

# Summary of Recreational Mark-selective Fisheries for Chinook Conducted in Marine Catch Areas 01-13 during the Years 2003-2013

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## INTRODUCTION

The purpose of this report is to present a summary of all recreational mark-selective fisheries for Chinook salmon (*Oncorhynchus tshawytscha*) that have been conducted in marine catch areas 1-13 (Figure 1) as designated by the Washington Department of Fish and Wildlife (WDFW). Based on agreements between the State of Washington and the Northwest Treaty Tribes, WDFW has been conducting recreational mark-selective fisheries (MSFs) for Chinook in the marine areas of Puget Sound (catch areas 05 - 13) since 2003. Recreational MSFs for Chinook in the ocean areas (catch areas 1 - 4) started in 2010. In MSFs, anglers are allowed to retain adipose-fin clipped ("marked") hatchery fish and are required to release unharmed any unclipped ("unmarked", predominantly wild) salmon encountered<sup>1</sup>.

The goal of MSFs is to allow increased angler opportunities on hatchery-raised, marked salmon while limiting impacts on unmarked (adipose fin intact, typically wild origin) stocks of conservation concern, particularly ESA-listed Puget Sound Chinook. The combination of large-scale hatchery marking (i.e., fin clipping) programs and mark-selective harvest regulations makes it possible for anglers to pursue and harvest hatchery Chinook salmon with reduced impacts to wild salmon populations when compared to traditional recreational fisheries.

### Sampling and Monitoring Programs

As part of the State-Tribal agreement for conducting mark-selective fisheries, WDFW has been conducting sampling and monitoring programs to collect the data needed to evaluate the impacts of MSFs on unmarked Chinook salmon. There have been two levels of monitoring conducted, "intensive" monitoring and "baseline" monitoring. Intensive monitoring requires a statistically designed creel survey, additional sampling to estimate the mark-status|size composition of the Chinook targeted by a fishery, and surveys to determine the access point of boats participating in the fishery. For a complete description of the methods used for "intensive" monitoring refer to WDFW's *"Methods Report: Monitoring Mark-Selective Recreational Chinook Fisheries in the Marine Catch Areas of Puget Sound"* (<http://www.wdfw.wa.gov/publications/01357/>). Methods used to provide estimates of total encounters and release mortalities for MSFs with baseline monitoring are described in *"Estimating Total Chinook Encounters using Catch Record Card Estimates of Harvest"* (WDFW and NWIFC 2014 draft).

Both monitoring programs provide estimates of the following critical parameters needed for evaluating mark-selective fisheries: *i)* the mark rate of the targeted Chinook population, *ii)* the total number of Chinook salmon harvested (by size [legal or sublegal] and mark-status [marked or unmarked] group), and *iii)* the total number of Chinook salmon released (by size and mark-status group). Intensive monitoring allows for in-season and immediate post-season estimates of angler effort, landed catch, total encounters, and release mortalities. Final estimates for intensively monitored MSFs are typically available before the following year's North of Falcon process. For baseline monitored MSFs, which rely on harvest estimates from the Catch Record Card (CRC) system, final estimates are not available until approximately one year after the fishery has ended.

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<sup>1</sup> Mark-selective fishery regulations specific to Chinook allow the retention of marked Chinook (fish with a healed adipose fin clip) that are legal-size. Legal size is defined as  $\geq 22$  inches (56 cm) in Puget Sound catch areas 5-13 and  $\geq 24$  inches (61 cm) in ocean catch areas 1-4. Regulations require the immediate release of all unmarked or sublegal-size Chinook. Additionally, anglers are required to use single-point, barbless hooks while fishing for salmon and may not bring unmarked and/or sublegal-size Chinook aboard their vessels. Bag limits vary depending upon area, season, and year.

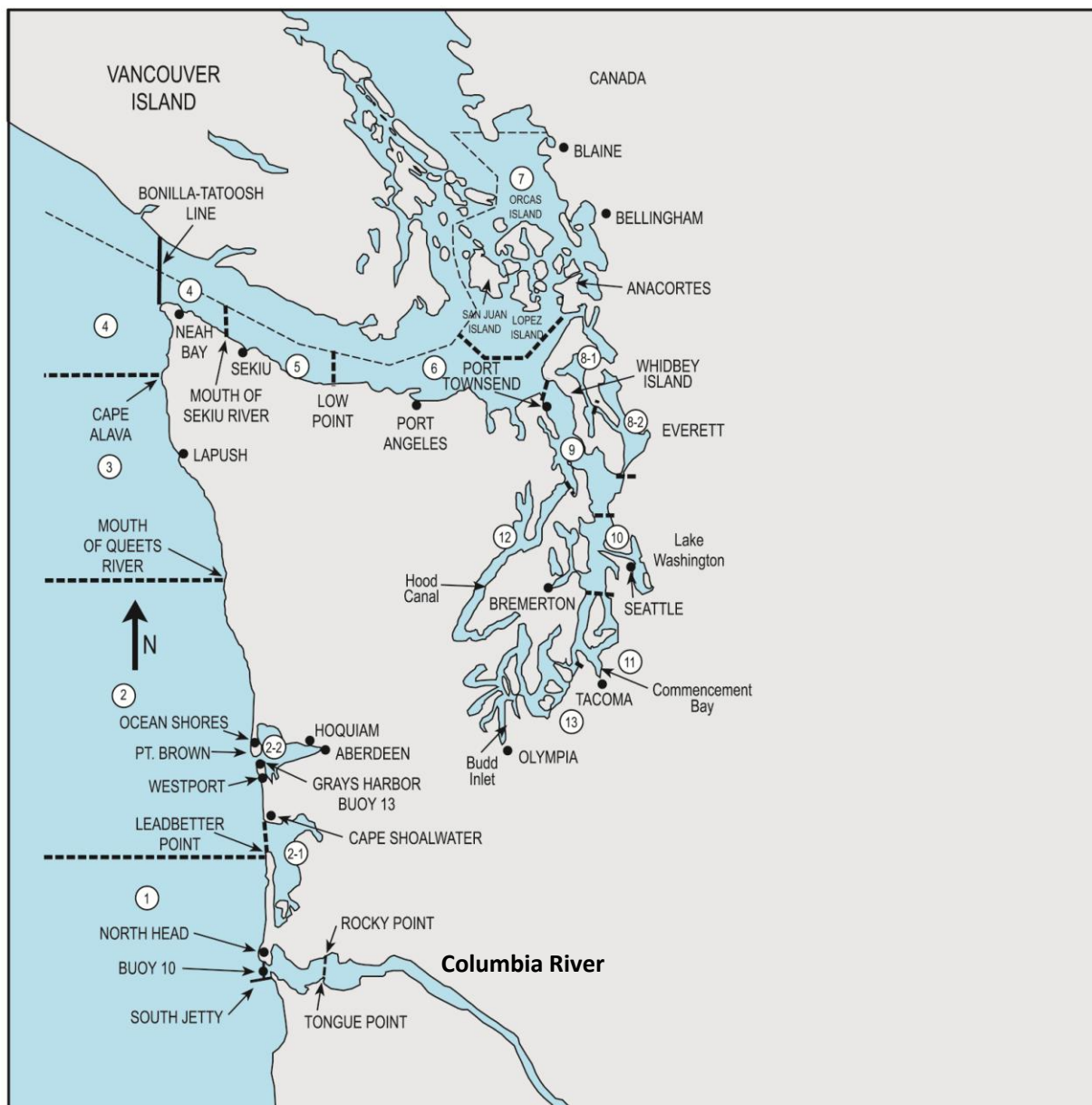


Figure 1. Map of Western Washington, showing the marine catch areas of Puget Sound (areas 5 through 13) and the Washington Coast (areas 1 through 4).

## METHODS

The focus of this report is to present summaries of the estimates provided by the monitoring programs. A summary of angler effort (in angler-trips) and Chinook mortalities across all years and areas is presented first followed by summaries for each catch area. Annual estimates of the number harvested and number released are provided for four size-and-mark status (S|M) categories of Chinook:

1. Legal-size and marked Chinook (LM),
2. Legal-size and unmarked Chinook (LU),
3. Sublegal-size and marked Chinook (SM), and
4. Sublegal-size and unmarked Chinook (SU).

Different release-mortality rates are used for legal-size and sublegal-size Chinook. For this report, the release-mortality rates used are those agreed to by State and Tribal co-managers: 15% for legal-size fish and 20% for sublegal-size fish. Release mortalities are estimated as the product of the estimated number of Chinook released for each S|M category and the appropriate release-mortality rate.

### Area Summaries

#### Effort and Encounters Summary Tables:

Two summary tables are provided for each area; each table presents estimates for each year a MSF has been conducted in the area. Note that the year indicated in each table is the management year for the fishery, so winter fisheries that occur in January through April in year *i* are labeled as year *i-1* to correspond to their management year (the year the fisheries were approved during the North of Falcon process). The first table gives annual summaries of angler effort, number of Chinook retained in each S|M category, number of Chinook released in each S|M category, and total Chinook encounters.

The second table provides some fishery evaluation statistics. Values for these evaluation statistics that may be a concern to management are highlighted (shaded in yellow) in the tables. The five MSF evaluation statistics, and the critical value used to denote possible management concerns for each statistic, are:

- A. Number of Chinook released for each LM Chinook retained: values  $\geq 10$  Chinook released for each LM Chinook retained are highlighted.
- B. Percentage of total encounters that are LM Chinook: percentages  $\leq 16.7\%$  are highlighted - percentages below this level always result in more than one Chinook release mortality for each LM Chinook retained.
- C. Percentage of retained Chinook that are illegal to keep (i.e., marked Chinook that are sublegal size or any unmarked Chinook): percentages  $\geq 10\%$  are highlighted.
- D. Number of release mortalities (marked and unmarked combined) for each LM Chinook retained: values  $\geq 1.0$  Chinook release mortality for each LM Chinook retained are highlighted.
- E. Number of unmarked release mortalities for each LM Chinook retained: values  $\geq 1.0$  unmarked Chinook release mortality for each LM Chinook retained are highlighted.

Please note that the definitions of critical values are entirely my own and others could be used. Each area summary also includes a figure comparing annual estimates of total number of Chinook retained, total number of Chinook released, total number of release mortalities, and angler effort.

## Monitoring-based Estimates Compared to Pre-season FRAM Runs:

The creel survey data from the intensive and baseline monitoring programs provide estimates of a number of fishery summary statistics that can be compared to output from pre-season FRAM runs. In this section of the summary for each area, tables and figures compare annual creel-based estimates to pre-season FRAM outputs for the following fishery summary statistics:

1. Number of Chinook encounters by S|M category,
2. Total Chinook encounters,
3. Total legal-size Chinook encounters (marked and unmarked combined),
4. Total number of marked Chinook mortalities (catch plus release mortalities), and
5. Total number of unmarked Chinook mortalities (catch plus release mortalities).

In addition, a figure is used to compare two summary ratios that can be calculated from the monitoring program estimates and FRAM outputs:

- the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio), and
- the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio).

Percent error when comparing fishery summary statistics was calculated as:

$$\%Error = \frac{FRAM\ projection - Creel\ Survey\ Estimate}{Creel\ Survey\ Estimate}.$$

Therefore, negative *%Error* indicates an underestimate by FRAM and positive *%Error* indicates an overestimate by FRAM. In the FRAM comparison summary tables all FRAM underestimates (negative *%Error*) are high-lighted in yellow. FRAM projections relative to monitoring program estimates focused on two issues:

- Bias - which for this report we define as the consistency of the direction (positive or negative) of the difference between the two. E.g., as assessed by *%Error*, does FRAM consistently overestimate or underestimate total encounters for a fishery? and
- Size of the *%Error* - how much is FRAM over- or under- estimating a summary statistic relative to the creel survey estimate?

Given that the creel survey summary statistics are estimates with error, and that the FRAM projections are the product of numerous stock-specific model inputs, fishery projections, and other manipulations internal to the model, we should not expect exact agreement between the two. As general guidance, I recommend that  $\%Error \leq \pm 50\%$  be considered adequate, and that  $\%Error \geq \pm 100\%$  be viewed as a possible management concern. Also, FRAM overestimates (positive *%Errors*) might be viewed differently than underestimates (negative *%Errors*). FRAM overestimates of the number of encounters and mortalities by a the fishery might be viewed as conservative (making an error to the benefit of the resource) as the impacts of the fishery conducted were less than expected (based on pre-season FRAM model runs).

## Data Sources:

The estimates presented were compiled from the series of annual reports that have been prepared by WDFW for each Chinook MSF conducted in the marine catch areas. These reports have received Tribal review and are available on WDFW's website ([www.wdfw.wa.gov/publications/fishing/selective\\_fishing](http://www.wdfw.wa.gov/publications/fishing/selective_fishing)). Rather than citing each report where appropriate in the text, all pertinent reports are listed in the References section of this document. WDFW is commended for all their efforts in annually preparing these reports and for working with the Tribes to present them in a format that is useful for managers.



## RESULTS

The number of areas and days open to recreational MSFs for Chinook in marine waters has gradually expanded since the first MSFs in areas 5 and 6 during the summer of 2003 (Figure 2). MSFs have been conducted during both the summer and winter seasons since 2005. In 2012 and 2013 more than 1,400 area-days were open to MSFs (an area-day is one marine catch area open for one day).

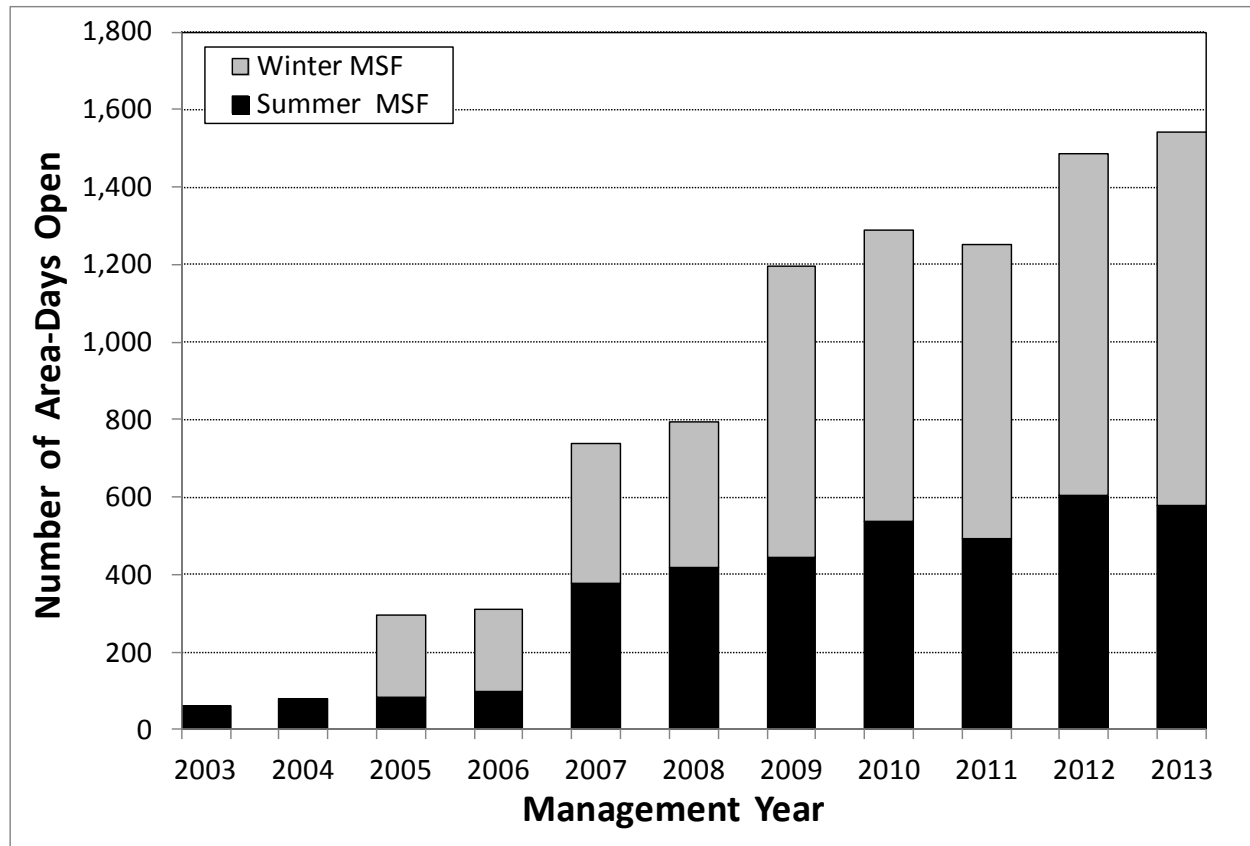


Figure 2. Total area-days open to Chinook mark-selective fishery regulations in WDFW catch areas 1 to 13, by management year. See Appendix Table A for summary by area.

The steady expansion of Chinook MSFs since 2003 has resulted in an increase in angler participation in MSFs from an estimated 24,593 angler trips during that first fishing season to more than 200,000 angler trips during the 2009 and 2011 management years<sup>2</sup>. The total harvest of marked Chinook salmon in mark-selective fisheries has increased similarly from 3,417 Chinook in 2003 to more than 35,000 in 2012<sup>3</sup> (Figure 3). By comparing Figures 2 and 3, one sees that angler effort is driven by more than just MSF availability as the peak year in angler effort was 2009 when there was less than 1,400 area-days open to MSFs.

<sup>2</sup> The estimate for the Area 12 winter MSF is not available for the 2011 management year.

<sup>3</sup> Estimates for the following MSFs are not yet available for the 2012 management year: areas 6, 12, and 13 summer; Area 12 winter.

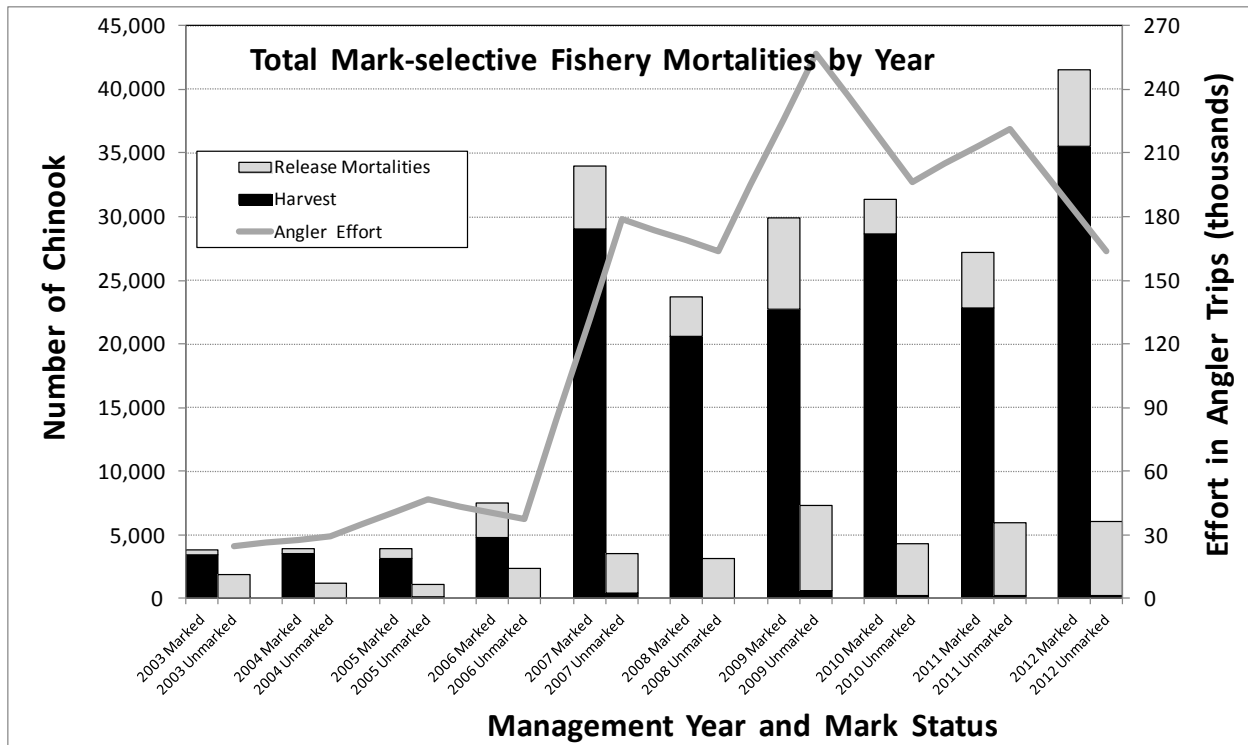


Figure 3. Total estimated harvest and release mortalities of marked and unmarked Chinook by recreational mark-selective fisheries in WDFW catch areas 1-13 combined, 2003-2012. Angler effort for these fisheries is shown, also. See footnotes 2 and 3 regarding estimates still needed for the 2011 and 2012 management years.

## Area 5 Summary

### Area 5 Summer:

Summer MSFs have been conducted in Area 5 since 2003. Since 2010 this fishery has been open annually from July 1 to August 15. In 2008, although an intensive monitoring program was conducted, only one day was sampled during each stratum; i.e., the creel survey was not statistically valid for estimating the precision of the estimates. During the 11 years that this fishery has been conducted, it has averaged 21,983 angler trips, a harvest of 3,891 LM Chinook, and 16,813 total Chinook encounters (Table 5S-1). In 2013, the estimate of retained catch of LM Chinook was the largest and the estimate of total Chinook encounters was the second largest during the monitoring period (Figure 5S-1).

This fishery has averaged 3.1 Chinook released for every LM Chinook retained (Table 5S-2). Relative to other summer MSFs in Puget Sound, the average percentage of Chinook retained that are illegal for this fishery is high (9.1%) and the average percentage of Chinook encounters that are both legal-size and marked (30.8%) is low. This area has the highest average number of release mortalities of unmarked Chinook for each LM Chinook retained (0.40 mortalities per LM retained) of all summer MSFs.

FRAM Comparison<sup>4</sup>: Since 2009, FRAM has consistently under-predicted both total Chinook encounters and encounters of legal-size Chinook compared to monitoring program estimates (Figure 5S-2A). For 2013, the FRAM prediction of total encounters was less than half the estimated total (Table 5S-3). Marked Chinook mortalities have generally been over-predicted by FRAM while unmarked Chinook mortalities have generally been under-predicted (Figure 5S-2B). However, in 2013 both were under-predicted with -40% and -75% %Errors, respectively. FRAM has consistently over-predicted the marked-to-unmarked ratio for Chinook encounters in the Area 5 summer MSF; for the last three years FRAM has consistently predicted a M2U ratio close to 2.25 while the estimated ratio has never exceeded 1.10 (Figure 5S-3). FRAM over-predicted the sublegal-to-legal ratio from 2010 to 2012 but under-predicted this ratio in 2013.

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<sup>4</sup> From 2003 to 2007, FRAM evaluations for the areas 5 and 6 summer fisheries were reported for the combined fisheries. See Appendix B for these summaries.

Table 5S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 5 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Estimated Retained Chinook				Estimated Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Jul. 5 - Aug. 3	2003	19,398	2,251	53	225	0	336	3,435	1,656	5,174	13,130
Jul. 1 - Aug. 8	2004	25,174	2,706	0	194	0	404	4,017	1,167	2,462	10,950
Jul. 1 - Aug. 10	2005	30,115	1,520	23	100	26	227	1,418	1,210	1,459	5,983
Jul. 1-Aug. 14,18-21	2006	23,177	3,105	10	196	7	464	3,125	1,010	2,212	10,129
Jul. 1-Aug. 4 & Aug. 9	2007	18,830	2,969	23	280	94	444	2,509	1,371	1,118	8,808
Jul. 1 - Aug. 9	2008	13,004	2,773	0	45	0	414	1,869	65	330	5,496
Jul. 1 - Aug. 6	2009	23,662	4,843	78	1,115	362	724	6,210	9,823	14,309	37,464
Jul. 1 - Aug. 15	2010	16,806	5,461	14	242	0	816	4,961	3,163	4,140	18,797
Jul. 1 - Aug. 15	2011	24,848	4,259	70	276	22	636	9,275	1,593	5,319	21,450
Jul. 1 - Aug. 15	2012	21,074	5,437	9	242	9	812	4,617	3,105	4,765	18,996
Jul. 1 - Aug. 15	2013	25,725	7,473	77	933	81	1,117	7,188	8,173	8,702	33,744
Average		21,983	3,891	32	350	55	581	4,420	2,940	4,545	16,813

Blue shaded cells indicate a year where a statistically valid creel survey was not conducted.

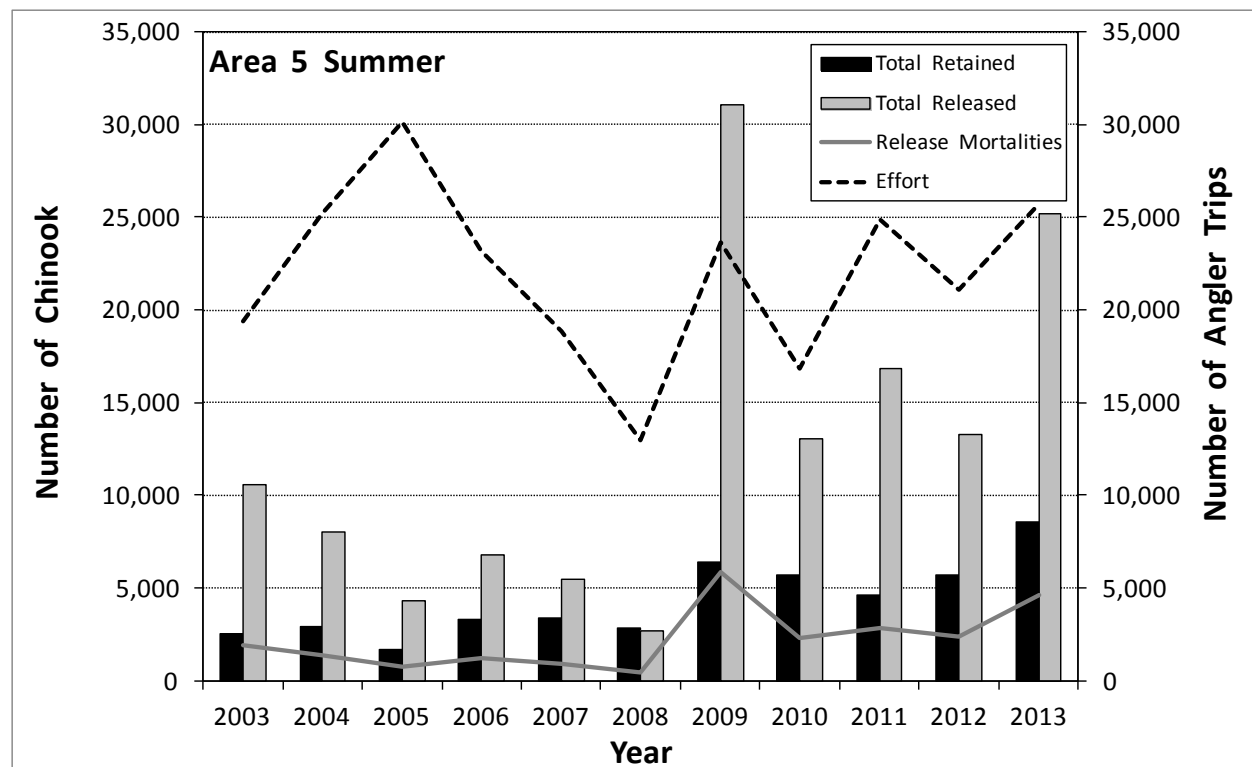


Figure 5S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 5 during the summer season.

