66	177	227	525	1206	805	609	155								191
	4852	**3308**	**2722**	**2492**	**2661**	**3575**	**6177**	**3782**	**3653**	**1568**	**1422**	**1393**	**4071**	**2203**	**1529**	**1095**	**1201**

3. Compute average monthly catch and variance.

Average Catch:

$$\bar{x} = \frac{\sum_{y} x_{ym}}{n}$$

Variance:

$$Var_m = \frac{\sum_y (x_{ym} - \bar{x})^2}{n-1}$$

Where,
x = Catch
m = month
y=year
n = number of observations in the sample
$\bar{x}$ *= average monthly catch*
Var_m *= Variance of monthly catch*

4. Compute catch and variance for the entire October through April period.

$$a = \sum_m \bar{x}_m$$

$$v = \sum_m Var_m$$

Where,
a = Average monthly catch summed over months
v = Variance of monthly catch summed over months

5. Compute the 95% confidence interval

95% Confidence Interval = +/- 1.96* $\sqrt{v}$

6. Compute FRAM catch for a non-selective fishery.

The FRAM catch of a non-selective fishery equals the number of marked plus unmarked legal-size encounters:

Encounters Legal Marked + Encounters Legal Unmarked = FRAM Catch

05/06: 1,325 + 3,172 = 4,497
06/07: 1,876 + 1,981 = 3,875