Table 5S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 5 during the summer season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Jul. 5 - Aug. 3	2003	4.71	19.7%	11.0%	0.86	0.69
Jul. 1 - Aug. 8	2004	2.97	28.4%	6.7%	0.51	0.40
Jul. 1 - Aug. 10	2005	2.84	29.2%	8.9%	0.51	0.33
Jul. 1-Aug. 14,18-21	2006	2.19	35.2%	6.4%	0.38	0.29
Jul. 1-Aug. 4 & Aug. 9	2007	1.83	38.7%	11.8%	0.32	0.20
Jul. 1 - Aug. 9	2008	0.97	58.0%	1.6%	0.15	0.12
Jul. 1 - Aug. 6	2009	6.41	14.9%	24.3%	1.21	0.78
Jul. 1 - Aug. 15	2010	2.40	33.4%	4.5%	0.43	0.29
Jul. 1 - Aug. 15	2011	3.95	22.8%	8.0%	0.67	0.58
Jul. 1 - Aug. 15	2012	2.45	32.9%	4.6%	0.44	0.30
Jul. 1 - Aug. 15	2013	3.37	25.5%	12.7%	0.62	0.38
<b>Average</b>		3.10	30.8%	9.1%	0.55	0.40

Blue shaded cells indicate a year where a statistically valid creel survey was not conducted.

Table 5S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 5 during the summer season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2008	FRAM	3,511	2,996	4,040	1,490	12,037	6,507	4,305	802
	Estimated	3,188	1,869	110	330	5,497	5,057	2,893	346
	% Error	10.1%	60.3%	3572.7%	351.5%	119.0%	28.7%	48.8%	131.8%
2009	FRAM	5,074	4,319	6,390	2,255	18,038	9,393	10,425	1,263
	Estimated	5,567	6,288	10,938	14,671	37,464	11,855	8,031	4,232
	% Error	-8.9%	-31.3%	-41.6%	-84.6%	-51.9%	-20.8%	29.8%	-70.2%
2010	FRAM	5,358	3,877	4,850	1,670	15,755	9,235	10,630	989
	Estimated	6,276	4,974	3,405	4,140	18,795	11,250	6,458	1,586
	% Error	-14.6%	-22.1%	42.4%	-59.7%	-16.2%	-17.9%	64.6%	-37.6%
2011	FRAM	6,809	4,200	6,950	1,970	19,929	11,009	7,744	1,062
	Estimated	4,895	9,345	1,869	5,340	21,449	14,240	4,949	2,547
	% Error	39.1%	-55.1%	271.9%	-63.1%	-7.1%	-22.7%	56.5%	-58.3%
2012	FRAM	5,453	3,486	5,975	1,595	16,509	8,939	6,283	873
	Estimated	6,250	4,626	3,346	4,774	18,996	10,876	6,422	1,663
	% Error	-12.8%	-24.6%	78.6%	-66.6%	-13.1%	-17.8%	-2.2%	-47.5%
2013	FRAM	5,589	3,368	4,410	1,105	14,472	8,957	6,096	756
	Estimated	8,589	7,265	9,106	8,783	33,743	15,854	10,207	2,977
	% Error	-34.9%	-53.6%	-51.6%	-87.4%	-57.1%	-43.5%	-40.3%	-74.6%

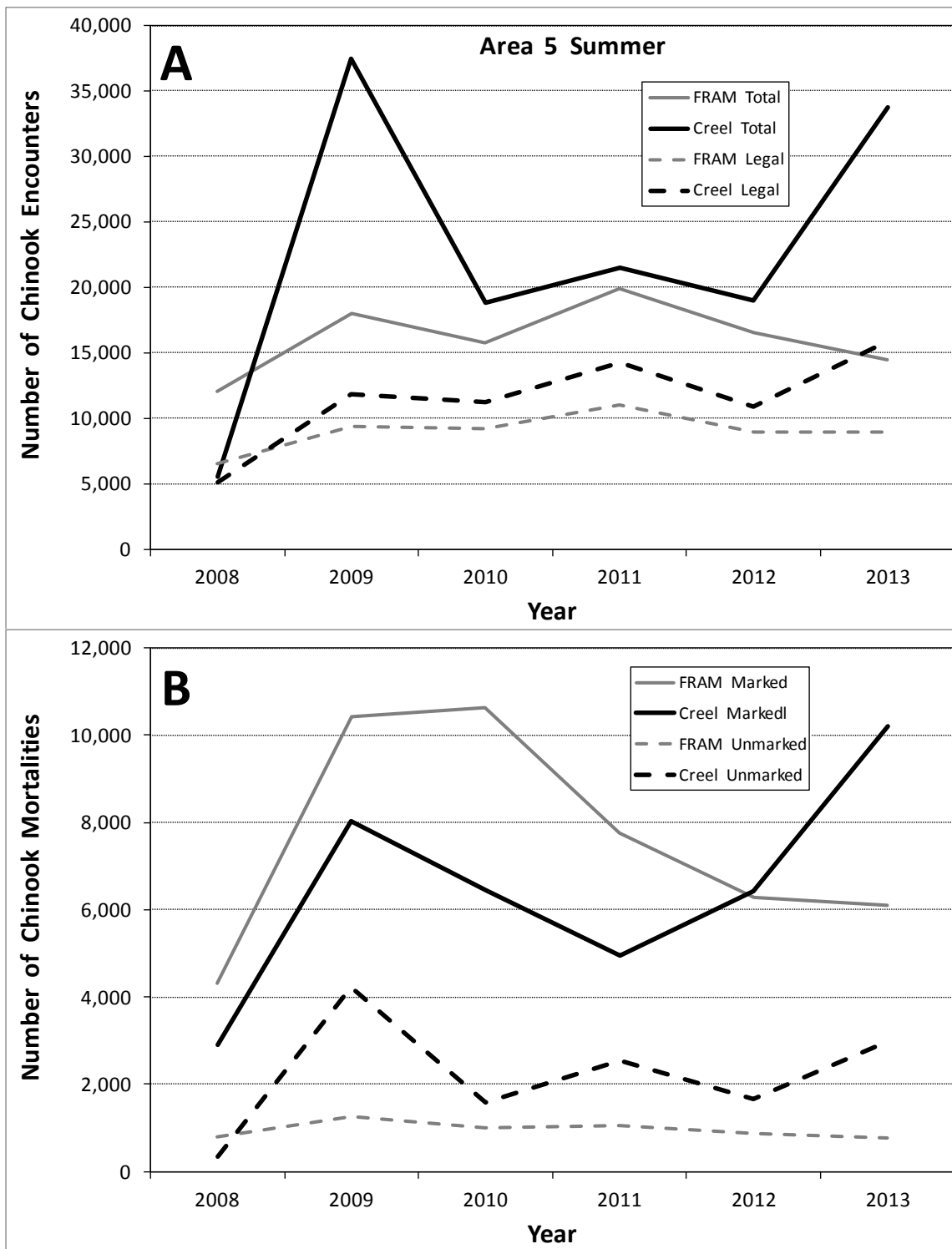


Figure 5S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 5 during the summer season.

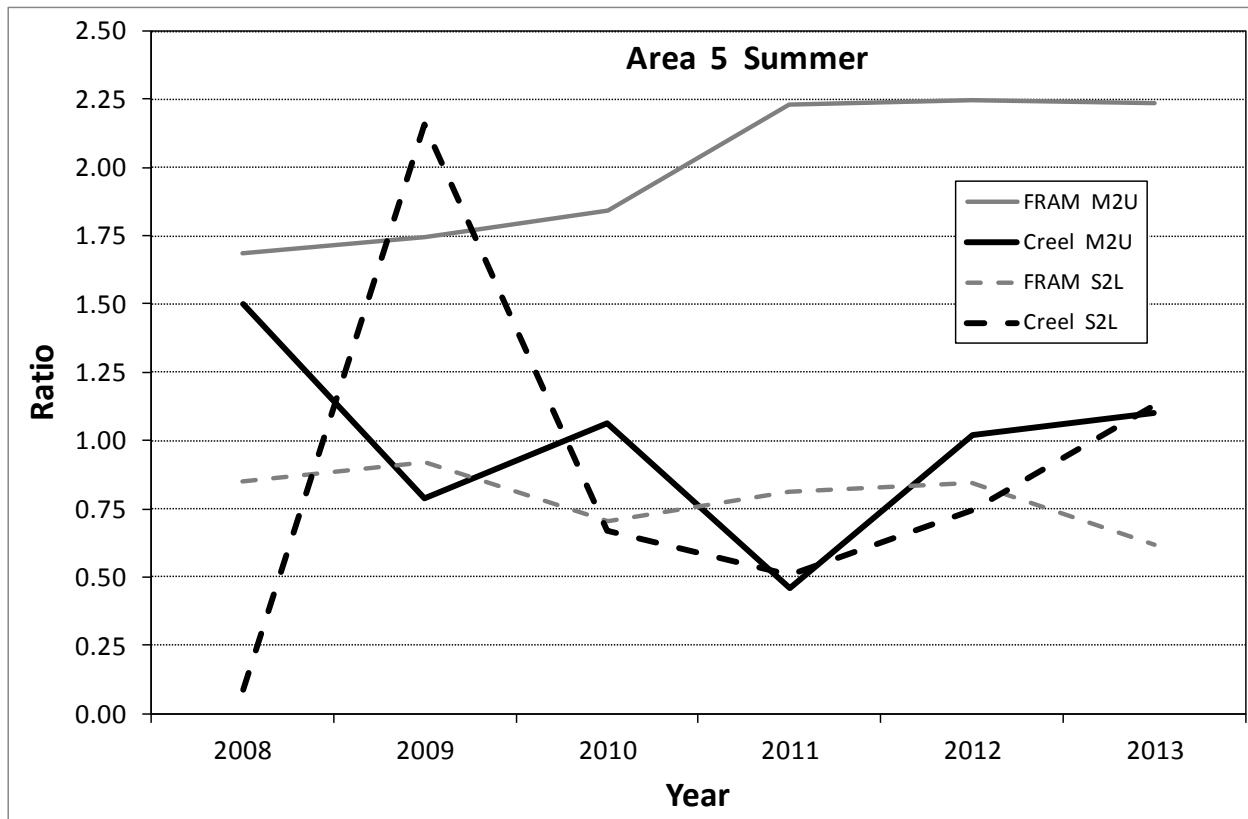


Figure 5S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 5 during the summer season.

## Area 6 Summary

### Area 6 Summer:

Summer MSFs have been conducted in Area 6 since 2003. Since 2010 this fishery has been open annually from July 1 to August 15. Across the nine years of estimates available for this fishery, it has averaged 5,236 angler trips, a harvest of 1,170 LM Chinook, and 2,443 total Chinook encounters (Table 6S-1). Effort, harvest, and total number released in 2011 (the last year for which estimates are available<sup>5</sup>) were all the largest observed (Figure 6S-1).

This fishery has averaged 1.2 Chinook released for every LM Chinook retained (Table 6S-2). Relative to other MSFs in Puget Sound, the average percentage of Chinook encounters that are LM is high in this fishery (average = 55%). Relative to other summer MSFs in Puget Sound, both the average percentage retained that are illegal (1.6%) and the average number of Chinook released per legal-size marked Chinook retained are low.

FRAM Comparison<sup>6</sup>: Since 2009, FRAM has predicted total Chinook encounters for this fishery with less than  $\pm 50$  %Error (Table 6S-3). However, FRAM has consistently under-predicted the encounters of legal-size Chinook compared to monitoring program estimates (Figure 6S-2A); the under-predictions have ranged from -27 to -60 %Error (Table 6S-3). Marked Chinook mortalities have generally been under-predicted by FRAM while the unmarked Chinook mortalities have been both over- and under- predicted (Figure 6S-2B). For three of the four years for which there are estimates, FRAM has projected the marked-to-unmarked ratio for Chinook encounters in the Area 6 summer MSF with less than  $\pm 16$  %Error (Figure 6S-3). FRAM projections and monitoring program estimates of the sublegal-to-legal ratio have not been close for this fishery; FRAM consistently projects a much higher sublegal-to-legal ratio than estimated by the monitoring program.

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<sup>5</sup> Since 2008, the Area 6 MSF has been monitored with the baseline sampling program and requires CRC estimates of total Chinook harvest before encounters and release mortalities can be estimated. Estimates for 2012 and 2013 are not yet available.

<sup>6</sup> From 2003 to 2007, FRAM evaluations for the areas 5 and 6 summer fisheries were reported for the combined fisheries. See Appendix B for these summaries.



Table 6S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 6 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Estimated Retained Chinook				Estimated Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Jul. 5 - Aug. 3	2003	5,195	941	22	0	0	141	1,283	52	103	2,542
Jul. 1 - Aug. 8	2004	4,251	669	5	2	0	100	820	42	11	1,649
Jul. 1 - Aug. 10	2005	3,971	404	0	0	4	60	790	70	0	1,328
Jul. 1-Aug. 14,18-21	2006	3,077	338	0	2	8	50	494	0	0	892
Jul. 1-Aug. 4 & Aug. 9	2007	3,221	715	7	7	0	107	404	9	0	1,249
Jul. 1 - Aug. 9	2008	2,812	535	2	0	0	80	378	0	15	1,010
Jul. 1 - Aug. 6	2009	9,394	2,336	0	36	0	349	1,216	193	275	4,405
Jul. 1 - Aug. 15	2010	4,744	1,394	2	4	0	208	544	41	27	2,220
Jul. 1 - Aug. 15	2011	10,463	3,202	7	97	14	479	1,746	634	512	6,691
Jul. 1 - Aug. 15	2012										
Jul. 1 - Aug. 15	2013										
Average		5,236	1,170	5	16	3	175	853	116	105	2,443

Grey shaded cells indicate estimates based on CRC methodology.

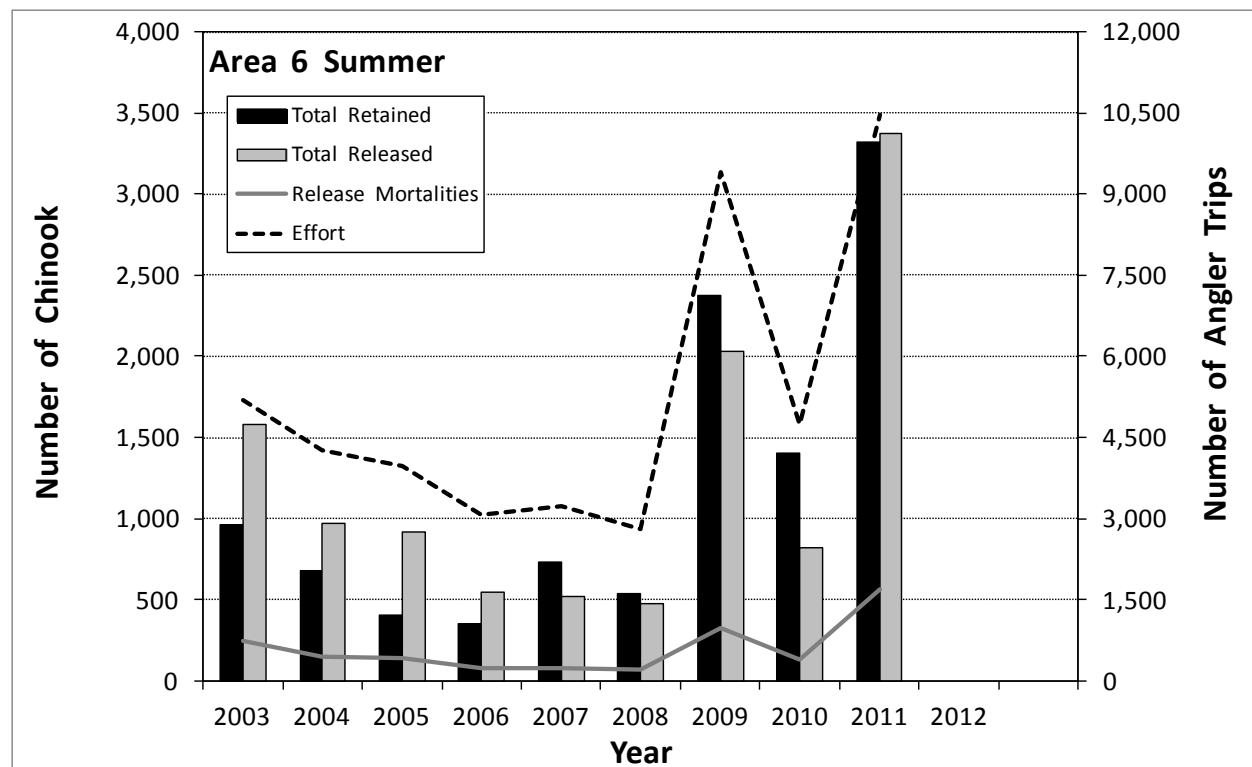


Figure 6S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 6 during the summer season.

Table 6S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 6 during the summer season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Jul. 5 - Aug. 3	2003	1.68	42.6%	2.3%	0.26	0.23
Jul. 1 - Aug. 8	2004	1.45	46.6%	1.0%	0.22	0.19
Jul. 1 - Aug. 10	2005	2.28	34.9%	1.0%	0.35	0.29
Jul. 1-Aug. 14,18-21	2006	1.61	43.5%	2.9%	0.24	0.22
Jul. 1-Aug. 4 & Aug. 9	2007	0.73	65.8%	1.9%	0.11	0.08
Jul. 1 - Aug. 9	2008	0.88	60.9%	0.4%	0.13	0.11
Jul. 1 - Aug. 6	2009	0.87	61.0%	1.5%	0.14	0.10
Jul. 1 - Aug. 15	2010	0.59	72.2%	0.4%	0.09	0.06
Jul. 1 - Aug. 15	2011	1.05	55.0%	3.6%	0.18	0.11
Jul. 1 - Aug. 15	2012		69.0%	1.0%		
Jul. 1 - Aug. 15	2013		48.1%	1.8%		
<b>Average</b>		1.24	54.5%	1.6%	0.19	0.16

Table 6S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 6 during the summer season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2008	FRAM	669	571	770	285	2,295	1,240	820	153
	Estimated	615	380	0	15	1,010	995	547	61
	% Error	8.8%	50.3%		1800.0%	127.2%	24.6%	49.9%	150.8%
2009	FRAM	846	720	1,065	375	3,006	1,566	1,002	196
	Estimated	2,685	1,216	229	275	4,405	3,901	2,463	237
	% Error	-68.5%	-40.8%	365.1%	36.4%	-31.8%	-59.9%	-59.3%	-17.3%
2010	FRAM	912	660	825	285	2,682	1,572	1,016	162
	Estimated	1,603	546	45	27	2,221	2,149	1,438	89
	% Error	-43.1%	20.9%	1733.3%	955.6%	20.8%	-26.8%	-29.3%	82.0%
2011	FRAM	1,355	836	1,385	390	3,966	2,191	1,542	211
	Estimated	3,681	1,753	730	526	6,690	5,434	3,498	385
	% Error	-63.2%	-52.3%	89.7%	-25.9%	-40.7%	-59.7%	-55.9%	-45.2%

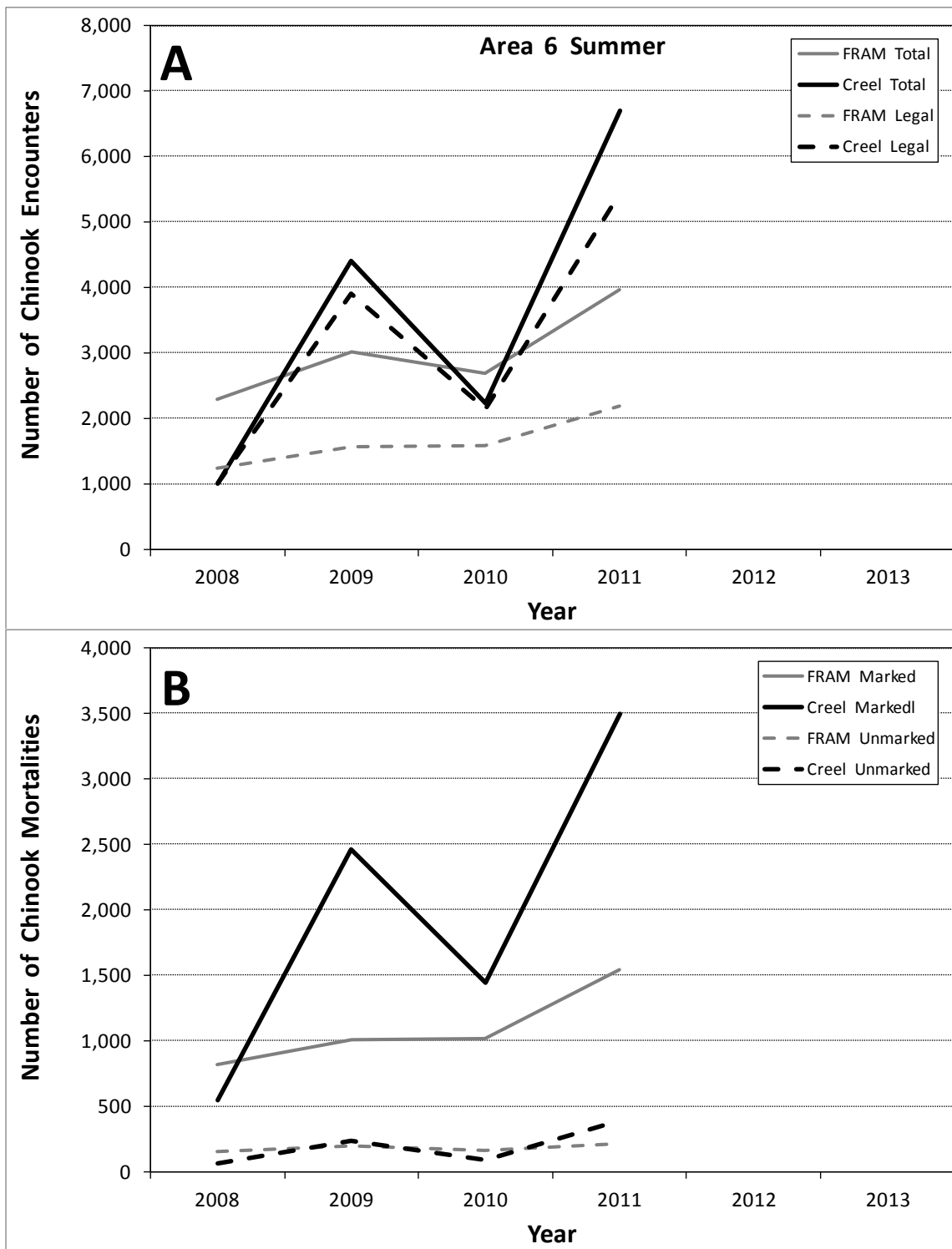


Figure 6S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 6 during the summer season.

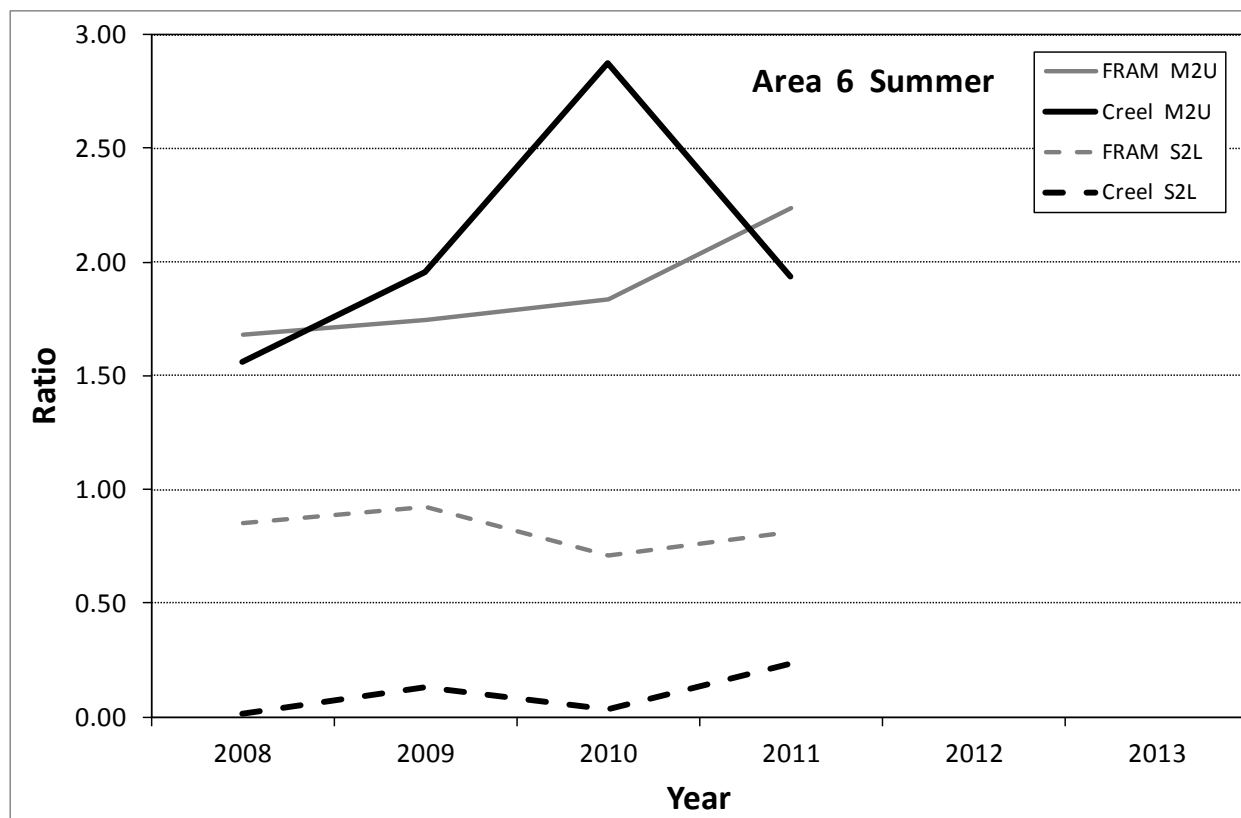


Figure 6S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 6 during the summer season.

#### Area 6 Winter:

A Chinook MSF was conducted in Area 6 during the winter for the first time during the 2012 management year. This fishery was conducted from December 1, 2012 to April 10, 2013 and was intensively monitored so there is a single year of monitoring program estimates available. For this fishery, there was an estimated total of 4,916 angler trips of effort with 1,395 LM Chinook retained, and a total of 2,474 encounters (Table 6W-1). A relatively high percentage of the encounters were legal-size and marked (Table 6W-2). FRAM projection for this fishery were very good; %Error for encounters and mortalities was less than  $\pm 11\%$  (Table 6W-3).

Table 6W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 6 during the winter season.

Fishery		Effort	Retained Chinook				Released Chinook				Total
Dates	Year	(angler trips)	LM	LU	SM	SU	LM	LU	SM	SU	Encounters
Dec. 1 - April 10	2012	4,916	1,395	21	14	0	209	385	315	135	2,474
	2013										

Table 6W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 6 during the winter season.

Fishery		# Rel./	% of Encntrs	% of Retained	Total Rel. Morts.	Unmrkd Rel. Morts.
Dates	Year	# LM Ret.	that are LM	that are Illegal	per LM Retained	per LM Retained
Dec. 1 - April 10	2012	0.75	64.8%	2.4%	0.10	0.05
	2013					

Table 6W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 6 during the winter season.

Year	Source	Encounters				Encounters		Mortalities		
		LM	LU	SM	SU	Total	Legal	Marked	Unmarked	
2012	FRAM	1,647	307	510	135	2,599	1,954	1,638	95	
	Estimated	1,604	406	329	135	2,474	2,010	1,503	106	
	% Error	2.7%	-24.4%	55.0%	0.0%	5.1%	-2.8%	9.0%	-10.4%	

## Area 7 Summary

### Area 7 Winter:

A winter MSF has been conducted in Area 7 since the 2007 management year. Since the 2009 management year, this fishery has been open annually from December 1 to April 30. During the six years that this fishery has been conducted, it has averaged 9,215 angler trips, a harvest of 2,051 LM Chinook, and 4,534 total Chinook encounters (Table 7W-1). Effort peaked in 2010, while Chinook harvest peaked in 2012 and total number of Chinook released in 2011 (Figure 7W-1).

This fishery has averaged 1.2 Chinook released for every LM Chinook retained (Table 7W-2) which is relatively low compared to other MSFs in Puget Sound. The average percentage of Chinook encounters that are LM is relatively high in this fishery (54%) compared to other winter MSFs in Puget Sound. Both the average percentage retained that are illegal (1.8%) and the average number of release mortalities per LM Chinook retained (0.20 mortalities per LM retained) are relatively low.

FRAM Comparison: Since 2008, FRAM has generally over-predicted total Chinook encounters for this fishery by 100% or more (Figure 7W-2A). FRAM projections of legal-size encounters have been within  $\pm 30\%$  for the last three years (Table 7W-3). Marked and unmarked Chinook mortalities have generally been over-predicted by FRAM (Figure 7W-2B). FRAM projections and monitoring program estimates of the marked-to-unmarked ratio have generally tracked for this fishery; FRAM consistently projects a much higher sublegal-to-legal ratio than observed (Figure 7W-3).

Table 7W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 7 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Feb. 1 - Feb. 29	2007	4,862	1,301	2	24	0	200	1,042	244	155	2,968
Feb. 1 - Apr. 15	2008	8,167	1,406	9	14	0	210	708	139	17	2,503
Dec. 1 - Apr. 30	2009	9,589	1,400	0	18	0	209	673	150	74	2,524
Dec. 1 - Apr. 30	2010	11,814	2,368	4	10	0	354	1,988	521	531	5,776
Dec. 1 - Apr. 30	2011	10,536	2,359	0	54	0	353	1,446	1,935	678	6,825
Dec. 1 - Apr. 30	2012	10,322	3,469	3	106	0	518	1,363	817	332	6,608
	2013										
Average		9,215	2,051	3	38	0	307	1,203	634	298	4,534

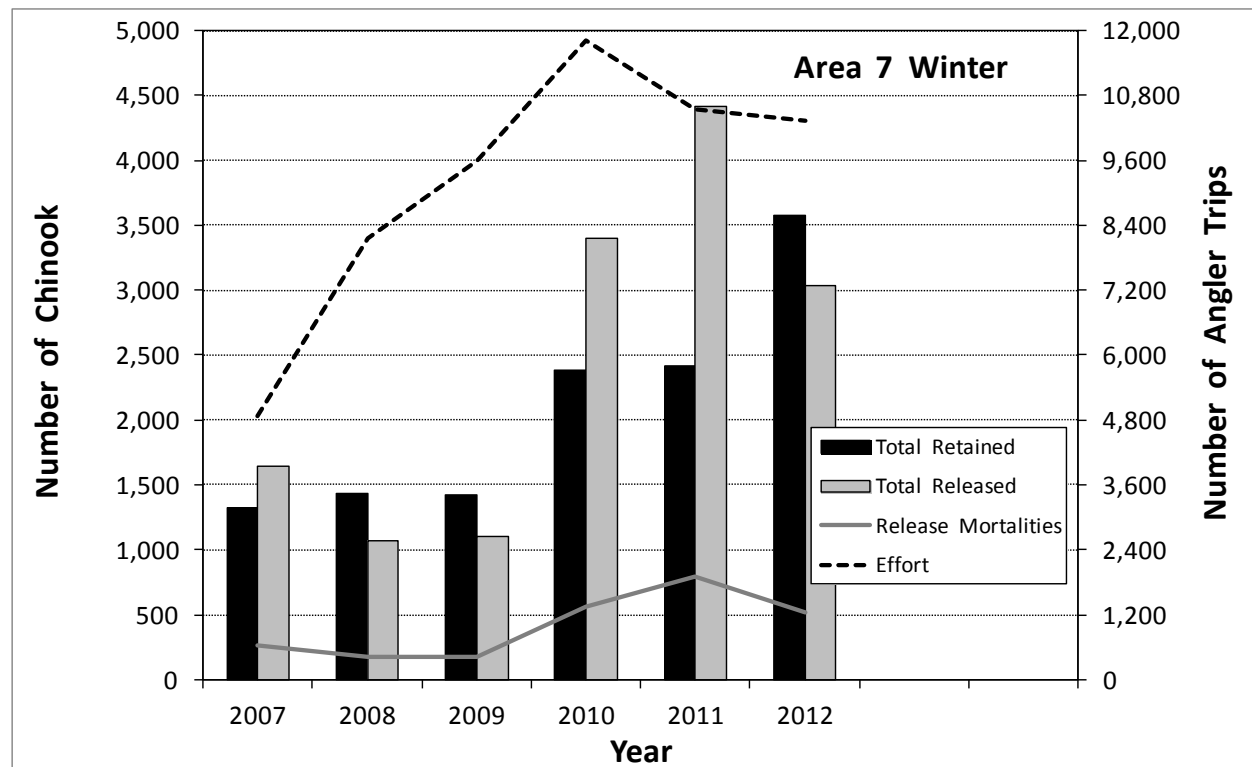


Figure 7W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 7 during the winter season.

Table 7W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 7 during the winter season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Feb. 1 - Feb. 29	2007	1.26	50.6%	2.0%	0.20	0.14
Feb. 1 - Apr. 15	2008	0.76	64.6%	1.6%	0.12	0.08
Dec. 1 - Apr. 30	2009	0.79	63.7%	1.3%	0.13	0.08
Dec. 1 - Apr. 30	2010	1.43	47.1%	0.6%	0.24	0.17
Dec. 1 - Apr. 30	2011	1.87	39.7%	2.2%	0.34	0.15
Dec. 1 - Apr. 30	2012	0.87	60.3%	3.0%	0.15	0.08
	2013					
<b>Average</b>		1.17	54.3%	1.8%	0.20	0.12

Table 7W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 7 during the winter season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	424	303	710	735	2,172	727	564	214
	Estimated	1,501	1,044	268	155	2,968	2,545	1,404	189
	% Error	-71.8%	-71.0%	164.9%	374.2%	-26.8%	-71.4%	-59.8%	13.0%
2008	FRAM	839	548	2,465	1,255	5,107	1,387	2,118	416
	Estimated	1,616	717	153	17	2,503	2,333	1,479	119
	% Error	-48.1%	-23.6%	1511.1%	7282.4%	104.0%	-40.5%	43.2%	249.6%
2009	FRAM	2,374	1,173	5,190	2,400	11,137	3,547	5,318	835
	Estimated	1,609	673	168	74	2,524	2,282	1,479	116
	% Error	47.5%	74.3%	2989.3%	3143.2%	341.2%	55.4%	259.6%	619.8%
2010	FRAM	2,497	971	5,245	2,505	11,218	3,468	3,378	656
	Estimated	2,722	1,992	531	531	5,776	4,714	2,536	409
	% Error	-8.3%	-51.3%	887.8%	371.8%	94.2%	-26.4%	33.2%	60.4%
2011	FRAM	3,492	779	8,000	2,170	14,441	4,271	4,858	558
	Estimated	2,712	1,446	1,989	678	6,825	4,158	2,853	353
	% Error	28.8%	-46.1%	302.2%	220.1%	111.6%	2.7%	70.3%	58.1%
2012	FRAM	3,544	740	8,390	1,945	14,619	4,284	4,984	506
	Estimated	3,988	1,366	923	332	6,609	5,354	3,816	273
	% Error	-11.1%	-45.8%	809.0%	485.8%	121.2%	-20.0%	30.6%	85.3%



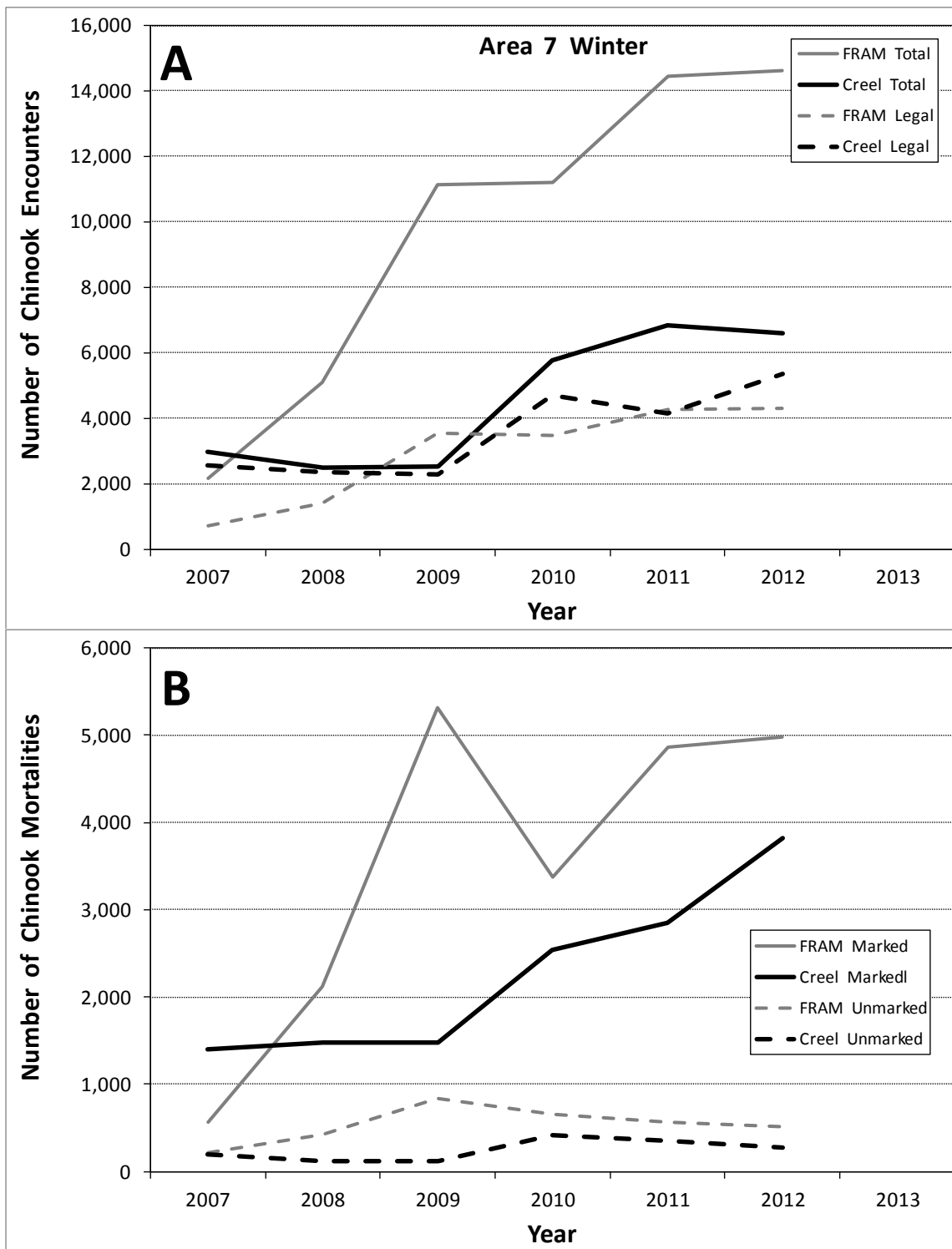


Figure 7W-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 7 during the winter season.

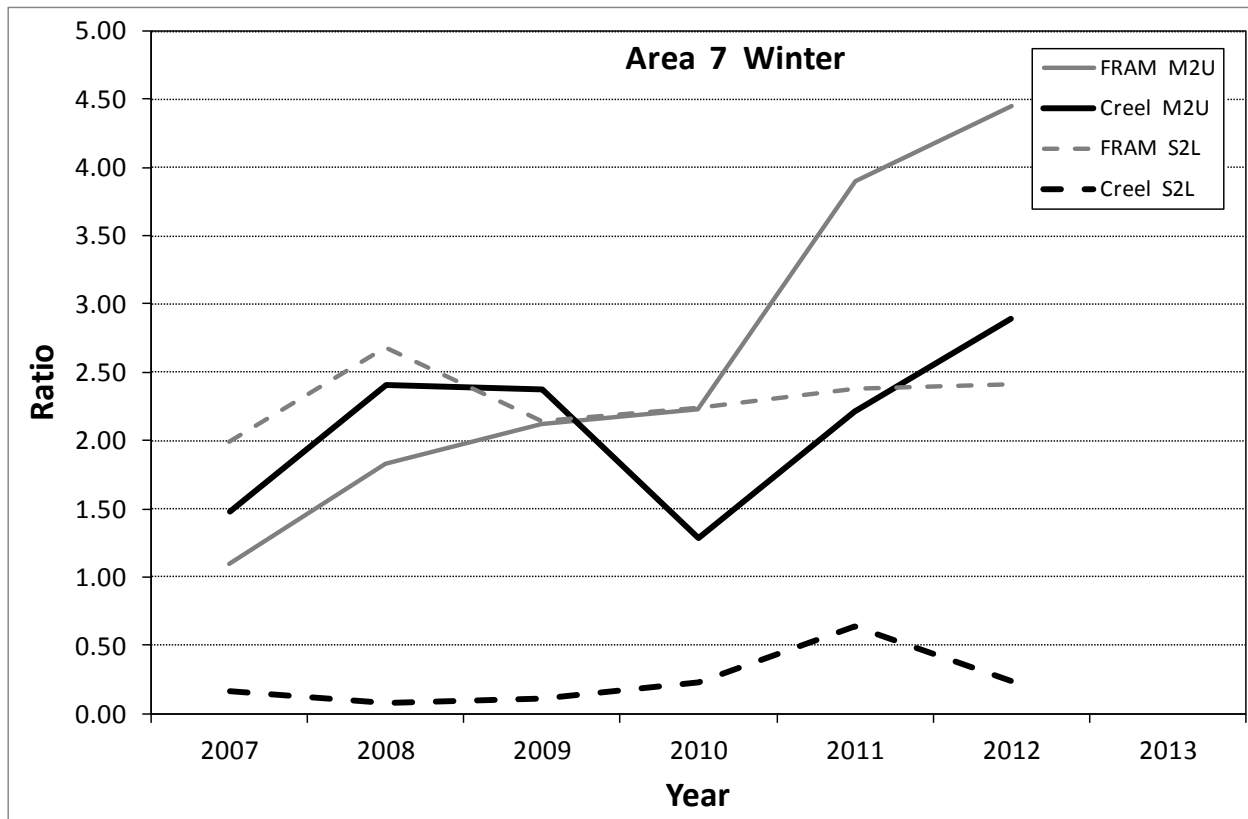


Figure 7W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 7 during the winter season.

## Area 8 Summary

### Area 8 Winter:

A winter MSF has been conducted in Area 8 since the 2005 management year. Since 2009 this fishery has been annually open from November 1 to April 30. Separate creel surveys are conducted for the two sub-areas of Area 8 (8-1 and 8-2). During the eight years that this fishery has been conducted, effort has averaged 2,955 angler-trips in Area 8-1 and 5,961 angler-trips in Area 8-2 (Tables 81W-1 and 82W-1). LM Chinook retained has averaged 316 in Area 8-1 and 567 in Area 8-2. Area 8-2 has averaged twice as many total Chinook encounters as Area 8-1 (4,403 compared to 2,001). Angler effort in both sub-areas has been declining since 2005 (Figure 8W-1).

The average number of Chinook released per LM Chinook retained (5.2 for Area 8-1 and 6.1 for Area 8-2) is relatively high for both sub-areas compared to other MSFs in Puget Sound (Tables 81W-2 and 82W-2). Relative to other MSFs in Puget Sound, the average proportion of encounters that are LM is low for both sub-areas in Area 8 (20.4% and 23.1%). These sub-areas also have a relatively high number of release mortalities of unmarked Chinook for each LM Chinook retained (0.40 and 0.42 mortalities per LM retained).

FRAM Comparison: FRAM typically over-predicts Chinook encounters and mortalities for these fisheries, sometimes by very large amounts (Table 8W-3). Marked and unmarked Chinook mortalities have generally been over-predicted by FRAM (Figure 8W-2B). The trend in decreasing marked mortalities over time in this fishery seen in the creel-survey data has not been captured in FRAM projections (Figure 8W-2B). FRAM projections and monitoring program estimates of both the S2L and M2U ratios have generally tracked for this fishery (Figure 8W-3) and there has typically been less than  $\pm 75$  %Error for either ratio.

Table 81W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 8-1 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Oct. 1 - Apr. 30	2005	3,976	303	0	39	0	45	188	763	575	1,913
Oct. 1 - Apr. 30	2006	3,454	278	8	37	4	42	118	1,437	857	2,781
Nov. 1 - Apr. 30	2007	3,288	638	5	36	0	95	304	1,345	577	3,000
Jan. 1 - Apr. 30	2008	2,518	396	12	7	0	59	45	1,443	909	2,871
Nov. 1 - Apr. 30	2009	3,192	273	0	11	0	41	45	595	269	1,234
Nov. 1 - Apr. 30	2010	2,398	87	0	9	0	13	15	91	68	283
Nov. 1 - Apr. 30	2011	2,767	284	0	7	0	42	136	1,027	272	1,768
Nov. 1 - Apr. 30	2012	2,046	268	0	14	0	40	88	955	793	2,158
	2013										
Average		2,955	316	3	20	1	47	117	957	540	2,001

Table 82W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 8-2 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Oct. 1 - Apr. 30	2005	8,521	735	40	35	0	106	618	1,706	876	4,116
Oct. 1 - Apr. 30	2006	7,848	766	18	95	3	113	183	10,486	5,407	17,071
Nov. 1 - Apr. 30	2007	5,678	795	15	74	3	114	181	942	303	2,427
Jan. 1 - Apr. 30	2008	5,946	495	15	14	0	74	18	1,557	468	2,641
Nov. 1 - Apr. 30	2009	6,732	814	4	10	0	122	164	1,300	487	2,901
Nov. 1 - Apr. 30	2010	3,505	111	0	5	0	17	20	122	88	363
Nov. 1 - Apr. 30	2011	5,197	470	2	27	0	70	223	1,683	450	2,925
Nov. 1 - Apr. 30	2012	4,260	346	0	17	0	52	113	1,231	1,021	2,780
	2013										
Average		5,961	567	12	35	1	84	190	2,378	1,138	4,403

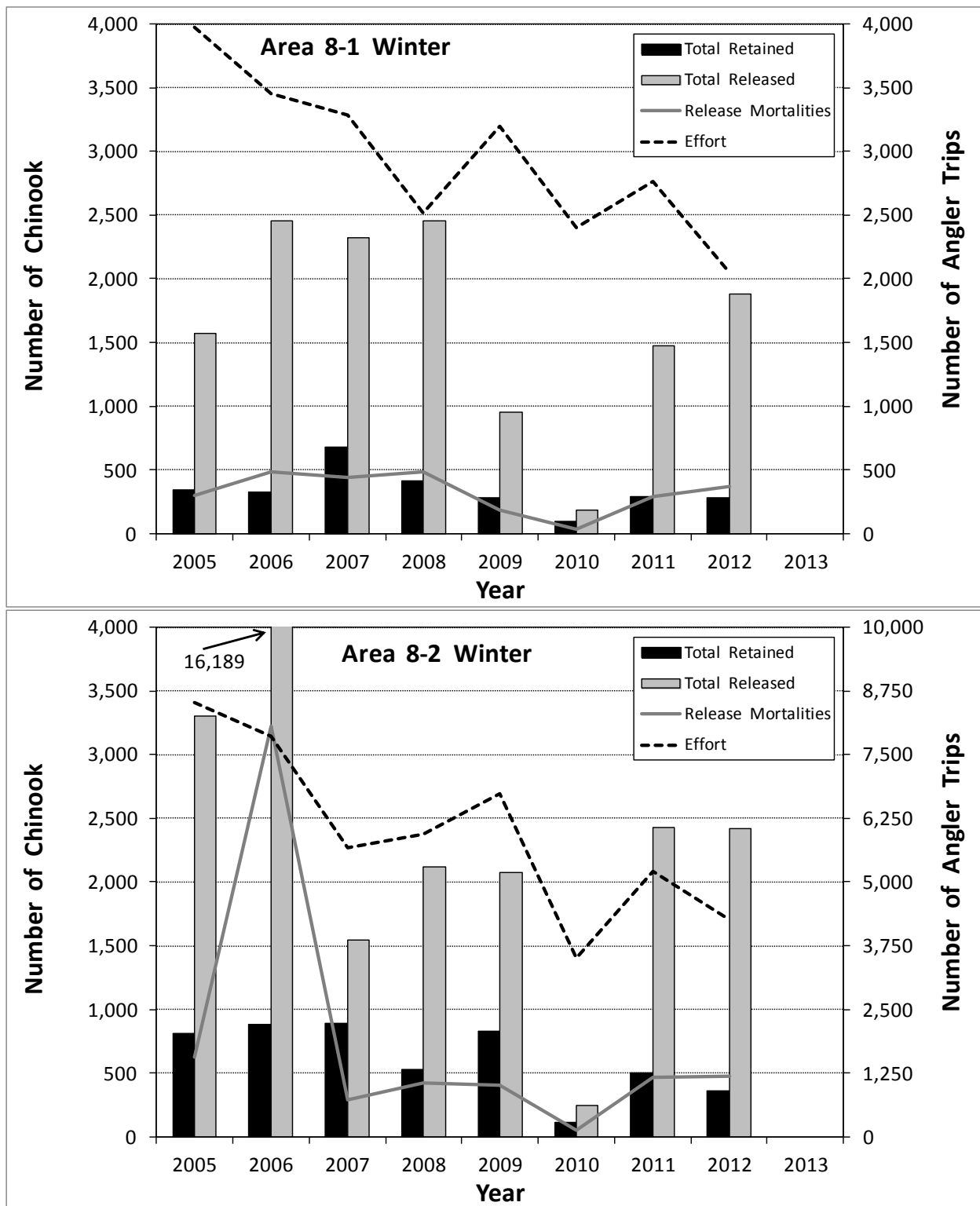


Figure 8W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Areas 8-1 and 8-2 during the winter season.

Table 81W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 8-1 during the winter season.

<b>Fishery</b>		# Rel./	% of Encntrs	% of Retained	Total Rel. Morts.	Unmrkd Rel. Morts.
<b>Dates</b>	<b>Year</b>	# LM Ret.	that are LM	that are Illegal	per LM Retained	per LM Retained
Oct. 1 - Apr. 30	2005	5.18	18.2%	11.4%	1.00	0.47
Oct. 1 - Apr. 30	2006	8.83	11.5%	15.0%	1.74	0.68
Nov. 1 - Apr. 30	2007	3.64	24.4%	6.0%	0.70	0.25
Jan. 1 - Apr. 30	2008	6.20	15.8%	4.6%	1.23	0.48
Nov. 1 - Apr. 30	2009	3.48	25.4%	3.9%	0.68	0.22
Nov. 1 - Apr. 30	2010	2.15	35.3%	9.4%	0.41	0.18
Nov. 1 - Apr. 30	2011	5.20	18.4%	2.4%	1.01	0.26
Nov. 1 - Apr. 30	2012	7.00	14.3%	5.0%	1.38	0.64
	2013					
<b>Average</b>		5.21	20.4%	7.2%	1.02	0.40

Table 82W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 8-2 during the winter season.

<b>Fishery</b>		# Rel./	% of Encntrs	% of Retained	Total Rel. Morts.	Unmrkd Rel. Morts.
<b>Dates</b>	<b>Year</b>	# LM Ret.	that are LM	that are Illegal	per LM Retained	per LM Retained
Oct. 1 - Apr. 30	2005	4.50	20.4%	9.3%	0.85	0.36
Oct. 1 - Apr. 30	2006	21.13	5.1%	13.2%	4.21	1.45
Nov. 1 - Apr. 30	2007	1.94	37.5%	10.4%	0.37	0.11
Jan. 1 - Apr. 30	2008	4.28	21.5%	5.5%	0.85	0.19
Nov. 1 - Apr. 30	2009	2.55	32.3%	1.7%	0.49	0.15
Nov. 1 - Apr. 30	2010	2.23	35.3%	4.3%	0.43	0.19
Nov. 1 - Apr. 30	2011	5.16	18.5%	5.8%	1.00	0.26
Nov. 1 - Apr. 30	2012	6.99	14.3%	4.7%	1.37	0.64
	2013					
<b>Average</b>		6.10	23.1%	6.9%	1.20	0.42

Table 8W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Areas 8-1 and 8-2 (combined) during the winter season.

Year	Source	Encounters				Encounters		Mortalities	
		LM	LU	SM	SU	Total	Legal	Marked	Unmarked
2005	FRAM	1,325	3,172	3,070	9,515	17,082	4,497	1,933	2,608
	Estimated	1,189	846	2,543	1,451	6,029	2,035	1,629	451
	% Error	11.4%	274.9%	20.7%	555.8%	183.3%	121.0%	18.7%	478.1%
2006	FRAM	1,876	1,981	7,745	7,460	19,062	3,857	3,417	1,931
	Estimated	1,199	327	12,055	6,271	19,852	1,526	3,584	1,331
	% Error	56.5%	505.8%	-35.8%	19.0%	-4.0%	152.8%	-4.7%	45.1%
2007	FRAM	1,742	2,551	5,475	5,155	14,923	4,293	2,830	1,598
	Estimated	1,642	505	2,398	883	5,428	2,147	2,032	271
	% Error	6.1%	405.1%	128.3%	483.8%	174.9%	100.0%	39.3%	489.7%
2008	FRAM	1,501	1,393	7,295	4,295	14,484	2,894	4,251	1,255
	Estimated	1,023	90	3,021	1,377	5,511	1,113	1,531	312
	% Error	46.7%	1447.8%	141.5%	211.9%	162.8%	160.0%	177.7%	302.2%
2009	FRAM	1,742	2,551	5,475	5,155	14,923	4,293	2,830	1,598
	Estimated	1,250	213	1,916	756	4,135	1,463	1,512	187
	% Error	39.4%	1097.7%	185.8%	581.9%	260.9%	193.4%	87.2%	754.5%
2010	FRAM	1,700	900	9,170	5,270	17,040	2,600	4,899	1,394
	Estimated	227	35	227	157	646	262	258	37
	% Error	648.9%	2471.4%	3939.6%	3256.7%	2537.8%	892.4%	1798.8%	3667.6%
2011	FRAM	2,273	669	11,075	4,805	18,822	2,942	4,337	1,121
	Estimated	866	361	2,743	722	4,692	1,227	1,346	200
	% Error	162.5%	85.3%	303.8%	565.5%	301.2%	139.8%	222.2%	460.5%
2012	FRAM	2,319	444	11,435	4,600	18,798	2,763	4,451	1,019
	Estimated	706	202	2,217	1,814	4,939	908	1,095	393
	% Error	228.5%	119.8%	415.8%	153.6%	280.6%	204.3%	306.5%	159.3%

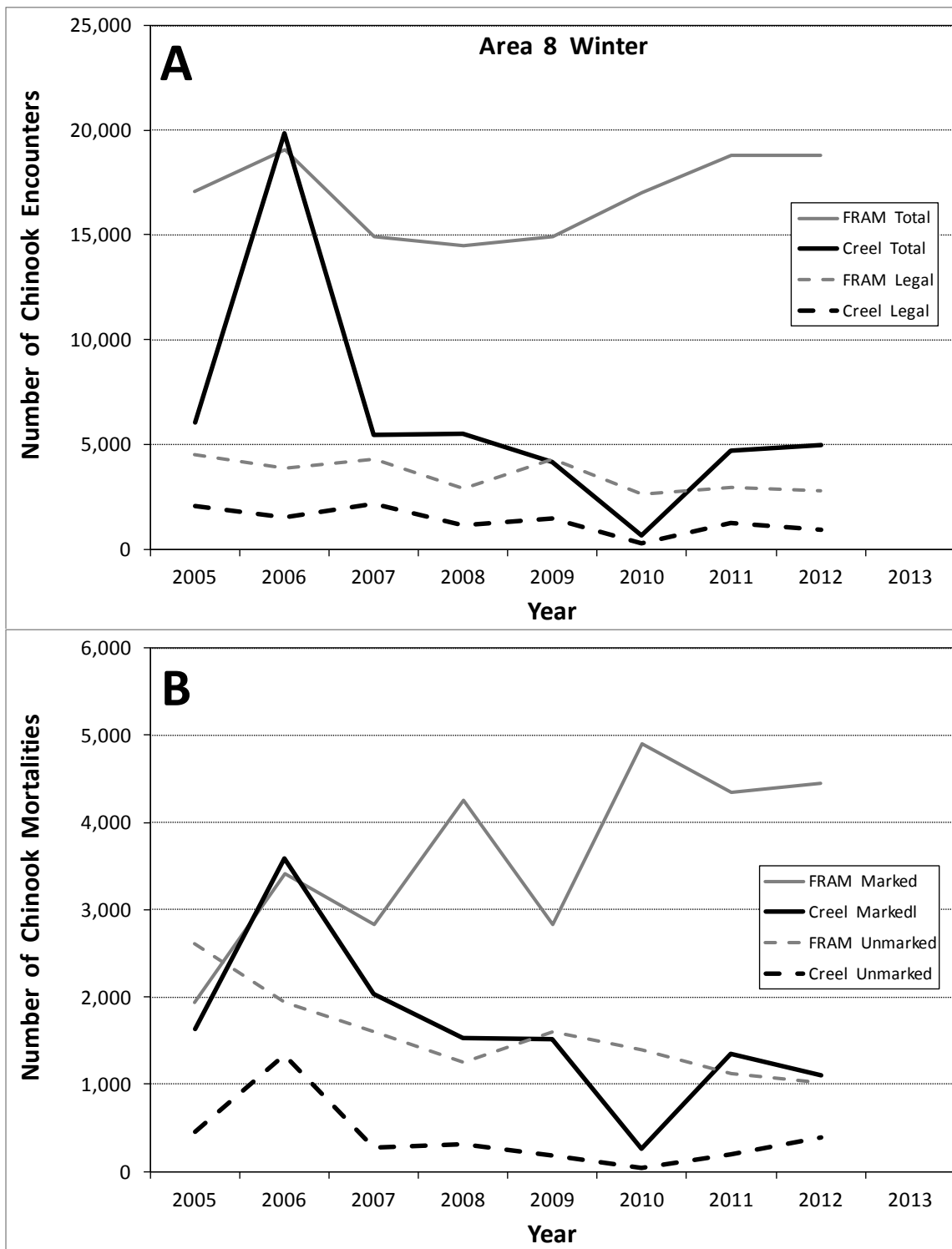


Figure 8W-2. Comparison of monitoring program estimates to FRAM pre-season projects for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Areas 8-1 and 8-2 (combined) during the winter season.



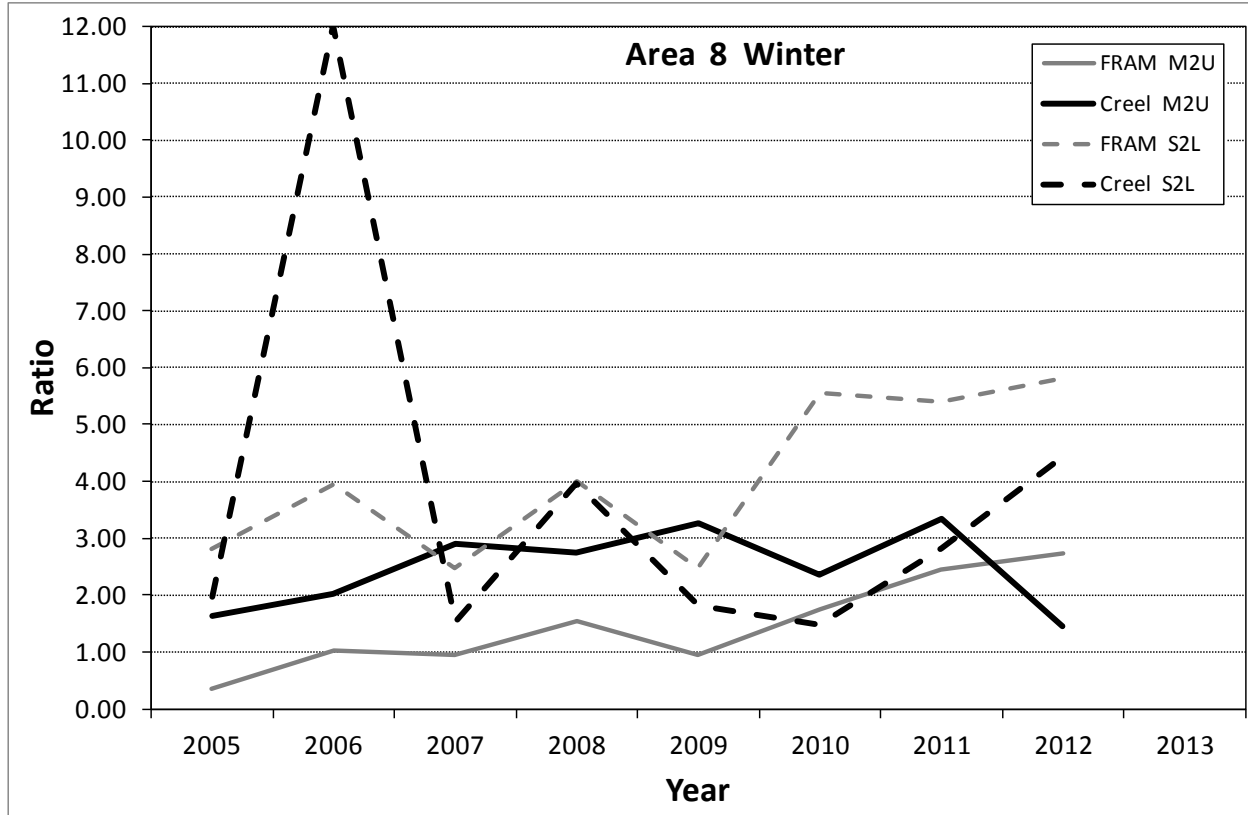


Figure 8W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Areas 8-1 and 8-2 (combined) during the winter season.

## Area 9 Summary

### Area 9 Summer:

Summer MSFs have been conducted in Area 9 since 2007. Since 2009 this fishery has been scheduled to be open annually from July 16 to August 31<sup>7</sup>. During the seven years that this fishery has been conducted, it has averaged 27,890 angler trips, a harvest of 4,489 LM Chinook, and 11,932 total Chinook encounters (Table 9S-1). Total catch and total encounters in 2012 were the highest observed (Figure 9S-1) during the years monitored. In 2013, angler effort expressed as number of angler trips per day open exceeded annual estimates for the previous five years by at least 200 angler trips per day and was similar to that estimated for the first year the fishery was open.

This fishery has averaged 1.8 Chinook released for every LM Chinook retained (Table 9S-2). Compared to other summer MSFs in Puget Sound, the average number of release mortalities of unmarked Chinook per legal-size marked Chinook retained is relatively high (0.15 mortalities per LM retained).

FRAM Comparison: In every year but 2012, FRAM over-predicted total Chinook encounters compared to monitoring program estimates (Figure 9S-2A). The %Errors for legal-size encounters have (with one exception) been less than  $\pm 100\%$  (Table 9S-3). Marked and unmarked Chinook mortalities were over-predicted by FRAM in every year but 2012 (Figure 9S-2B) but the 2012 and 2013 fisheries were closed two to three weeks early to keep them within FRAM projections (see footnote 7). FRAM has generally over-predicted the marked-to-unmarked ratio for Chinook encounters in the Area 9 summer MSF and had %Errors > 100% in 2011 and 2012 (Figure 9S-3). FRAM projections and monitoring program estimates of the sublegal-to-legal ratio have shown similar trends during the last three years although FRAM has over-predicted the S2L ratio in each year.

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<sup>7</sup> In 2012 and 2013 this fishery was closed on August 19 and August 4, respectively, as target encounter levels were achieved earlier than expected.

Table 9S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 9 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Jul. 16 - Jul. 31	2007	18,160	5,094	13	146	20	711	1,111	1,286	317	8,698
Jul. 16 - Aug. 15	2008	20,399	4,035	3	10	0	597	1,608	3,212	3,826	13,291
Jul. 16 - Aug. 31	2009	42,219	3,090	20	139	0	462	1,271	8,257	2,905	16,144
Jul. 16 - Aug. 31	2010	31,200	5,282	33	10	6	740	2,125	750	249	9,195
Jul. 16 - Aug. 31	2011	37,862	2,285	19	78	6	339	1,142	2,150	1,070	7,089
Jul. 16 - Aug. 19	2012	24,886	6,972	12	101	2	1,039	2,351	5,168	4,721	20,366
Jul. 16 - Aug. 4	2013	20,501	4,667	18	39	0	697	1,174	1,750	397	8,742
Average		27,890	4,489	17	75	5	655	1,540	3,225	1,926	11,932

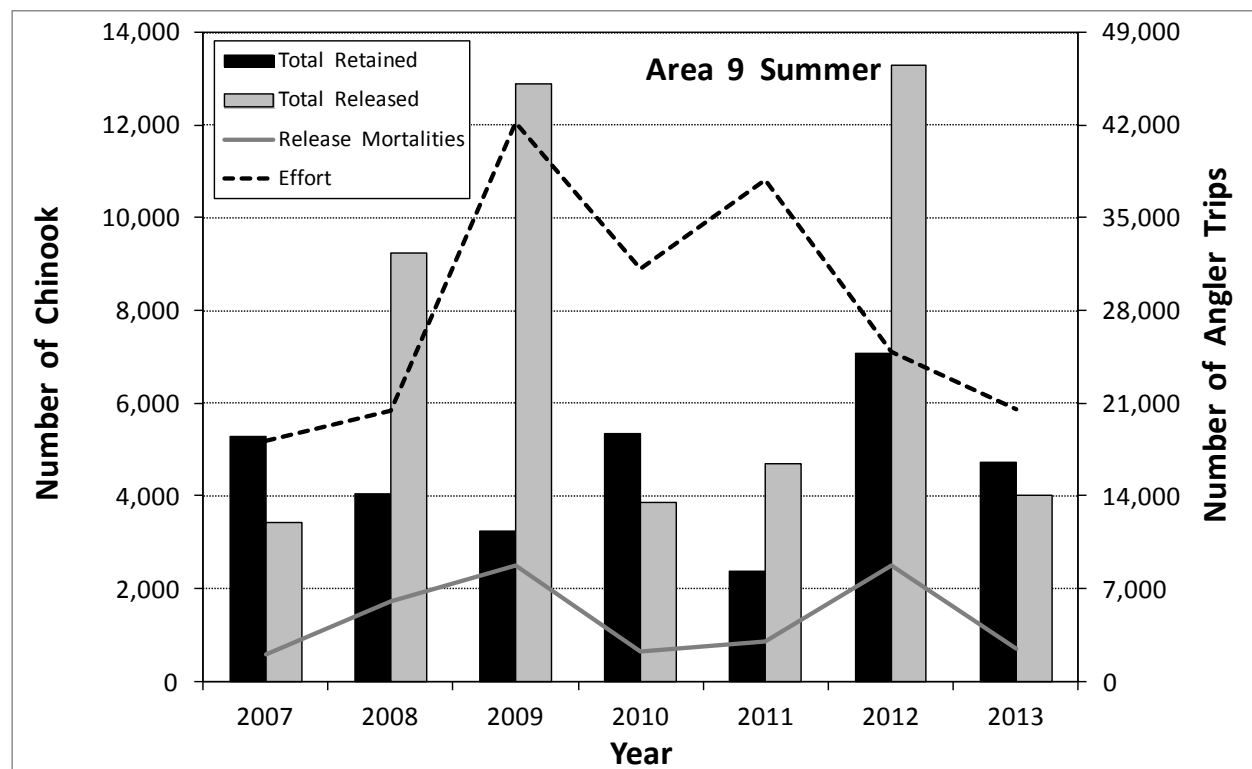


Figure 9S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 9 during the summer season.

Table 9S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 9 during the summer season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Jul. 16 - Jul. 31	2007	0.67	66.7%	3.4%	0.12	0.05
Jul. 16 - Aug. 15	2008	2.29	34.9%	0.3%	0.43	0.25
Jul. 16 - Aug. 15	2009	4.17	22.0%	4.9%	0.81	0.25
Jul. 16 - Aug. 31	2010	0.73	65.5%	0.9%	0.12	0.07
Jul. 16 - Aug. 31	2011	2.06	37.0%	4.3%	0.38	0.17
Jul. 16 - Aug. 19	2012	1.90	39.3%	1.6%	0.36	0.19
Jul. 16 - Aug. 4	2013	0.86	61.4%	1.2%	0.15	0.05
<b>Average</b>		1.81	46.7%	2.4%	0.34	0.15

Table 9S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 9 during the summer season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	5,462	2,070	5,370	1,720	14,622	7,532	6,514	804
	Estimated	5,805	1,125	1,432	337	8,699	6,930	5,604	263
	% Error	-5.9%	84.0%	275.0%	410.4%	68.1%	8.7%	16.2%	205.7%
2008	FRAM	4,110	2,271	7,915	2,785	17,081	6,381	5,678	1,020
	Estimated	4,632	1,611	3,222	3,826	13,291	6,243	4,777	1,009
	% Error	-11.3%	41.0%	145.7%	-27.2%	28.5%	2.2%	18.9%	1.1%
2009	FRAM	10,097	3,334	16,925	5,135	35,491	13,431	21,589	1,655
	Estimated	3,552	1,291	8,395	2,905	16,143	4,843	4,950	792
	% Error	184.3%	158.2%	101.6%	76.8%	119.9%	177.3%	336.1%	109.0%
2010	FRAM	6,108	2,047	8,845	2,835	19,835	8,155	12,781	912
	Estimated	6,022	2,158	759	255	9,194	8,180	5,552	408
	% Error	1.4%	-5.1%	1065.3%	1011.8%	115.7%	-0.3%	130.2%	123.5%
2011	FRAM	5,632	1,388	9,045	1,985	18,050	7,020	7,064	630
	Estimated	2,624	1,161	2,228	1,076	7,089	3,785	2,844	411
	% Error	114.6%	19.6%	306.0%	84.5%	154.6%	85.5%	148.4%	53.3%
2012	FRAM	5,100	1,050	8,535	1,715	16,400	6,150	6,465	519
	Estimated	8,011	2,363	5,269	4,724	20,367	10,374	8,262	1,311
	% Error	-36.3%	-55.6%	62.0%	-63.7%	-19.5%	-40.7%	-21.8%	-60.4%
2013	FRAM	5,658	870	5,410	910	12,848	6,528	6,362	327
	Estimated	5,364	1,192	1,789	397	8,742	6,556	5,160	274
	% Error	5.5%	-27.0%	202.4%	129.2%	47.0%	-0.4%	23.3%	19.3%

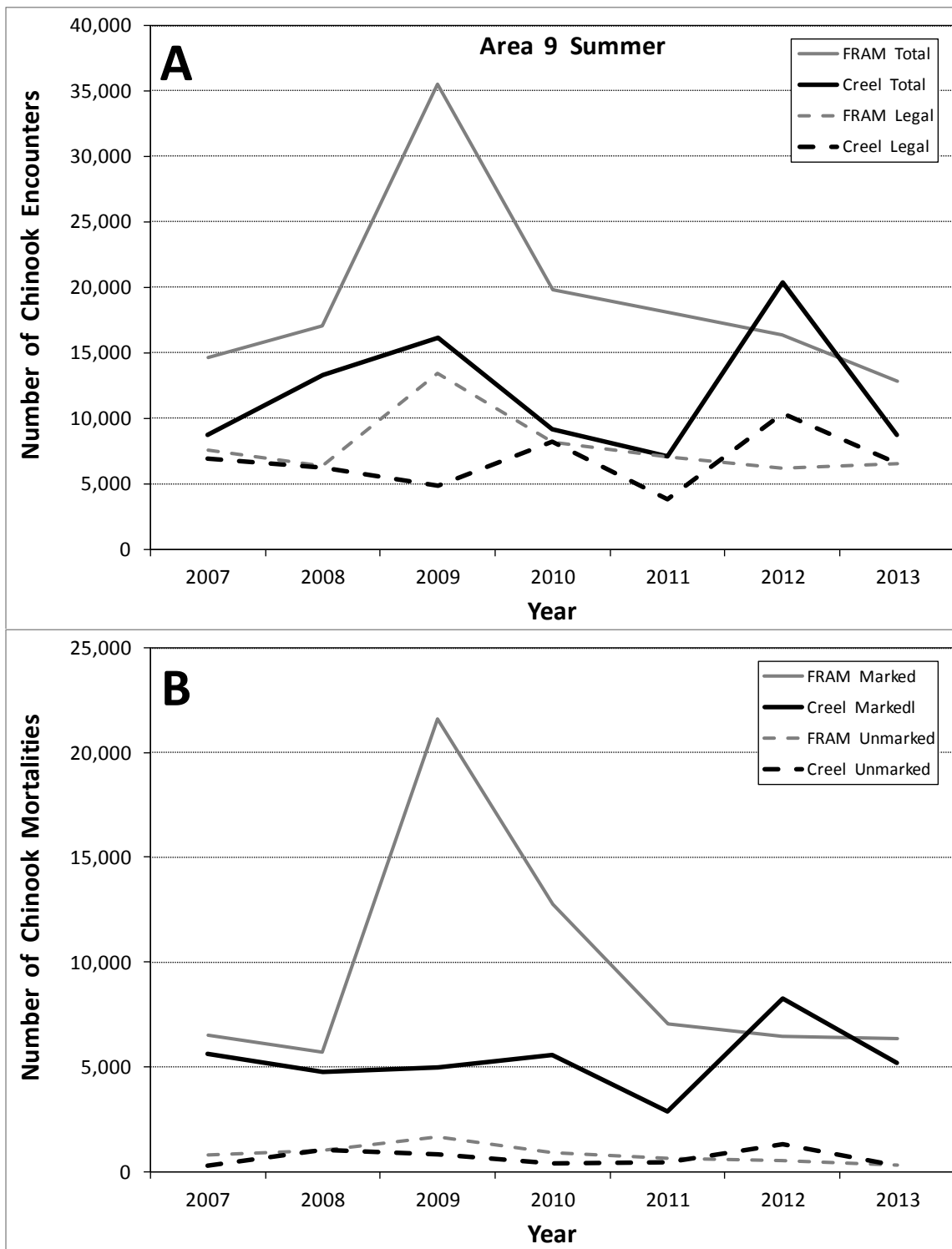


Figure 9S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 9 during the summer season.

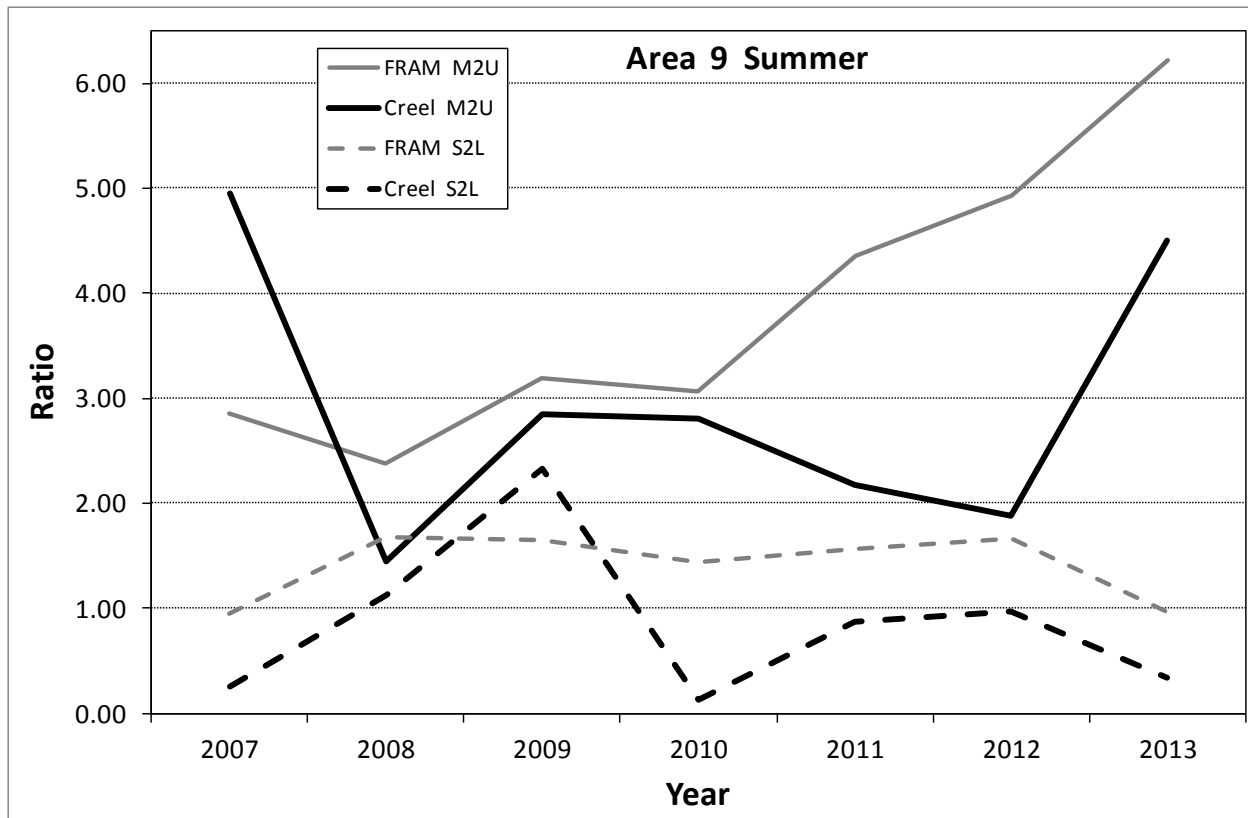


Figure 9S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 9 during the summer season.

#### Area 9 Winter:

Winter MSFs have been conducted in Area 9 since the 2007 management year. Since 2008 this fishery has been open annually for the month of November and then from January 16 to April 15. During the six years that this fishery has been conducted, it has averaged 6,060 angler trips, a harvest of 1,002 LM Chinook, and 4,361 total Chinook encounters (Table 9W-1). Angler effort in 2012 was more than 50% greater than the previous two years; total encounters in 2012 were the second highest estimated (Figure 9W-1).

This fishery has averaged 3.7 Chinook released for every LM Chinook retained (Table 9W-2). The fishery evaluation statistics for this fishery are typical of most winter MSFs in Puget Sound.

FRAM Comparison: FRAM has over-predicted total Chinook encounters compared to monitoring program estimates in every year (Figure 9W-2A). FRAM has also over-predicted total legal-size Chinook encounters in every year but 2012. FRAM projections in 2012 were relatively close to estimates from the monitoring program (Table 9W-3). Marked and unmarked Chinook mortalities have similar patterns to total and legal-size encounters, respectively (Figure 9W-2B). FRAM has generally over-predicted the

marked-to-unmarked ratio for Chinook encounters in the Area 9 winter MSF (Figure 9W-3) but %Errors have been less than  $\pm 85\%$ . Monitoring program estimates of the sublegal-to-legal ratio have fluctuated greatly in this fishery while the FRAM projections have remained relatively constant from year to year (Figure 9W-3).

Table 9W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 9 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Jan. 16 - Apr. 15	2007	6,887	1,333	3	72	0	195	304	1,288	375	3,570
Nov., Jan. 16 - Apr. 15	2008	7,064	871	14	15	0	130	158	3,521	2,837	7,546
Nov., Jan. 16 - Apr. 15	2009	6,823	1,451	18	107	10	217	353	2,166	615	4,937
Nov., Jan. 16 - Apr. 15	2010	4,425	429	0	3	0	65	117	583	422	1,619
Nov., Jan. 16 - Apr. 15	2011	4,361	421	0	34	3	63	140	1,433	548	2,642
Nov., Jan. 16 - Apr. 15	2012	6,801	1,504	0	31	18	225	469	2,617	986	5,850
	2013										
Average		6,060	1,002	6	44	5	149	257	1,935	964	4,361

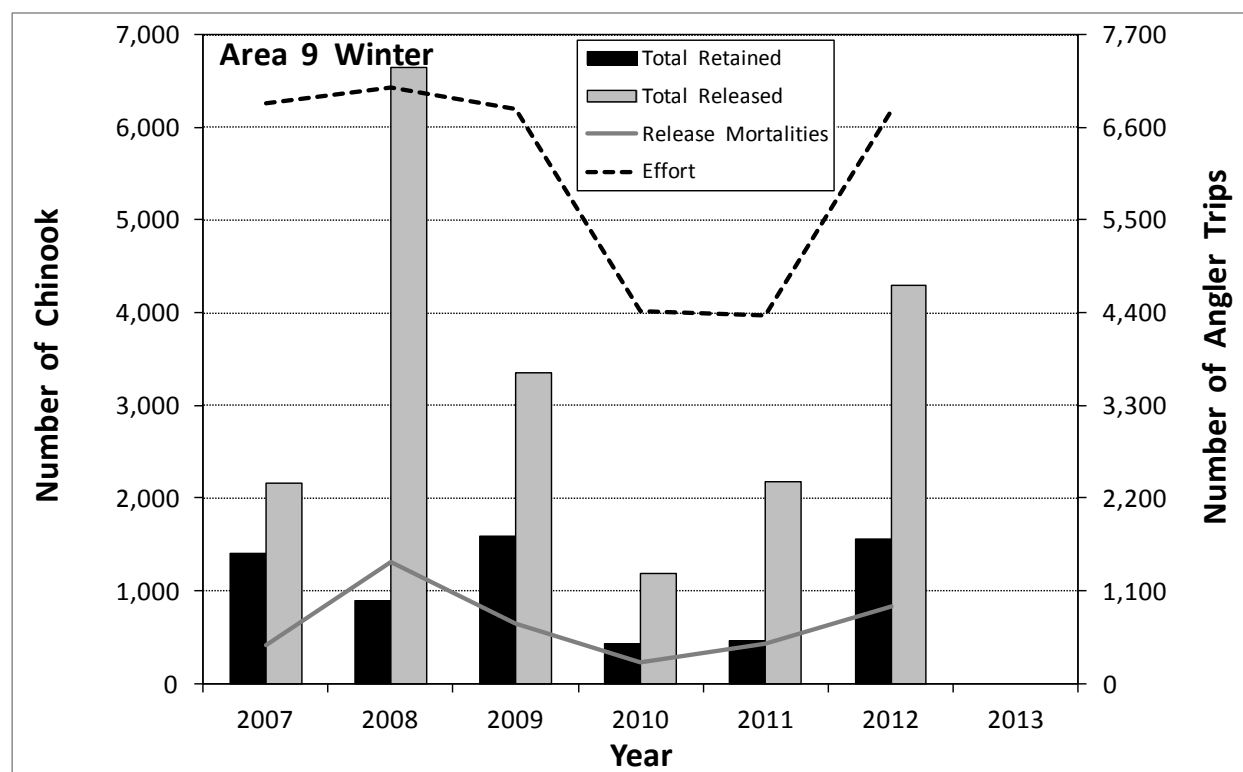


Figure 9W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 9 during the winter season.

Table 9W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 9 during the winter season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Jan. 16 - Apr. 15	2007	1.62	42.8%	5.3%	0.31	0.09
Nov.,Jan. 16 - Apr. 15	2008	7.63	13.3%	3.2%	1.51	0.68
Nov.,Jan. 16 - Apr. 15	2009	2.31	33.8%	8.5%	0.44	0.12
Nov.,Jan. 16 - Apr. 15	2010	2.77	30.5%	0.7%	0.53	0.24
Nov.,Jan. 16 - Apr. 15	2011	5.19	18.3%	8.1%	1.01	0.31
Nov.,Jan. 16 - Apr. 15	2012	2.86	29.6%	3.2%	0.55	0.18
	2013					
<b>Average</b>		3.73	28.0%	4.8%	0.73	0.27

Table 9W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 9 during the winter season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	1,938	614	4,765	1,420	8,737	2,552	4,706	469
	Estimated	1,528	307	1,360	375	3,570	1,835	1,692	124
	% Error	26.8%	100.0%	250.4%	278.7%	144.7%	39.1%	178.1%	278.2%
2008	FRAM	2,383	1,129	9,380	3,095	15,987	3,512	4,249	849
	Estimated	1,002	172	3,535	2,837	7,546	1,174	1,609	605
	% Error	137.8%	556.4%	165.3%	9.1%	111.9%	199.1%	164.1%	40.3%
2009	FRAM	2,859	959	8,840	2,695	15,353	3,818	6,922	793
	Estimated	1,668	371	2,273	625	4,937	2,039	2,024	204
	% Error	71.4%	158.5%	288.9%	331.2%	211.0%	87.2%	242.0%	288.7%
2010	FRAM	2,808	927	8,850	2,755	15,340	3,735	4,390	731
	Estimated	494	117	586	422	1,619	611	558	102
	% Error	468.4%	692.3%	1410.2%	552.8%	847.5%	511.3%	686.7%	616.7%
2011	FRAM	1,375	322	4,510	1,000	7,207	1,697	2,185	263
	Estimated	484	140	1,467	551	2,642	624	751	134
	% Error	184.1%	130.0%	207.4%	81.5%	172.8%	172.0%	190.9%	96.3%
2012	FRAM	1,334	281	4,605	965	7,185	1,615	2,166	250
	Estimated	1,728	469	2,648	1,004	5,849	2,197	2,092	285
	% Error	-22.8%	-40.1%	73.9%	-3.9%	22.8%	-26.5%	3.5%	-12.3%



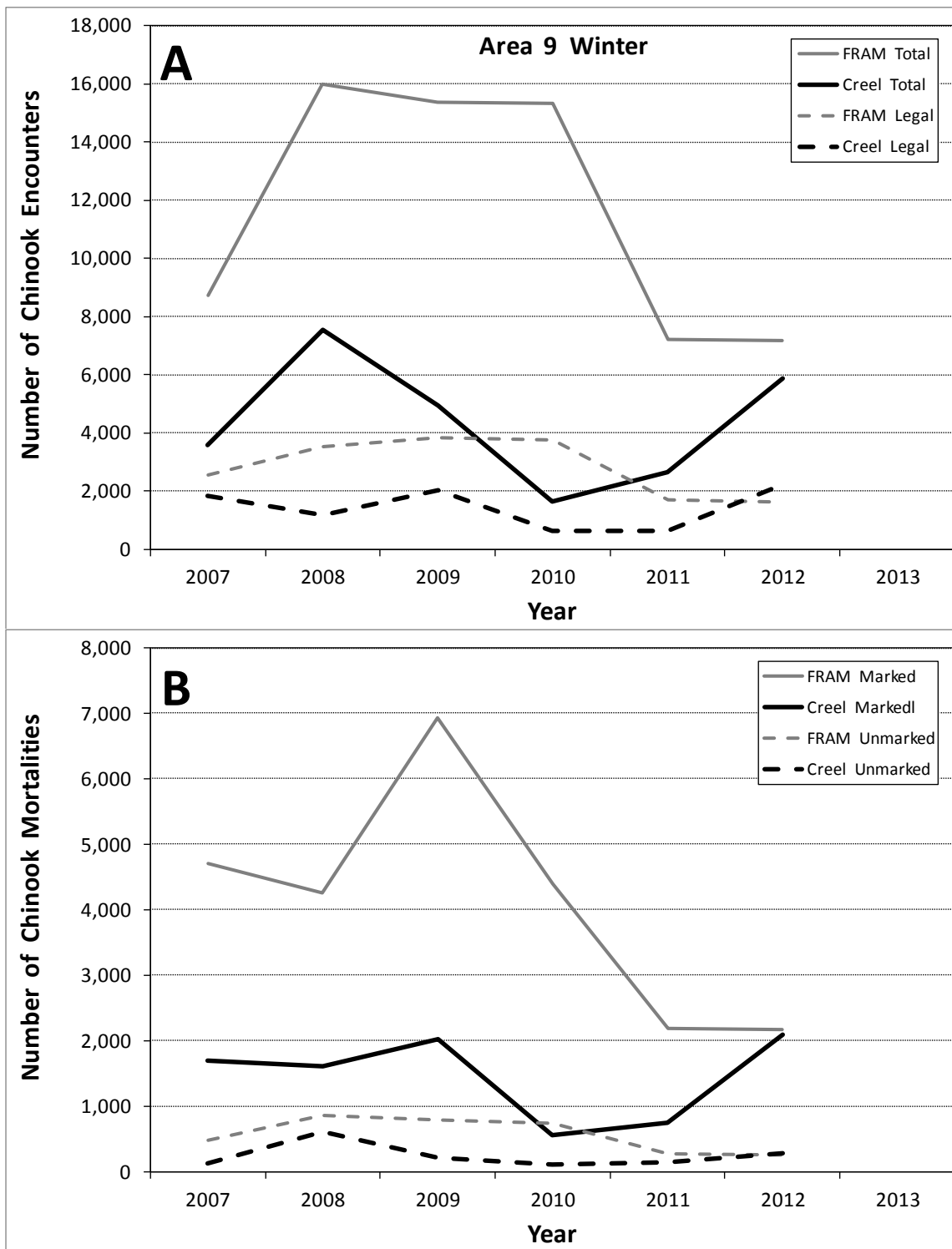


Figure 9W-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 9 during the winter season.

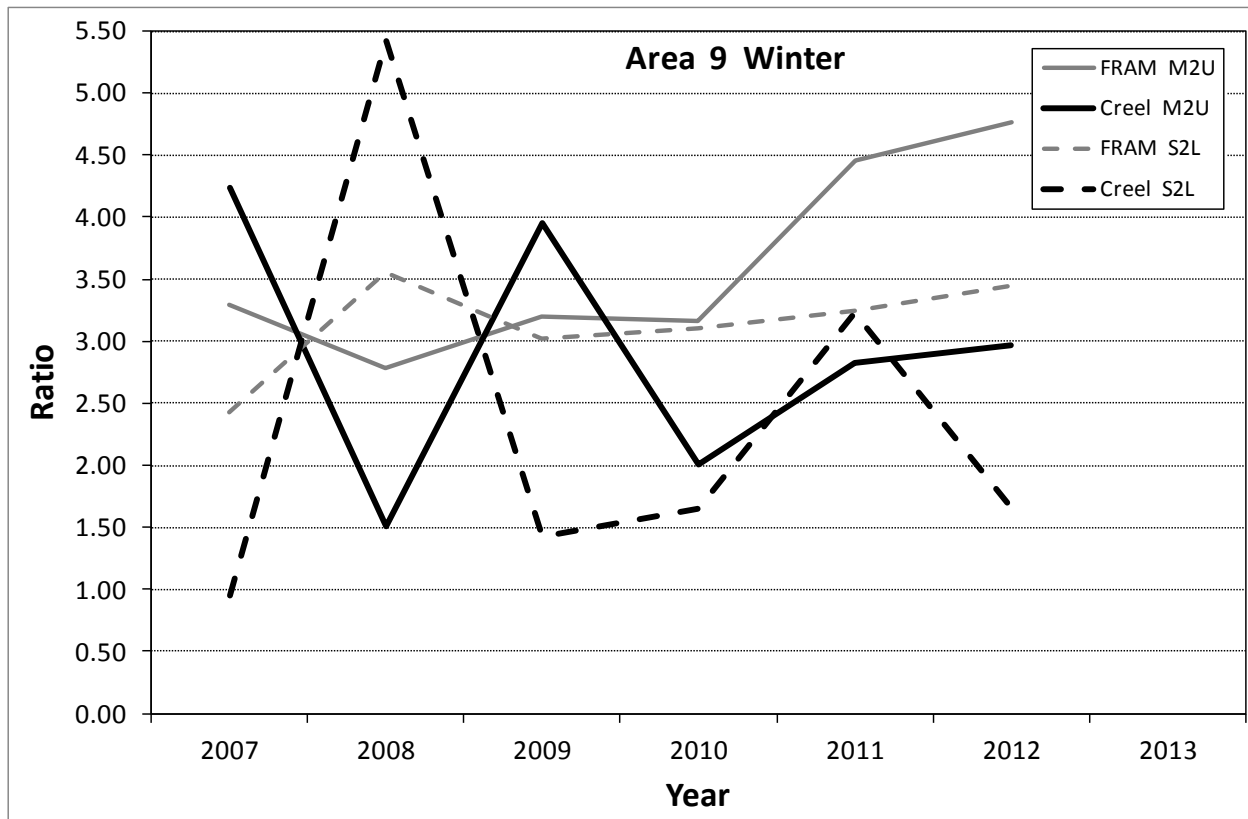


Figure 9W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 9 during the winter season.

## Area 10 Summary

### Area 10 Summer:

Summer MSFs have been conducted in Area 10 since 2007. Since 2009 this fishery has been scheduled to be open annually from July 16 to August 31<sup>8</sup>. During the seven years that this fishery has been conducted, it has averaged 19,984 angler trips, a harvest of 2,273 LM Chinook, and 6,837 total Chinook encounters (Table 10S-1). Estimated angler effort in 2013 was the second highest recorded and estimated landed Chinook catch was the highest recorded for this fishery (Figure 10S-1).

This fishery has averaged 2.0 Chinook released for every LM Chinook retained (Table 10S-2). The number of release mortalities for unmarked Chinook per LM Chinook retained (average = 0.15 mortalities per LM retained) has been fairly consistent over the years. The fishery evaluation statistics for this fishery are typical of most summer MSFs in Puget Sound.

FRAM Comparison: Since 2008, FRAM has over-predicted total Chinook encounters compared to monitoring program estimates in every year but 2012 (Figure 10S-2A) but the 2012 and 2013 fisheries were closed two to three weeks early to keep them within FRAM projections (see footnote 8). The %Errors for legal-size encounters have been less than  $\pm 25\%$  for the last four years (Table 10S-3). Except for marked mortalities in 2012 and 2013, which were slightly under-predicted, marked and unmarked Chinook mortalities have been over-predicted by FRAM (Figure 10S-2B). FRAM projections and monitoring program estimates of the marked-to-unmarked ratio have had %Errors  $\leq \pm 40\%$  in all years but 2011 and generally track each other (Figure 10S-3). Monitoring program estimates of the sublegal-to-legal ratio have fluctuated greatly in this fishery while the FRAM projections have remained relatively constant from year to year.

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<sup>8</sup> In 2012 and 2013 this fishery was closed on August 19 and August 18, respectively, as target encounter levels were achieved earlier than expected.

Table 10S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 10 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Jul. 16 - Jul. 28	2007	8,374	1,469	30	70	8	209	497	3,101	723	6,107
Jul. 16 - Aug. 15	2008	13,808	1,027	3	4	0	128	510	189	385	2,246
Jul. 16 - Aug. 31	2009	23,179	1,505	22	116	0	220	82	2,488	1,017	5,450
Jul. 16 - Aug. 31	2010	21,636	2,950	33	37	9	432	1,026	1,024	1,665	7,176
Jul. 16 - Aug. 31	2011	27,753	2,548	14	94	14	372	1,872	964	694	6,572
Jul. 16 - Aug. 19	2012	17,823	2,976	17	88	17	443	377	6,343	1,950	12,211
Jul. 16 - Aug. 18	2013	27,317	3,434	6	77	17	512	298	2,149	1,603	8,096
<b>Average</b>		19,984	2,273	18	69	9	331	666	2,323	1,148	6,837

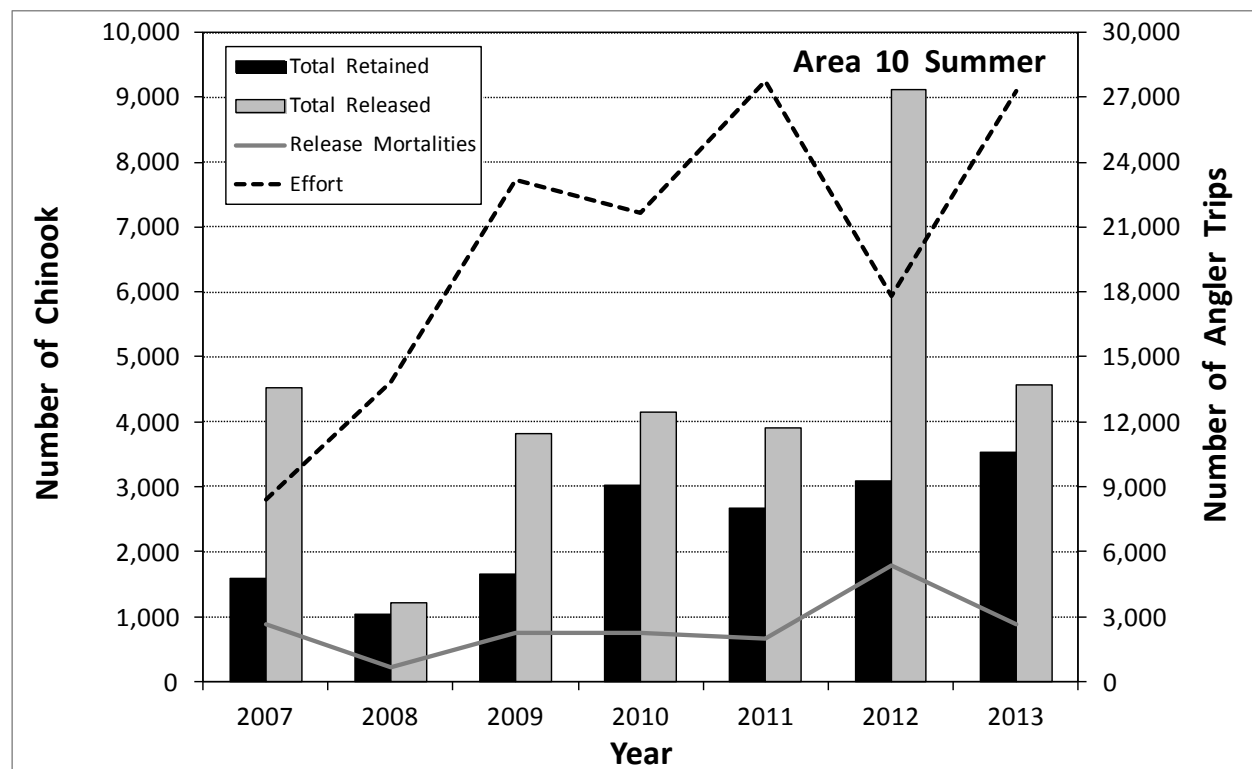


Figure 10S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 10 during the summer season.

Table 10S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 10 during the summer season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Jul. 16 - Jul. 28	2007	3.08	27.5%	6.8%	0.59	0.15
Jul. 16 - Aug. 15	2008	1.18	51.4%	0.7%	0.20	0.15
Jul. 16 - Aug. 23	2009	2.53	31.7%	8.4%	0.50	0.14
Jul. 16 - Aug. 31	2010	1.41	47.1%	2.6%	0.26	0.17
Jul. 16 - Aug. 31	2011	1.53	44.4%	4.6%	0.26	0.16
Jul. 16 - Aug. 19	2012	3.06	28.0%	3.9%	0.60	0.15
Jul. 16 - Aug. 18	2013	1.33	48.7%	2.8%	0.25	0.11
<b>Average</b>		2.02	39.8%	4.3%	0.38	0.15

Table 10S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 10 during the summer season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	1,740	803	2,520	995	6,058	2,543	2,237	377
	Estimated	1,678	527	3,171	731	6,107	2,205	2,191	257
	% Error	3.7%	52.4%	-20.5%	36.1%	-0.8%	15.3%	2.1%	46.7%
2008	FRAM	2,996	3,066	5,540	2,665	14,267	6,062	4,092	1,158
	Estimated	1,155	513	193	385	2,246	1,668	1,088	157
	% Error	159.4%	497.7%	2770.5%	592.2%	535.2%	263.4%	276.1%	637.6%
2009	FRAM	3,331	1,264	5,105	2,070	11,770	4,595	7,027	651
	Estimated	1,726	99	2,608	1,017	5,450	1,825	2,153	237
	% Error	93.0%	1176.8%	95.7%	103.5%	116.0%	151.8%	226.4%	174.7%
2010	FRAM	2,347	1,744	3,660	1,630	9,381	4,091	4,964	918
	Estimated	3,383	1,059	1,062	1,675	7,179	4,442	3,257	529
	% Error	-30.6%	64.7%	244.6%	-2.7%	30.7%	-7.9%	52.4%	73.5%
2011	FRAM	2,721	1,104	4,780	1,620	10,225	3,825	3,495	569
	Estimated	2,921	1,886	1,058	709	6,574	4,807	2,891	448
	% Error	-6.8%	-41.5%	351.8%	128.5%	55.5%	-20.4%	20.9%	27.0%
2012	FRAM	2,792	1,171	5,885	1,895	11,743	3,963	3,782	629
	Estimated	3,419	394	6,431	1,968	12,212	3,813	4,399	481
	% Error	-18.3%	197.2%	-8.5%	-3.7%	-3.8%	3.9%	-14.0%	30.8%
2013	FRAM	3,031	841	5,095	1,445	10,412	3,872	3,847	460
	Estimated	3,947	304	2,227	1,620	8,098	4,251	4,019	388
	% Error	-23.2%	176.6%	128.8%	-10.8%	28.6%	-8.9%	-4.3%	18.6%

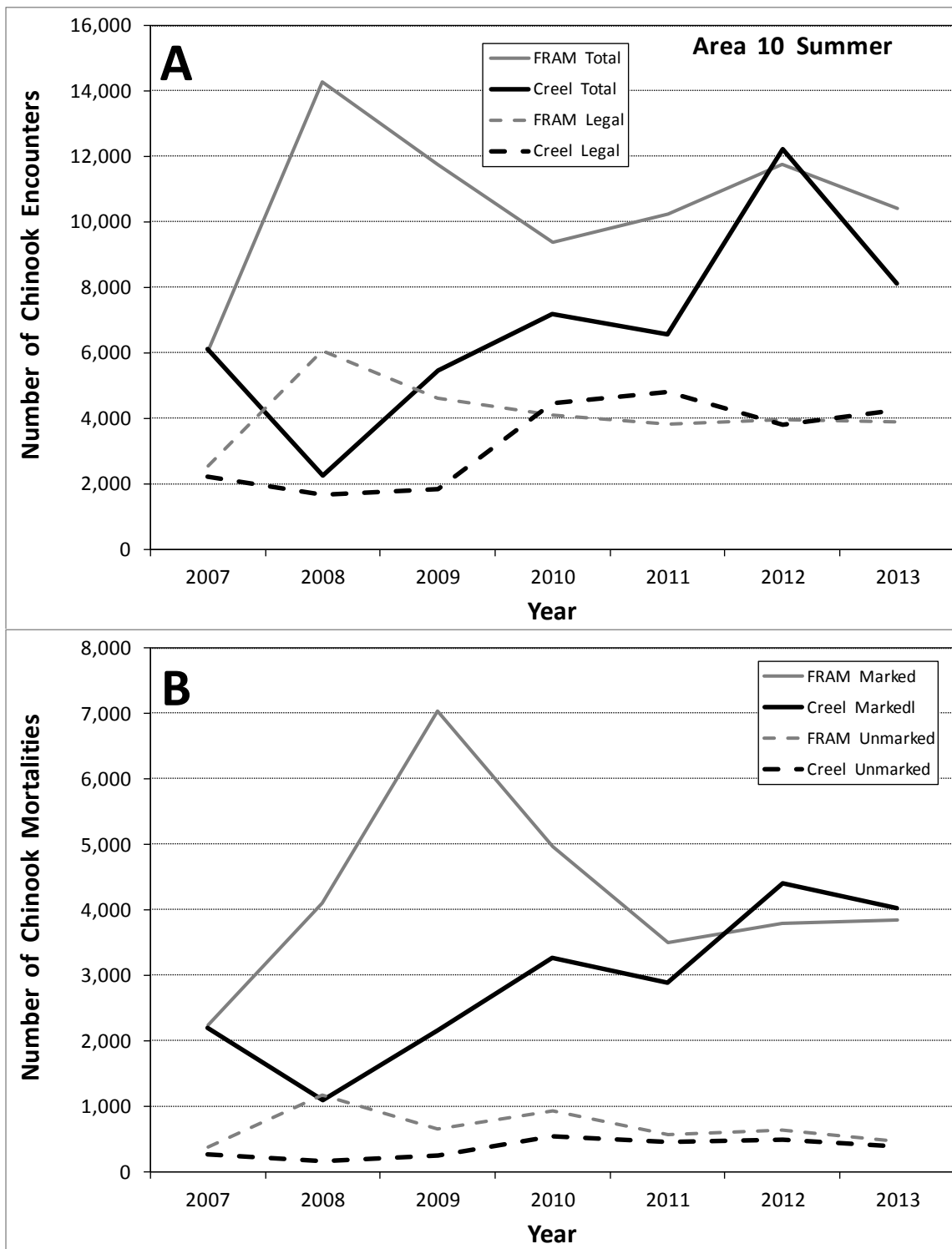


Figure 10S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 10 during the summer season.

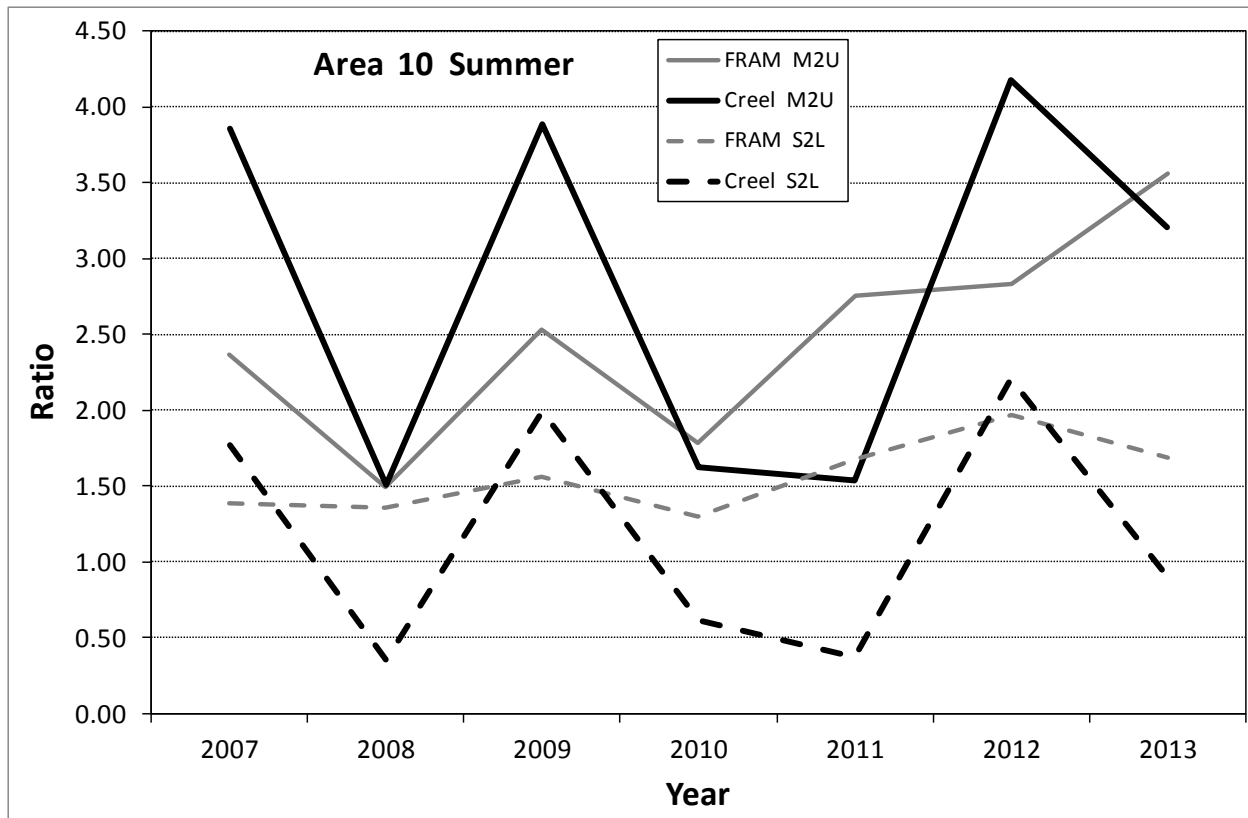


Figure 10S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 10 during the summer season.

#### Area 10 Winter:

Winter MSFs have been conducted in Area 10 since the 2007 management year. Since 2009 this fishery has been open annually from October 1 to January 31. During the six years that this fishery has been conducted, it has averaged 4,088 angler trips, a harvest of 273 LM Chinook, and 2,857 total Chinook encounters (Table 10W-1). Annual angler effort in this fishery has been relatively constant since 2009 (Figure 10W-1). Total Chinook encounters in this fishery have tended to be much higher in odd-numbered management years compared to even-numbered years.

This fishery has averaged 10.9 Chinook released for every LM Chinook retained (Table 10W-2); this is the highest average rate in all MSFs. This is related to an average percentage of encounters that are LM of only 11.4% which is the lowest in all MSFs examined. Relative to other MSFs in Puget Sound, the average percentage of Chinook retained that are illegal for this fishery is high (8.3%). Both the average number of release mortalities and number of unmarked Chinook release mortalities per legal-size marked Chinook retained are the highest estimated for all MSFs (2.16 and 0.72 mortalities per LM retained, respectively).

**FRAM Comparison:** Compared to monitoring program estimates, FRAM has over-predicted total Chinook and legal-size Chinook encounters in every year (Figure 10W-2A), often by substantial amounts (Table 10W-3). Marked and unmarked Chinook mortalities have similar patterns to total and legal-size encounters, respectively (Figure 10W-2B). FRAM has over-predicted the marked-to-unmarked ratio for Chinook encounters in the Area 10 winter MSF for the last three years (Figure 10W-3). Monitoring program estimates of the sublegal-to-legal ratio have increased greatly in this fishery since 2007 while the annual FRAM projections for this ratio have remained almost constant.

Table 10W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 10 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Dec. 1 - Jan. 31	2007	2,544	539	21	96	0	80	163	1,860	361	3,120
Dec. 1 - Jan. 31	2008	2,029	247	0	4	0	37	36	1,010	462	1,796
Oct. 1 - Jan. 31	2009	5,560	353	2	42	0	53	83	2,531	898	3,962
Oct. 1 - Jan. 31	2010	4,461	150	0	13	0	22	53	814	740	1,792
Oct. 1 - Jan. 31	2011	4,615	227	5	15	9	34	183	2,870	1,230	4,573
Oct. 1 - Jan. 31	2012	5,321	121	0	0	0	18	27	1,183	549	1,898
	2013										
Average		4,088	273	5	28	2	41	91	1,711	707	2,857

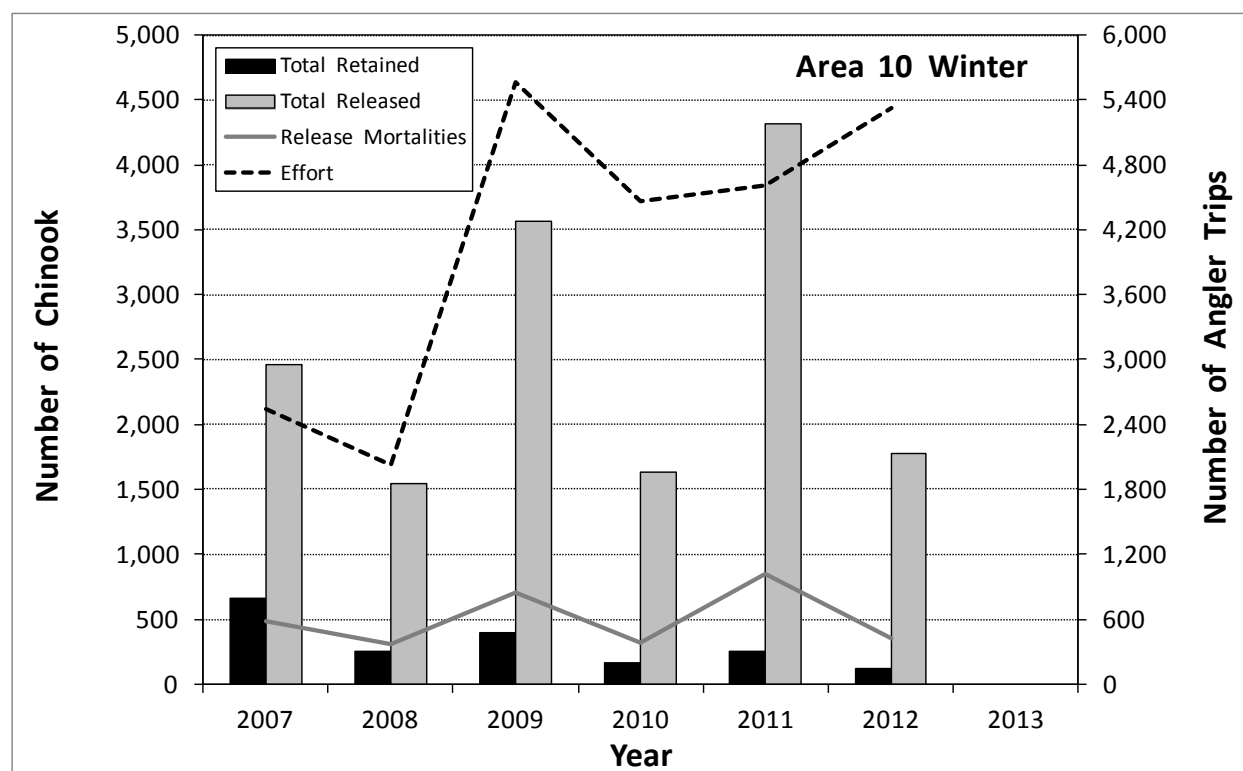


Figure 10W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 10 during the winter season.



Table 10W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 10 during the winter season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Dec. 1 - Jan. 31	2007	4.57	19.8%	17.8%	0.89	0.18
Dec. 1 - Jan. 31	2008	6.26	15.8%	1.6%	1.24	0.40
Oct. 1 - Jan. 31	2009	10.10	10.2%	11.1%	2.00	0.54
Oct. 1 - Jan. 31	2010	10.86	9.6%	8.0%	2.15	1.04
Oct. 1 - Jan. 31	2011	19.02	5.7%	11.3%	3.76	1.20
Oct. 1 - Jan. 31	2012	14.69	7.3%	0.0%	2.92	0.94
	2013					
<b>Average</b>		10.91	11.4%	8.3%	2.16	0.72

Table 10W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 10 during the winter season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	756	329	2,775	1,110	4,970	1,085	2,020	331
	Estimated	619	184	1,956	361	3,120	803	1,019	118
	% Error	22.1%	78.8%	41.9%	207.5%	59.3%	35.1%	98.2%	180.5%
2008	FRAM	953	484	3,975	1,760	7,172	1,437	2,639	480
	Estimated	284	36	1,013	462	1,796	320	459	98
	% Error	235.0%	1261.1%	292.2%	280.7%	299.4%	349.0%	474.9%	389.8%
2009	FRAM	1,996	748	7,415	3,195	13,354	2,744	5,081	836
	Estimated	407	85	2,572	898	3,962	492	909	195
	% Error	390.4%	780.0%	188.3%	255.8%	237.1%	457.7%	459.0%	328.7%
2010	FRAM	1,937	879	7,420	3,235	13,471	2,816	3,291	827
	Estimated	172	53	827	740	1,792	225	329	156
	% Error	1026.2%	1558.5%	797.2%	337.2%	651.7%	1151.6%	900.3%	430.1%
2011	FRAM	2,172	736	8,545	3,055	14,508	2,908	3,735	755
	Estimated	260	188	2,886	1,240	4,574	448	821	288
	% Error	735.4%	291.5%	196.1%	146.4%	217.2%	549.1%	354.9%	162.2%
2012	FRAM	2,244	681	8,715	3,025	14,665	2,925	3,826	731
	Estimated	139	27	1,183	549	1,898	166	360	114
	% Error	1514.4%	2422.2%	636.7%	451.0%	672.7%	1662.0%	962.8%	541.2%

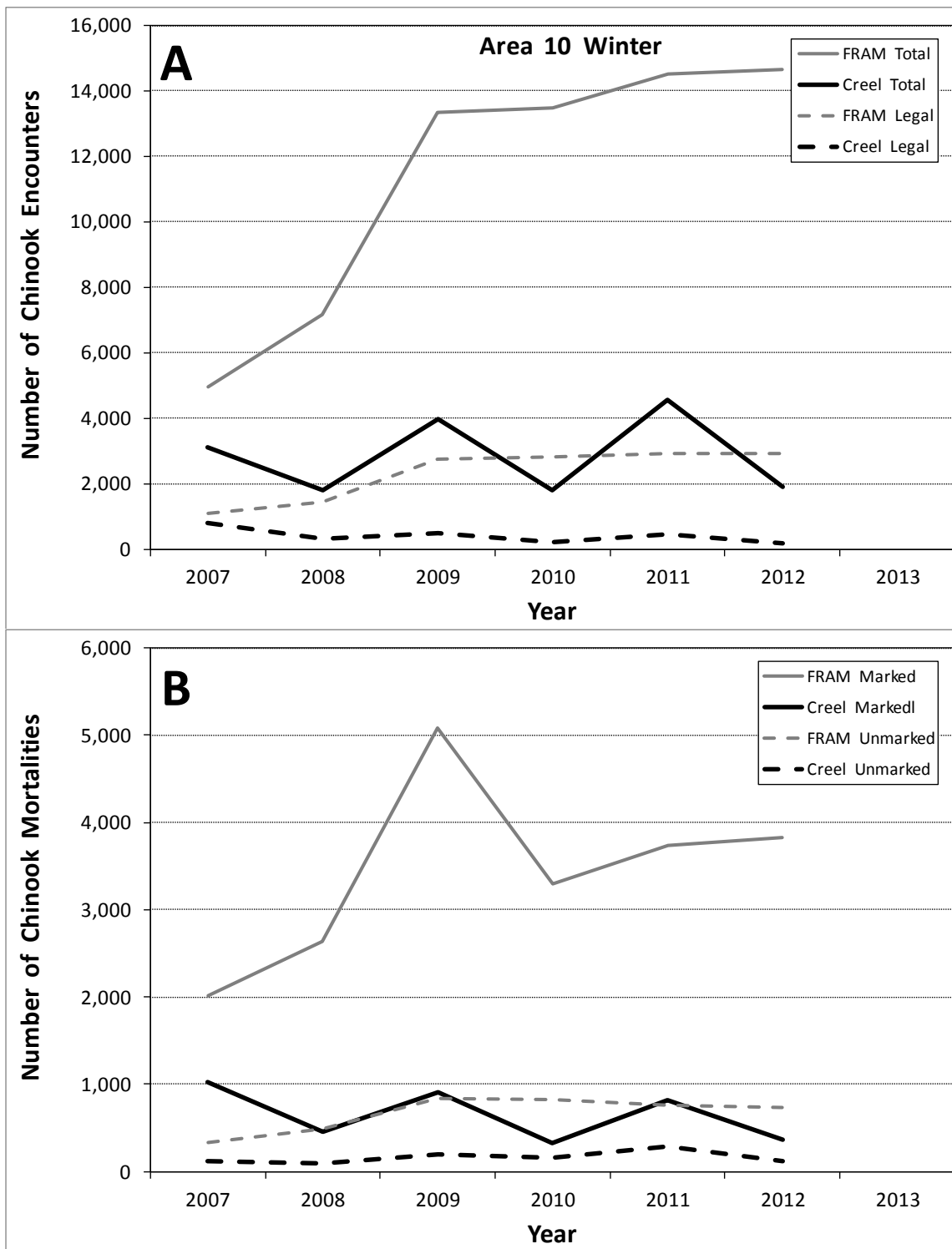


Figure 10W-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 10 during the winter season.

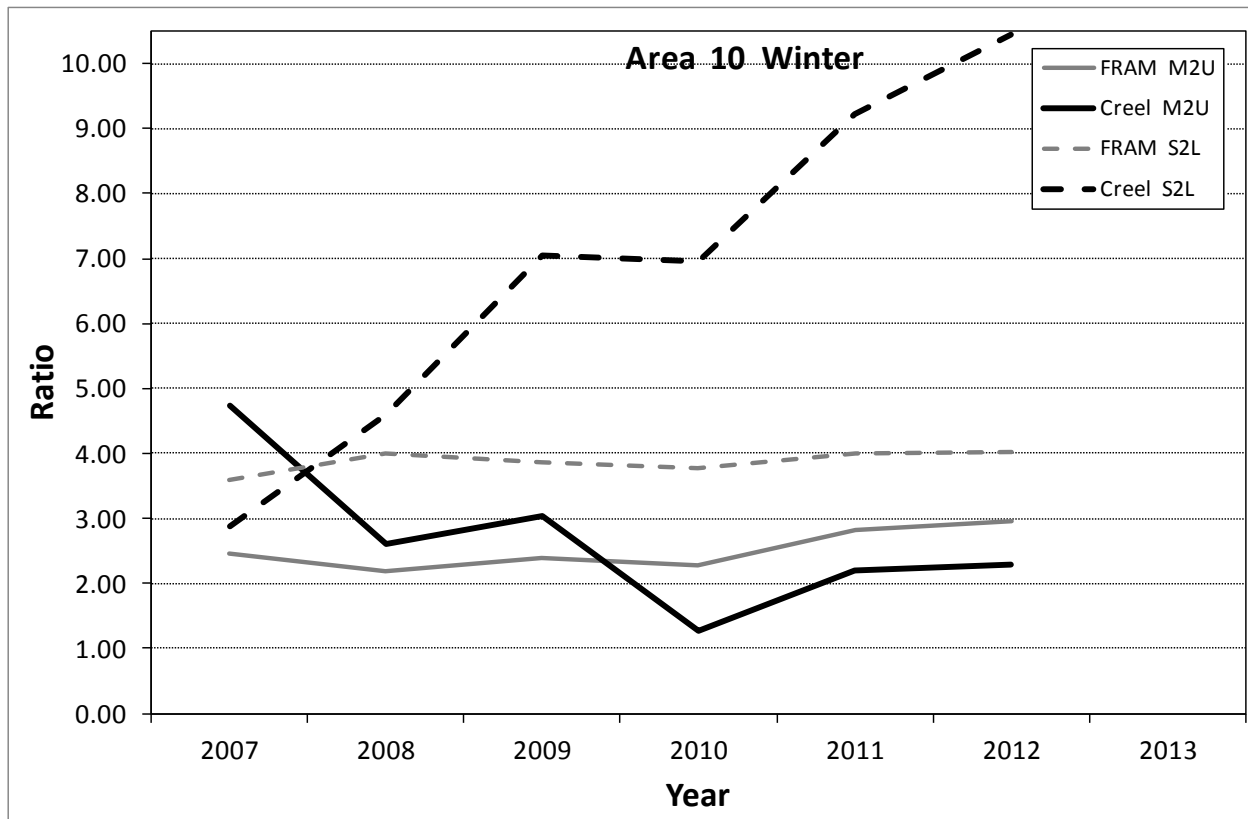


Figure 10W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 10 during the winter season.

## Area 11 Summary

### Area 11 Summer:

Summer MSFs have been open annually from June 1 to September 30 since 2007 in Area 11. During the seven years that this fishery has been conducted, it has averaged 67,213 angler trips, a harvest of 5,003 LM Chinook, and 12,159 total Chinook encounters (Table 11S-1). The highest retained catch and total Chinook encounters occurred during 2007, the first year this fishery was conducted (Figure 11S-1).

This fishery has averaged 1.5 Chinook released for every LM Chinook retained (Table 11S-2). The fishery evaluation statistics for this fishery are typical of most summer MSFs in Puget Sound.

FRAM Comparison: Since 2008, FRAM has over-predicted total Chinook encounters and legal-size encounters compared to monitoring program estimates (Figure 11S-2A). Total encounters have had %Error > 100% every year since 2008 except for 2013 (Table 11S-3). Except for marked mortalities in 2007 and unmarked mortalities in 2013, marked and unmarked Chinook mortalities have been over-predicted by FRAM (Figure 11S-2B). FRAM projections and monitoring program estimates of the marked-to-unmarked ratio have generally not corresponded (Figure 11S-3). FRAM has over-predicted the S2L ratio in every year but the two were very similar in 2013.

Table 11S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 11 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
June 1 - Sept. 30	2007	78,958	10,192	74	354	21	1,511	3,015	8,033	2,357	25,557
June 1 - Sept. 30	2008	65,728	7,277	18	100	5	1,087	1,999	1,969	248	12,703
June 1 - Sept. 30	2009	80,715	3,159	20	118	17	472	1,273	3,833	3,313	12,205
June 1 - Sept. 30	2010	54,594	3,883	64	27	0	580	1,105	900	405	6,964
June 1 - Sept. 30	2011	69,919	2,559	9	77	12	382	2,120	1,932	1,579	8,670
June 1 - Sept. 30	2012	56,065	4,894	57	72	14	731	2,665	2,649	1,157	12,239
June 1 - Sept. 30	2013	64,509	3,056	35	55	0	457	1,289	1,214	669	6,775
Average		67,213	5,003	40	115	10	746	1,924	2,933	1,390	12,159

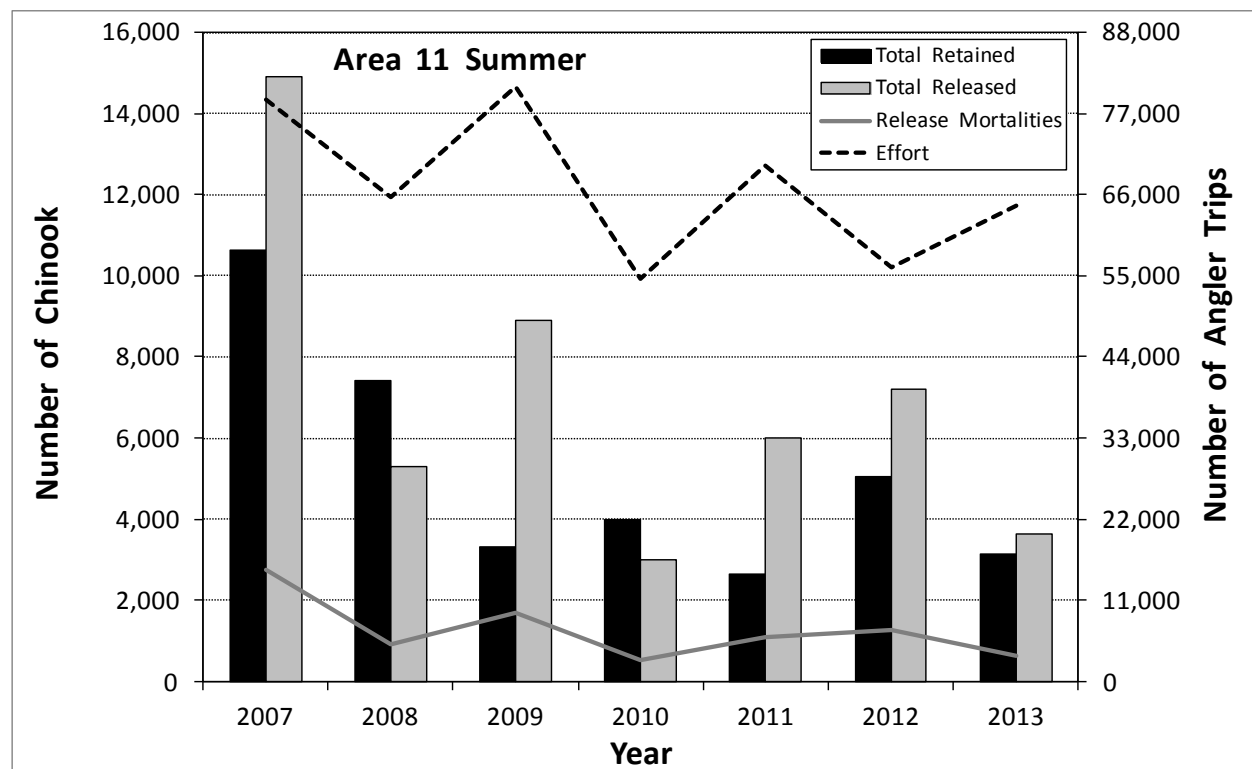


Figure 11S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 11 during the summer season.

Table 11S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 11 during the summer season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
June 1 - Sept. 30	2007	1.46	45.8%	4.2%	0.27	0.09
June 1 - Sept. 30	2008	0.73	65.8%	1.7%	0.12	0.05
June 1 - Sept. 30	2009	2.81	29.8%	4.7%	0.54	0.27
June 1 - Sept. 30	2010	0.77	64.1%	2.3%	0.13	0.06
June 1 - Sept. 30	2011	2.35	33.9%	3.7%	0.42	0.25
June 1 - Sept. 30	2012	1.47	46.0%	2.8%	0.26	0.13
June 1 - Sept. 30	2013	1.19	51.9%	2.9%	0.21	0.11
<b>Average</b>		1.54	48.2%	3.2%	0.28	0.14

Table 11S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 11 during the summer season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2007	FRAM	8,802	3,220	11,155	4,940	28,117	12,022	10,997	1,704
	Estimated	11,703	3,089	8,387	2,378	25,557	14,792	12,379	1,019
	% Error	-24.8%	4.2%	33.0%	107.7%	10.0%	-18.7%	-11.2%	67.2%
2008	FRAM	7,446	2,985	13,540	4,995	28,966	10,431	10,125	1,608
	Estimated	8,364	2,017	2,069	253	12,703	10,381	7,934	373
	% Error	-11.0%	48.0%	554.4%	1874.3%	128.0%	0.5%	27.6%	331.1%
2009	FRAM	7,362	1,642	13,775	4,345	27,124	9,004	16,029	1,177
	Estimated	3,631	1,293	3,950	3,330	12,204	4,924	4,114	891
	% Error	102.8%	27.0%	248.7%	30.5%	122.3%	82.9%	289.6%	32.1%
2010	FRAM	7,336	2,869	13,845	4,655	28,705	10,205	15,996	1,472
	Estimated	4,463	1,170	927	405	6,965	5,633	4,177	311
	% Error	64.4%	145.2%	1393.5%	1049.4%	312.1%	81.2%	283.0%	373.3%
2011	FRAM	9,690	1,607	15,500	4,030	30,827	11,297	12,142	1,091
	Estimated	2,942	2,129	2,009	1,590	8,670	5,071	3,080	654
	% Error	229.4%	-24.5%	671.5%	153.5%	255.6%	122.8%	294.2%	66.8%
2012	FRAM	8,765	1,362	15,515	3,820	29,462	10,127	11,282	1,005
	Estimated	5,625	2,722	2,722	1,171	12,240	8,347	5,606	703
	% Error	55.8%	-50.0%	470.0%	226.2%	140.7%	21.3%	101.2%	43.0%
2013	FRAM	7,082	893	3,140	715	11,830	7,975	7,234	301
	Estimated	3,513	1,324	1,268	669	6,774	4,837	3,422	362
	% Error	101.6%	-32.6%	147.6%	6.9%	74.6%	64.9%	111.4%	-16.9%

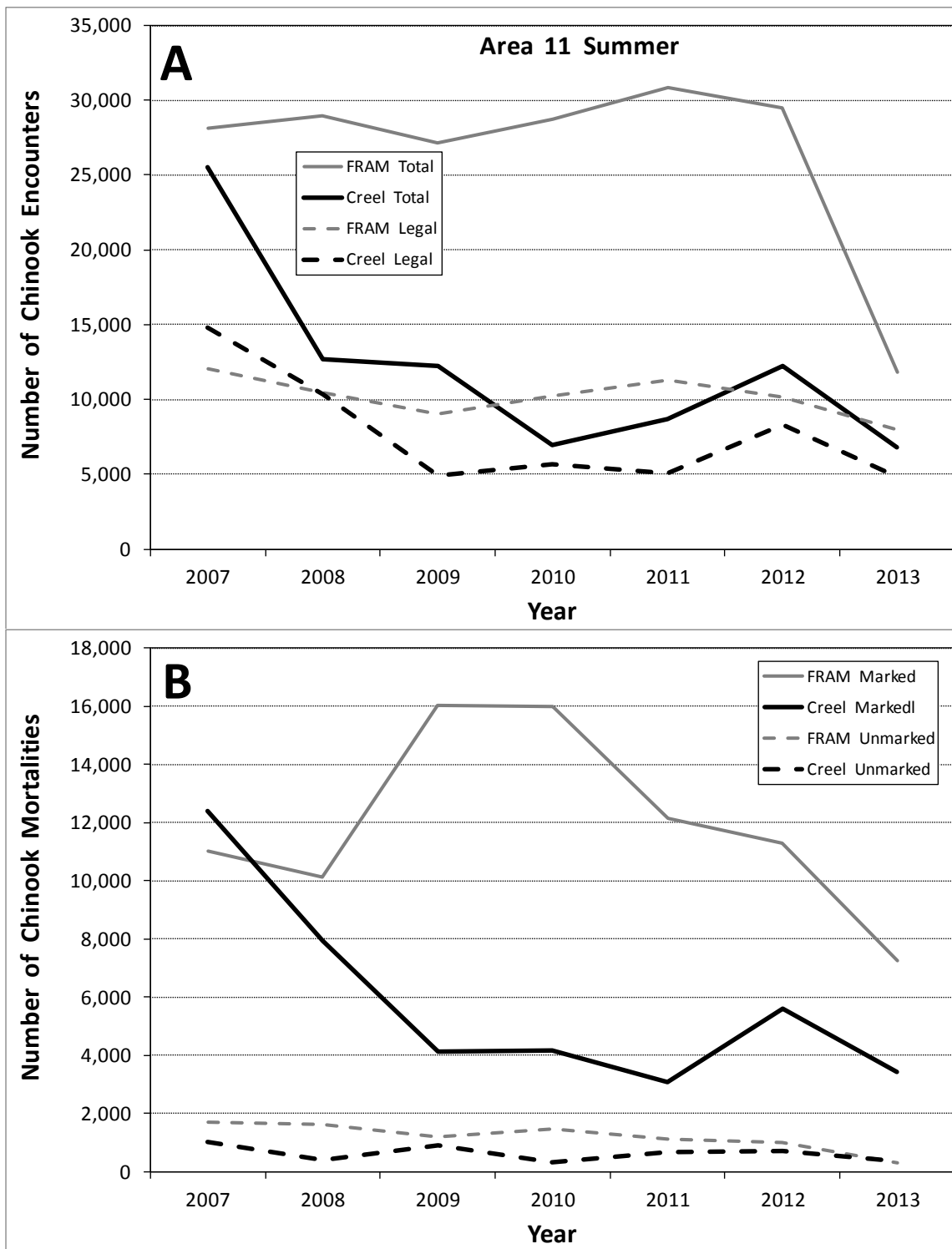


Figure 11S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 11 during the summer season.

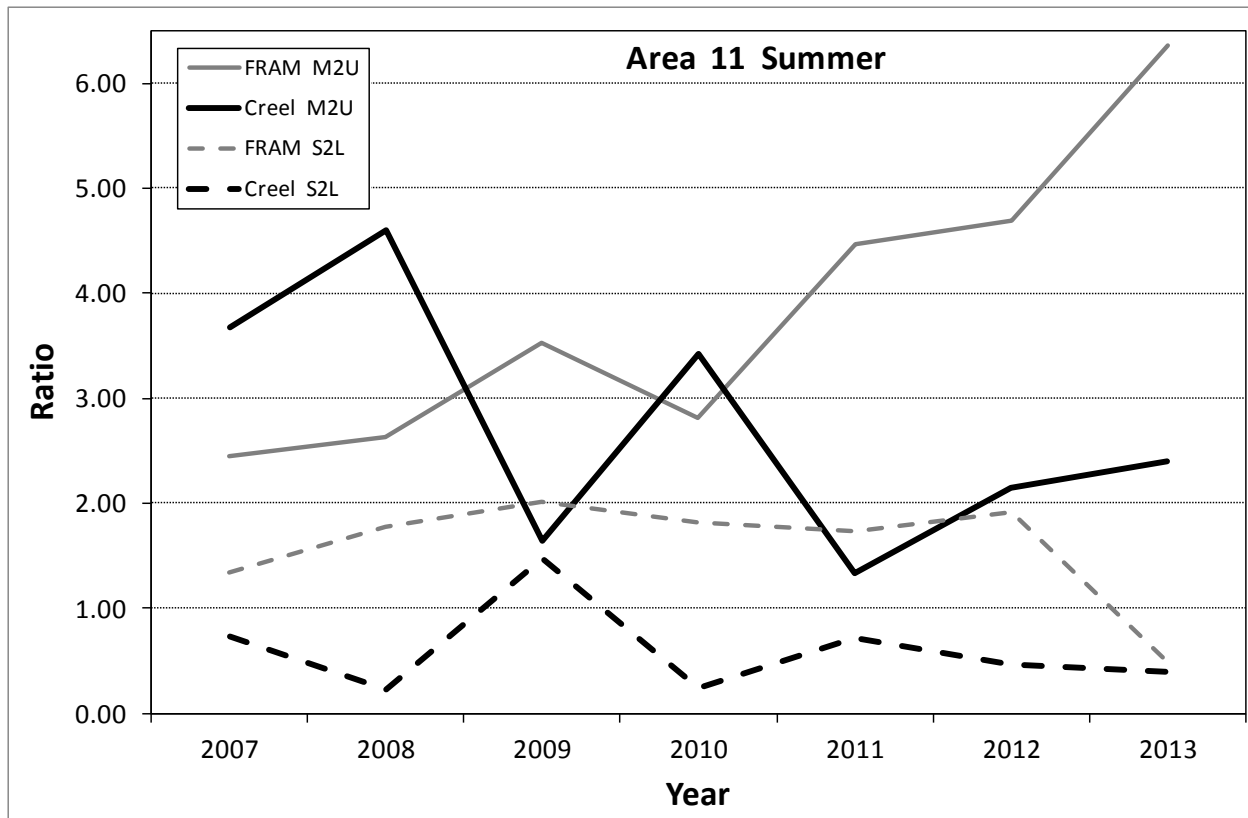


Figure 11S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 11 during the summer season.

#### Area 11 Winter:

Winter MSFs in Area 11 have been open annually from February 1 to April 30 since the 2009 management year. During the four years that this fishery has been conducted, it has averaged 2,172 angler trips, a harvest of 178 LM Chinook, and 749 total Chinook encounters (Table 11W-1). Angler effort in this fishery has been increasing since 2010 while the total number of Chinook released in 2012 was substantially lower compared to 2010 and 2011 (Figure 11W-1).

This fishery has averaged 4.3 Chinook released for every LM Chinook retained (Table 11W-2); this is relatively high compared to other Puget Sound MSFs. The other fishery evaluation statistics for this fishery are typical of most winter MSFs in Puget Sound.

**FRAM Comparison:** Compared to monitoring program estimates, FRAM has over-predicted total Chinook encounters with %Error > 100% in every year (Table 11W-3). Legal-size Chinook encounters have been over-predicted in the last three years, also (Figure 11W-2A). FRAM has over-predicted marked and unmarked Chinook mortalities every year (Figure 11W-2B), typically with %Error > 100%. FRAM projections and monitoring program estimates of the marked-to-unmarked ratio have generally



not corresponded (Figure 11W-3). Monitoring program estimates of the sublegal-to-legal ratio have fluctuated greatly in this fishery while the FRAM projections have remained relatively constant from year to year; FRAM has over-predicted the S2L ratio every year.

Table 11W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 11 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Feb. 1 - Apr. 30	2009	3,096	315	3	11	0	47	80	114	10	580
Feb. 1 - Apr. 30	2010	1,515	78	3	9	0	12	87	322	241	752
Feb. 1 - Apr. 30	2011	1,937	170	0	4	0	25	142	630	182	1,153
Feb. 1 - Apr. 30	2012	2,141	149	0	22	0	22	47	237	35	512
	2013										
Average		2,172	178	2	12	0	27	89	326	117	749

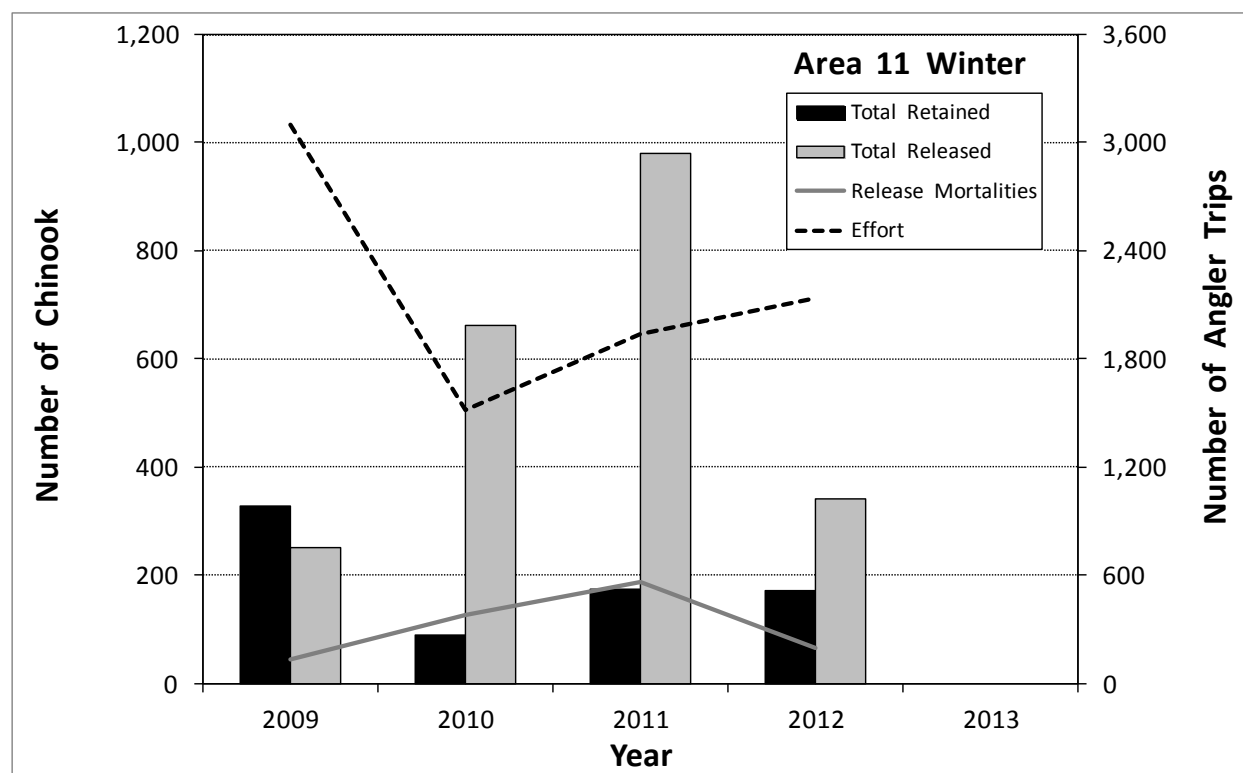


Figure 11W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 11 during the winter season.

Table 11W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 11 during the winter season.

<b>Fishery</b>		<b># Rel./</b>	<b>% of Encntrs</b>	<b>% of Retained</b>	<b>Total Rel. Morts.</b>	<b>Unmrkd Rel. Morts.</b>
<b>Dates</b>	<b>Year</b>	<b># LM Ret.</b>	<b>that are LM</b>	<b>that are Illegal</b>	<b>per LM Retained</b>	<b>per LM Retained</b>
Feb. 1 - Apr. 30	2009	0.80	62.4%	4.3%	0.14	0.04
Feb. 1 - Apr. 30	2010	8.49	12.0%	13.3%	1.63	0.79
Feb. 1 - Apr. 30	2011	5.76	16.9%	2.3%	1.10	0.34
Feb. 1 - Apr. 30	2012	2.29	33.4%	12.9%	0.43	0.09
	2013					
<b>Average</b>		4.33	31.2%	8.2%	0.83	0.32

Table 11W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 11 during the winter season.

<b>Year</b>	<b>Source</b>	<b>Encounters</b>				<b>Encounters</b>		<b>Mortalities</b>	
		<b>LM</b>	<b>LU</b>	<b>SM</b>	<b>SU</b>	<b>Total</b>	<b>Legal</b>	<b>Marked</b>	<b>Unmarked</b>
2009	FRAM	314	118	1,490	460	2,382	432	866	123
	Estimated	362	83	124	10	579	445	356	17
	% Error	-13.3%	42.2%	1101.6%	4500.0%	311.4%	-2.9%	143.3%	623.5%
2010	FRAM	311	176	1,495	475	2,457	487	590	132
	Estimated	90	90	331	241	752	180	153	65
	% Error	245.6%	95.6%	351.7%	97.1%	226.7%	170.6%	285.6%	103.1%
2011	FRAM	389	117	1,655	435	2,596	506	694	107
	Estimated	196	142	634	182	1,154	338	304	58
	% Error	98.5%	-17.6%	161.0%	139.0%	125.0%	49.7%	128.3%	84.5%
2012	FRAM	383	106	1,670	420	2,579	489	691	103
	Estimated	171	47	260	35	513	218	222	14
	% Error	124.0%	125.5%	542.3%	1100.0%	402.7%	124.3%	211.3%	635.7%

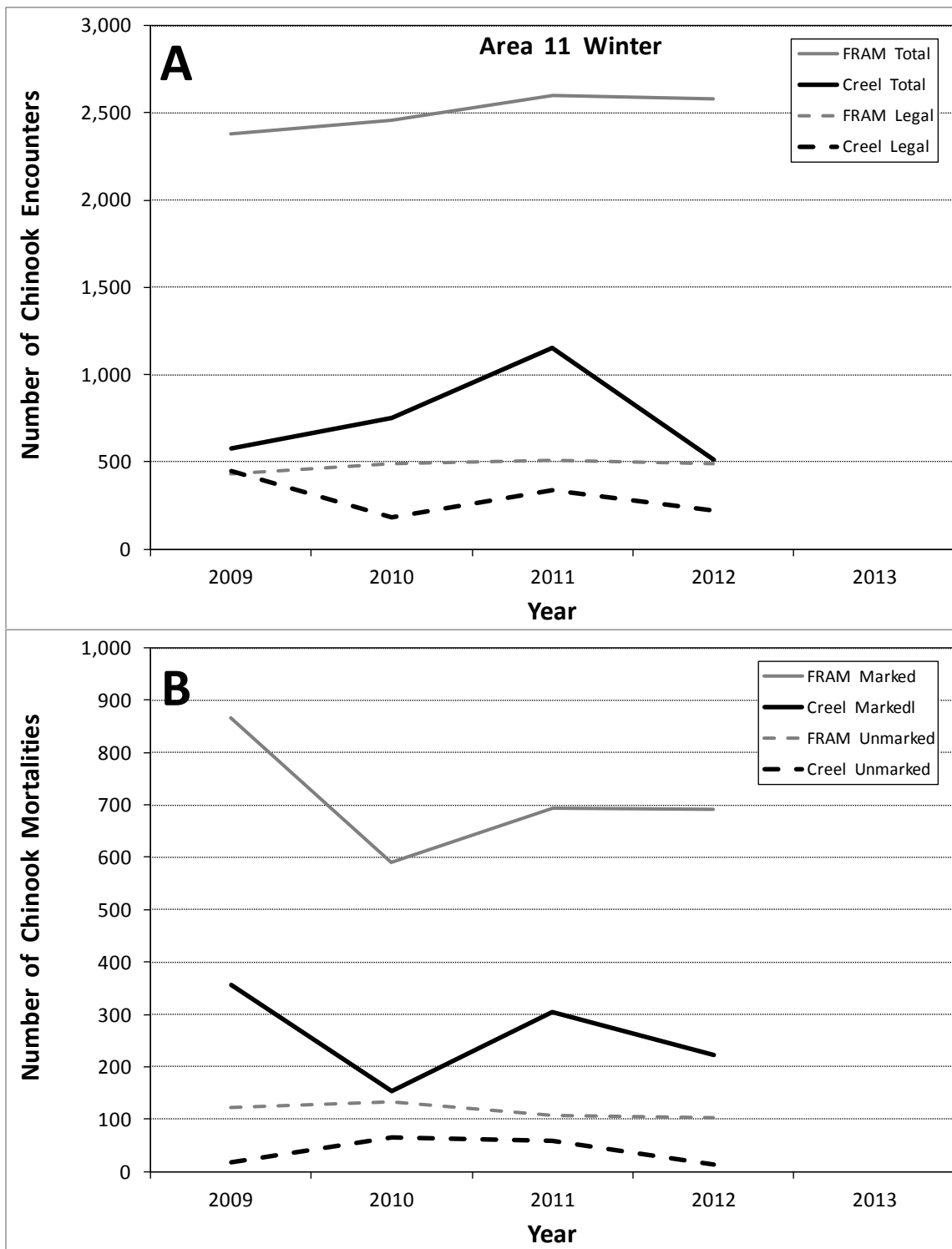


Figure 11W-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 11 during the winter season.

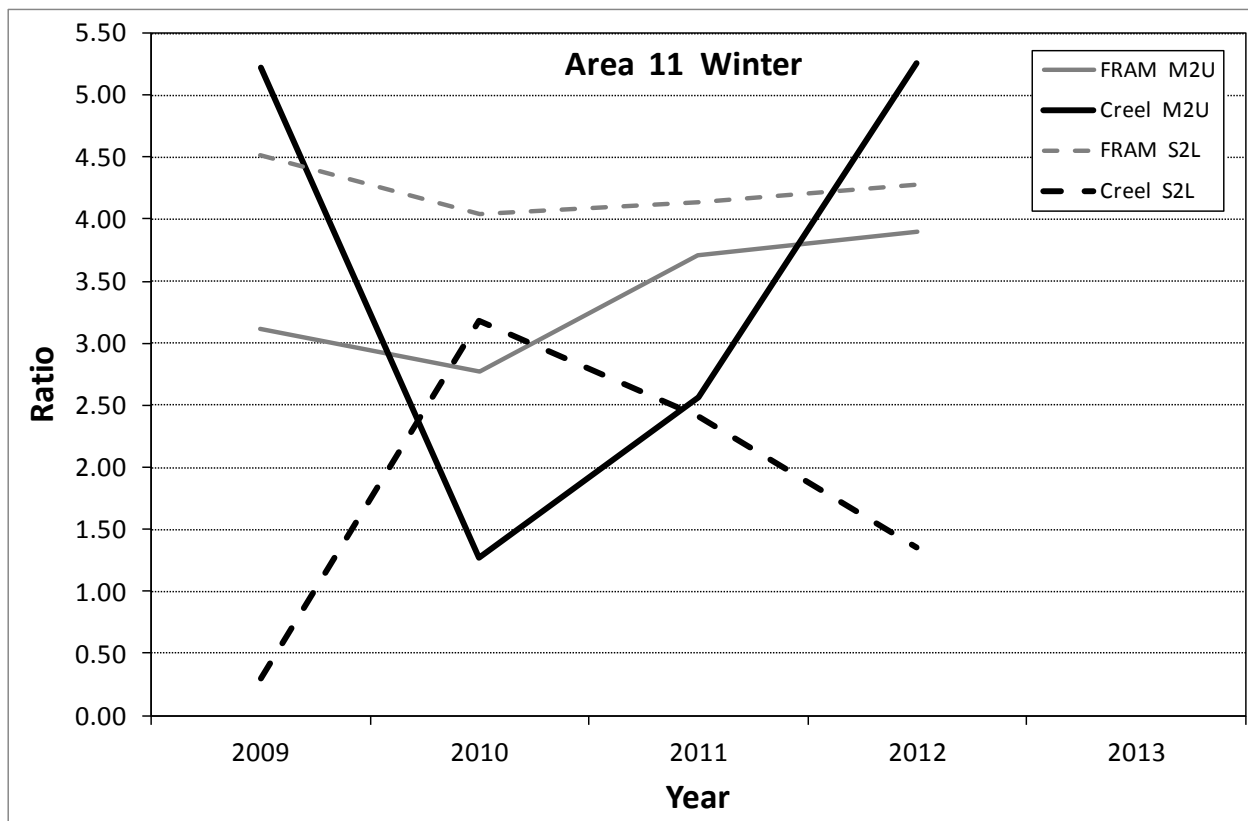


Figure 11W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 11 during the winter season.

## Area 12 Summary

### Area 12 Summer:

A summer MSF was conducted from July 1 to October 15 in Area 12 in 2012 and 2013. These fisheries were monitored using baseline sampling and the Chinook impacts (catch retained, numbers released, and number of release mortalities) will be estimated using the CRC methodology. Catch record card estimates for these years are not yet available.

### Area 12 Winter:

Winter MSFs year in Area 12 have been open annually from February 1 to April 30 since the 2009 management season. In addition, this fishery was open from October 16 to December 31 in 2012. This fishery is monitored using baseline sampling and the Chinook impacts (catch retained, numbers released, and number of release mortalities) are estimated using the CRC methodology. During the two years for which estimates are available, this fishery has averaged 2,081 angler trips, a harvest of 334 LM Chinook, and 1,052 total Chinook encounters (Table 12W-1). Angler effort increased by about 40% from 2009 to 2010 (Figure 12W-1).

This fishery averaged 2.2 Chinook released for every LM Chinook retained (Table 12W-2). Compared to other winter MSFs, the average proportion of encounters that are legal-size and marked (52%) is high for this fishery.

FRAM Comparison: Compared to monitoring program estimates, FRAM has under-predicted total Chinook encounters and legal-size Chinook encounters in both years for which there are estimates (Figure 12W-2A) although %Errors have been < -82% (Table 12W-3). FRAM has also under-predicted marked Chinook mortalities each year while over-predicting unmarked Chinook mortalities (Figure 12W-2B). FRAM under-predicted the marked-to-unmarked ratio by a large amount each year (Figure 12W-3) while greatly over-predicting the S2L ratio (%Error > 400%).

Table 12W-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 12 during the winter season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
Feb. 1 - Apr. 30	2009	1,736	244	0	8	0	176	79	262	51	820
Feb. 1 - Apr. 30	2010	2,425	424	6	6	0	252	148	364	84	1,284
Feb. 1 - Apr. 30	2011										
	2012										
	2013										
Average		2,081	334	3	7	0	214	114	313	68	1,052

Grey shaded cells indicate estimates based on CRC methodology.

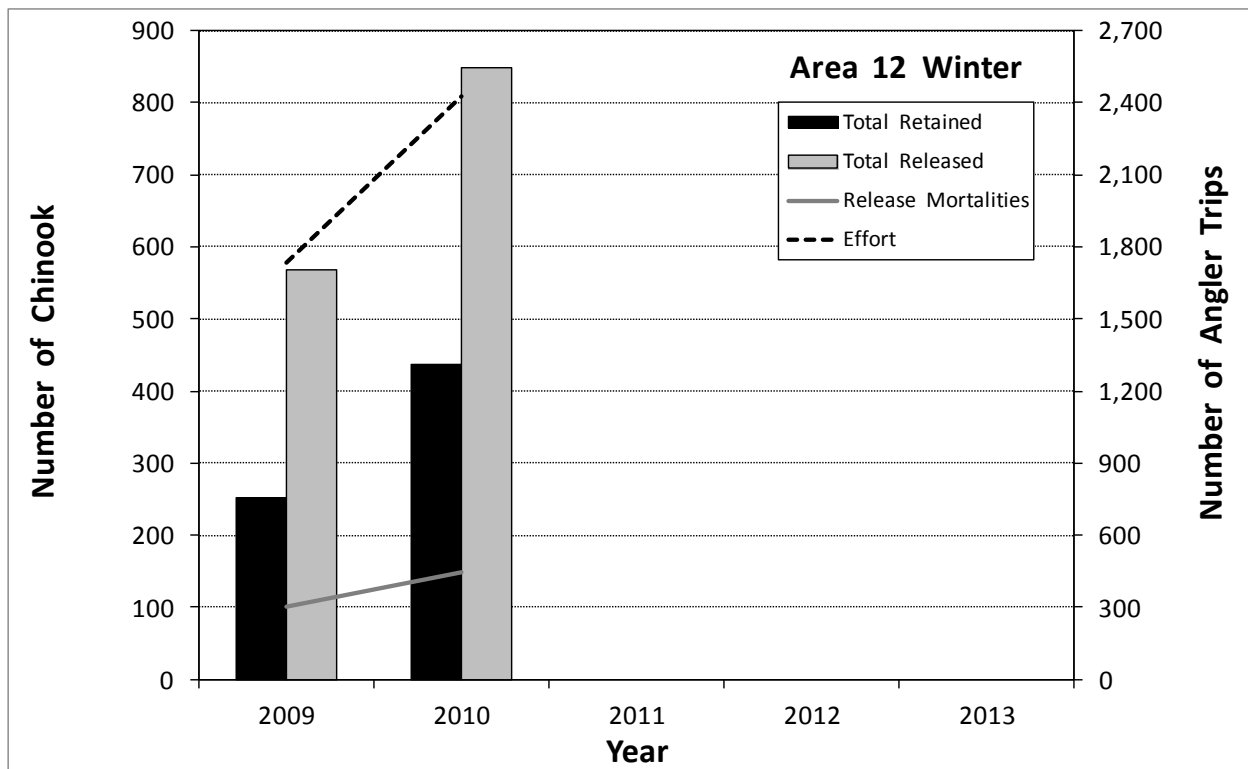


Figure 12W-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 12 during the winter season.

Table 12W-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 12 during the winter season.

Fishery Dates	Year	# Rel./ # LM Ret.	% of Encntrs that are LM	% of Retained that are Illegal	Total Rel. Morts. per LM Retained	Unmrkd Rel. Morts. per LM Retained
Feb. 1 - Apr. 30	2009	2.33	51.2%	3.2%	0.41	0.09
Feb. 1 - Apr. 30	2010	2.00	52.6%	2.8%	0.35	0.09
Feb. 1 - Apr. 30	2011					
	2012					
	2013					
Average		2.16	51.9%	3.0%	0.38	0.09

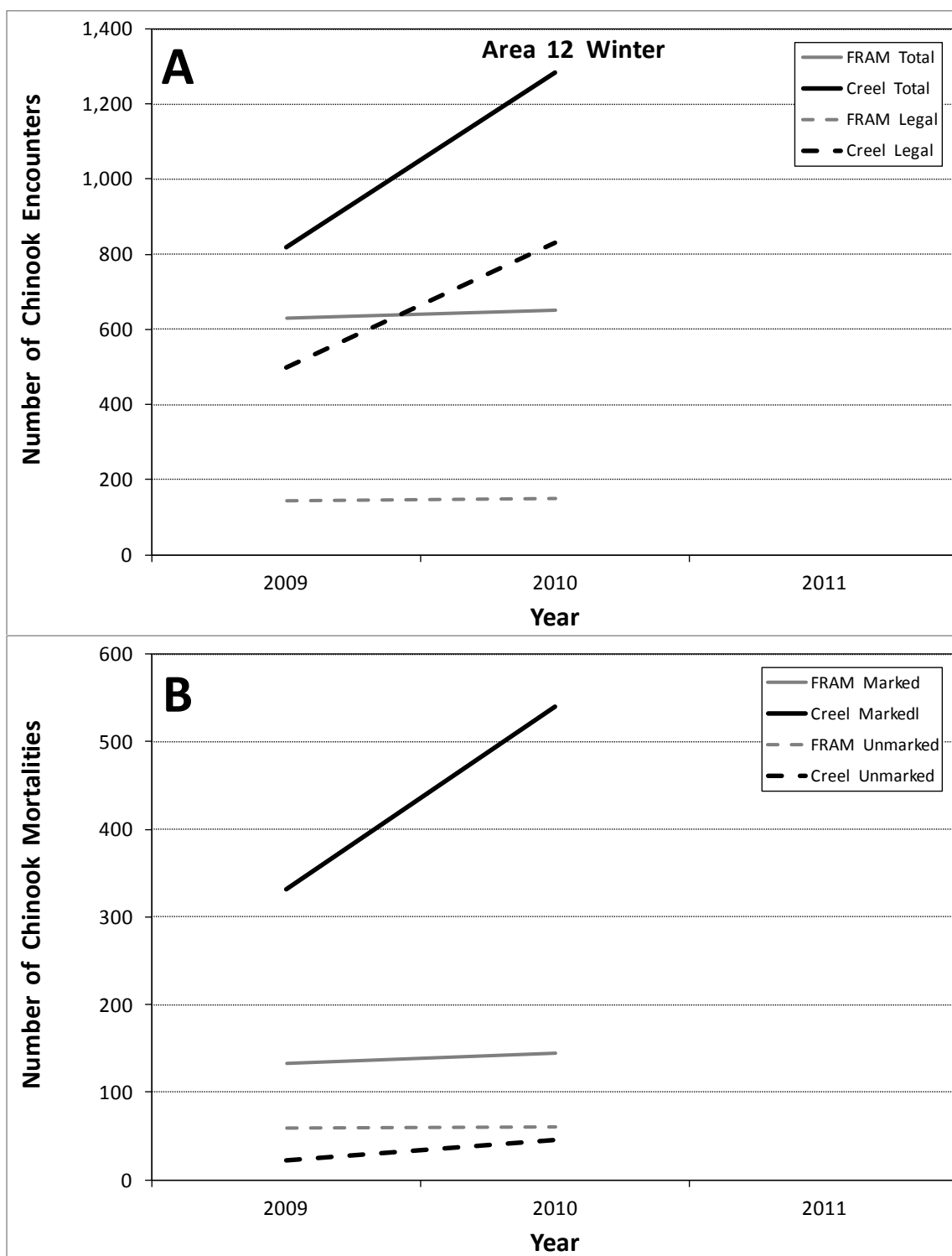


Figure 12W-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 12 during the winter season.

Table 12W-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 12 during the winter season.

Year	Source	Encounters				Encounters		Mortalities	
		LM	LU	SM	SU	Total	Legal	Marked	Unmarked
2009	FRAM	88	57	255	230	630	145	133	59
	Estimated	419	79	270	51	819	498	331	22
	% Error	-79.0%	-27.8%	-5.6%	351.0%	-23.1%	-70.9%	-59.8%	168.2%
2010	FRAM	100	51	260	240	651	151	145	60
	Estimated	676	154	370	84	1,284	830	540	45
	% Error	-85.2%	-66.9%	-29.7%	185.7%	-49.3%	-81.8%	-73.1%	33.3%

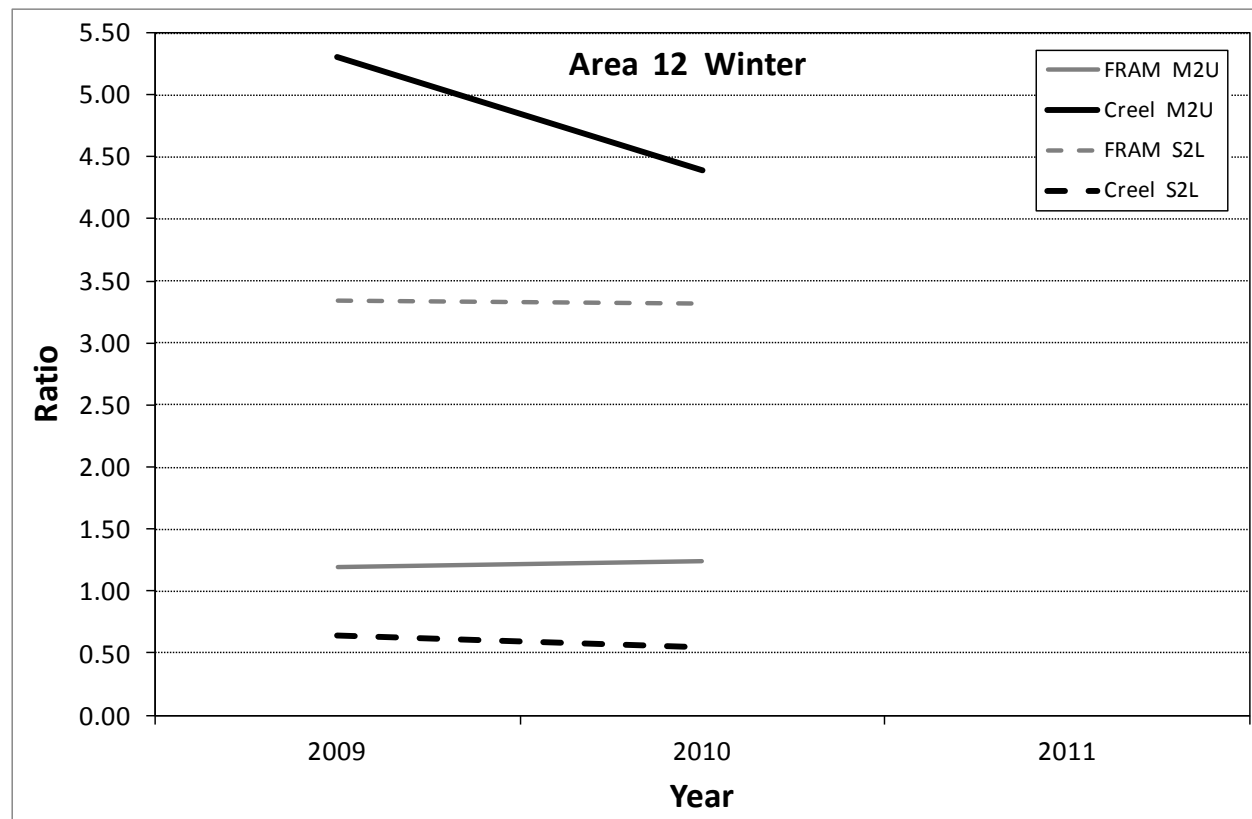


Figure 12W-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 12 during the winter season.



## Area 13 Summary

### Area 13 Summer:

Summer MSFs have been open annually from May 1 to September 30 since 2007 in Area 13. This fishery is monitored using baseline sampling and the Chinook impacts (catch retained, numbers released, and number of release mortalities) are estimated using the CRC methodology. For the five years for which estimates are available, this fishery has averaged 26,884 angler trips, a harvest of 1,370 LM Chinook, and 3,533 total Chinook encounters (Table 13S-1). Angler effort in 2010 and 2011 decreased substantially from the 2009 estimate (Figure 13S-1).

This fishery averaged 1.3 Chinook released for every LM Chinook retained (Table 13S-2). Compared to other MSFs, the average proportion of encounters that are legal-size and marked (62%) is the highest of all MSFs in Puget Sound. The average number of unmarked Chinook release mortalities per LM retained (0.08) is also the lowest for all Puget Sound MSFs.

**FRAM Comparison:** Compared to monitoring program estimates, FRAM has over-predicted total Chinook encounters in four of the five years for which there are estimates (Table 13S-3). FRAM has over-predicted marked and unmarked Chinook mortalities in three of the five years (Figure 13S-2B). FRAM projections and monitoring program estimates of the marked-to-unmarked ratio have generally not corresponded (Figure 13S-3). FRAM has greatly over-predicted the S2L ratio each year.

Table 13S-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in Area 13 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
May 1 - Sep. 30	2007	28,080	2,697	78	101	0	1,095	1,648	2,032	971	8,622
May 1 - Sep. 30	2008	22,494	1,327	0	8	0	198	197	238	98	2,066
May 1 - Sep. 30	2009	40,967	1,172	24	72	0	839	471	1,227	320	4,125
May 1 - Sep. 30	2010	27,060	646	21	0	0	97	85	106	35	990
May 1 - Sep. 30	2011	15,818	1,006	8	8	0	266	268	250	56	1,862
May 1 - Sep. 30	2012										
	2013										
Average		26,884	1,370	26	38	0	499	534	771	296	3,533

Grey shaded cells indicate estimates based on CRC methodology.

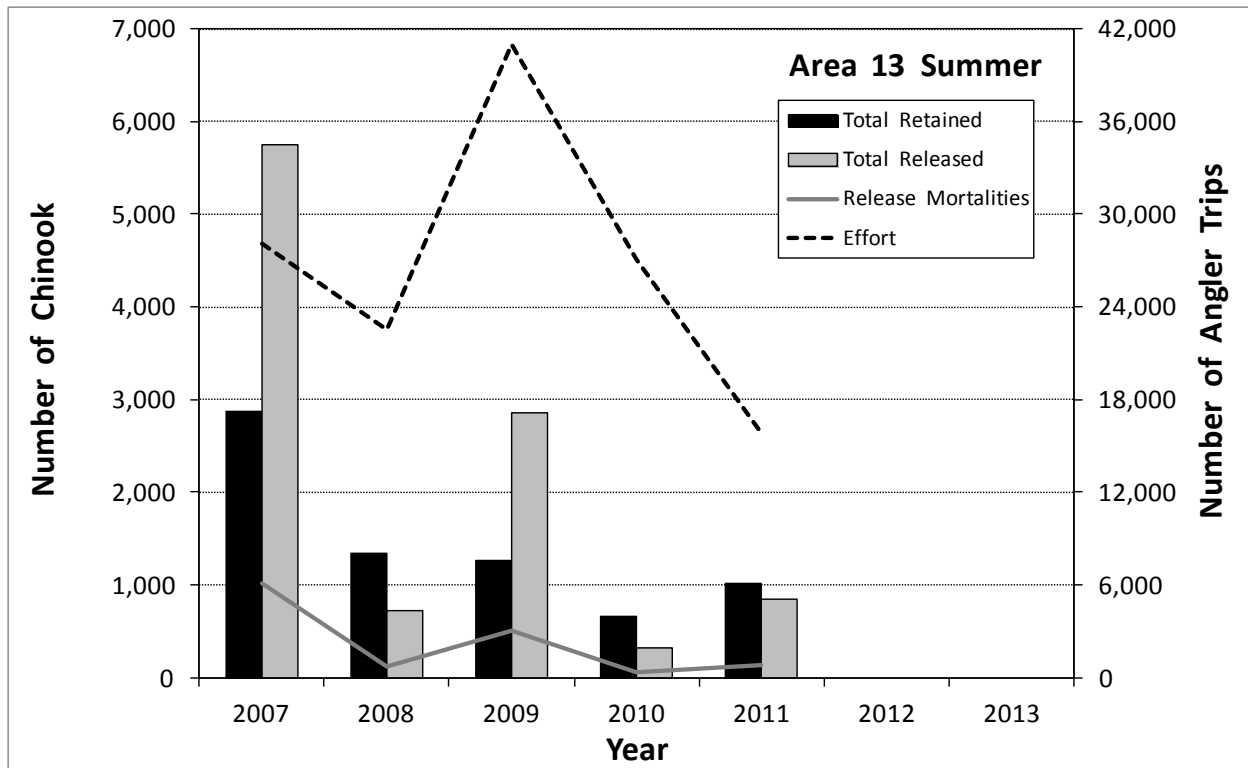


Figure 13S-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in Area 13 during the summer season.

Table 13S-2. Fishery evaluation statistics for mark-selective fisheries conducted in Area 13 during the summer season.

Fishery Dates	Year	# Rel./ # LM Ret.	% of Encntrs that are LM	% of Retained that are Illegal	Total Rel. Morts. per LM Retained	Unmrkd Rel. Morts. per LM Retained
May 1 - Sep. 30	2007	2.13	44.0%	6.2%	0.38	0.16
May 1 - Sep. 30	2008	0.55	73.8%	0.6%	0.10	0.04
May 1 - Sep. 30	2009	2.44	48.8%	7.6%	0.43	0.11
May 1 - Sep. 30	2010	0.50	75.1%	3.1%	0.09	0.03
May 1 - Sep. 30	2011	0.83	68.3%	1.6%	0.14	0.05
May 1 - Sep. 30	2012					
	2013					
Average		1.29	62.0%	3.8%	0.23	0.08

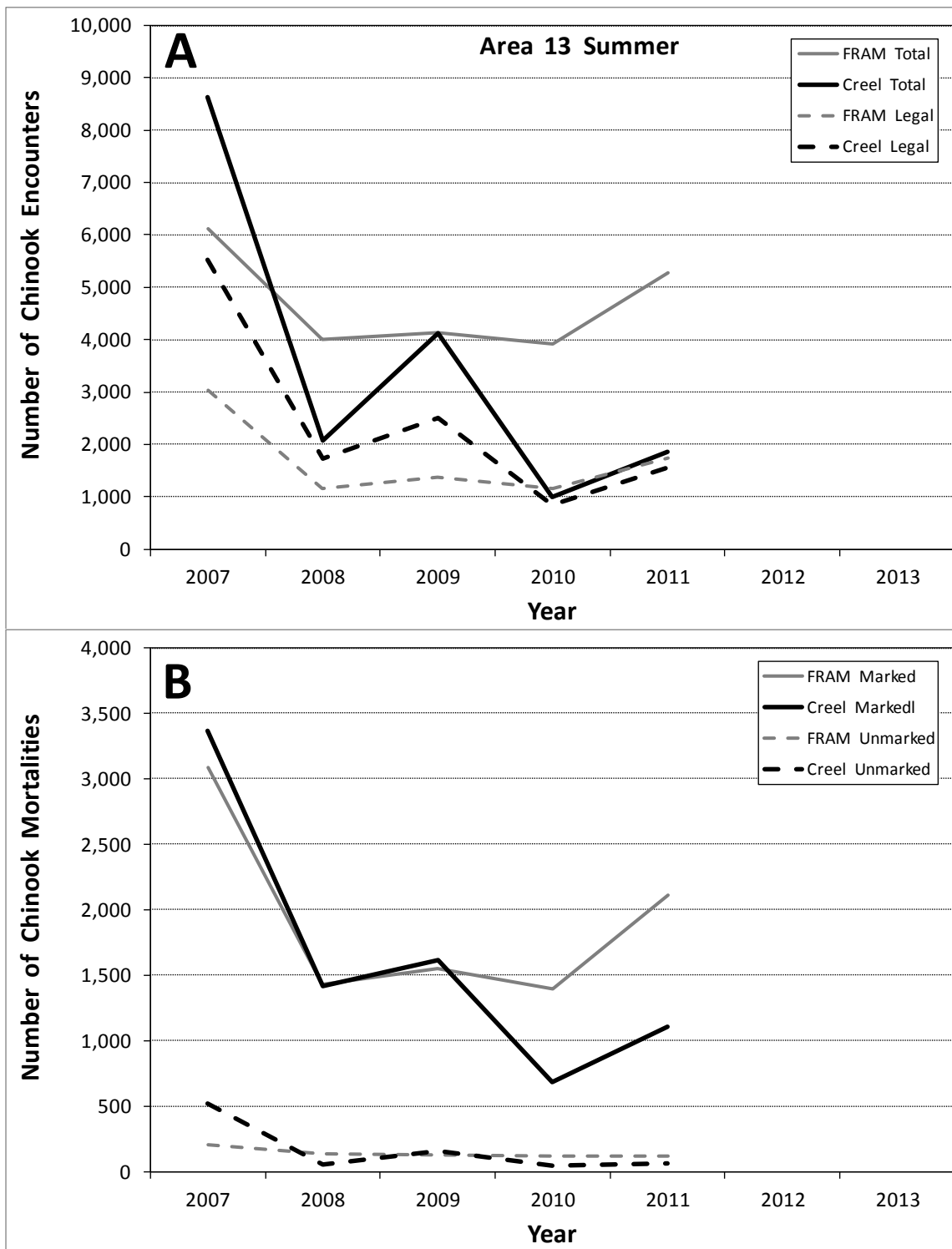


Figure 13S-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in Area 13 during the summer season.

Table 13S-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in Area 13 during the summer season.

Year	Source	Encounters				Encounters		Mortalities	
		LM	LU	SM	SU	Total	Legal	Marked	Unmarked
2007	FRAM	2,583	454	2,575	510	6,122	3,037	3,088	202
	Estimated	3,792	1,726	2,133	971	8,622	5,518	3,369	519
	% Error	-31.9%	-73.7%	20.7%	-47.5%	-29.0%	-45.0%	-8.3%	-61.1%
2008	FRAM	957	205	2,400	445	4,007	1,162	1,432	134
	Estimated	1,525	197	246	98	2,066	1,722	1,412	49
	% Error	-37.2%	4.1%	875.6%	354.1%	93.9%	-32.5%	1.4%	173.5%
2009	FRAM	1,174	208	2,380	380	4,142	1,382	1,547	122
	Estimated	2,011	495	1,299	320	4,125	2,506	1,615	159
	% Error	-41.6%	-58.0%	83.2%	18.8%	0.4%	-44.9%	-4.2%	-23.3%
2010	FRAM	989	160	2,375	400	3,924	1,149	1,397	115
	Estimated	743	106	106	35	990	849	682	41
	% Error	33.1%	50.9%	2140.6%	1042.9%	296.4%	35.3%	104.8%	180.5%
2011	FRAM	1,591	148	3,120	420	5,279	1,739	2,109	116
	Estimated	1,271	276	258	56	1,861	1,547	1,104	59
	% Error	25.2%	-46.4%	1109.3%	650.0%	183.7%	12.4%	91.0%	96.6%

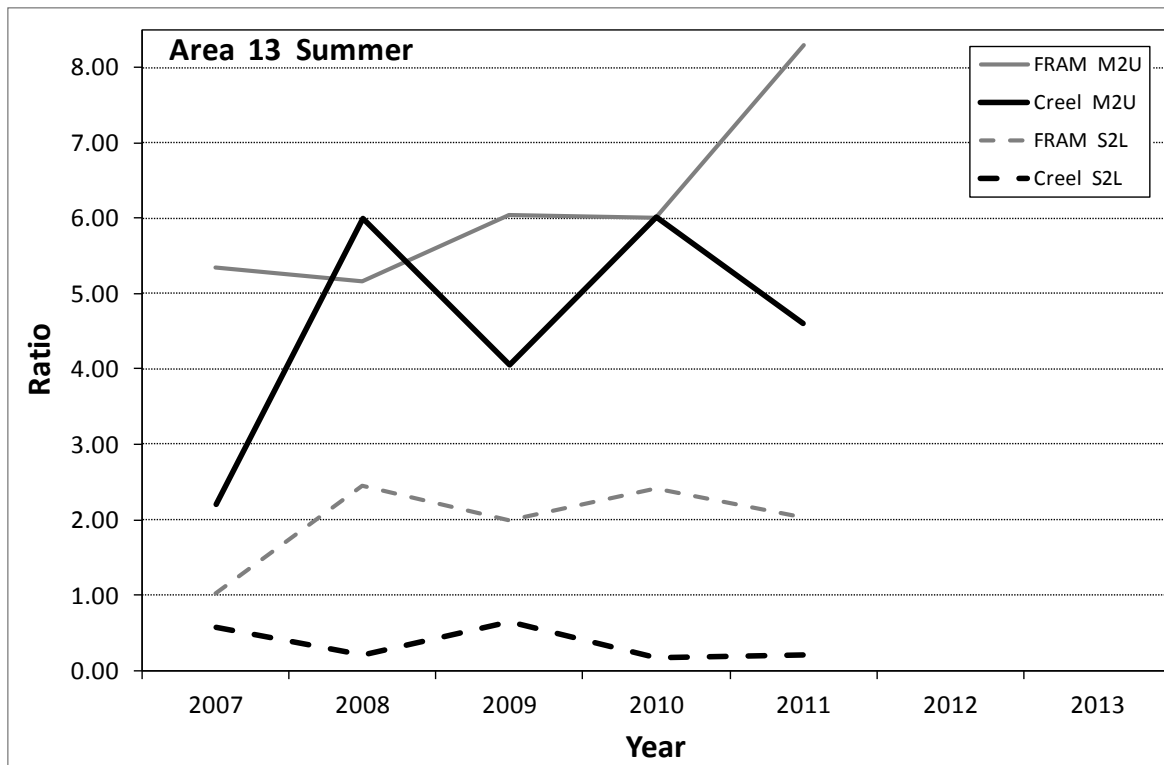


Figure 13S-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in Area 13 during the summer season.

## Ocean Areas 1 to 4 Summary

### Ocean Areas 1 to 4 Summer:

Summer MSFs have been conducted annually during parts of June in ocean catch areas 1 to 4 since 2010. The number of days open to Chinook MSFs in June has ranged from 8 to 19 days. During the three years that this fishery has been conducted, it has averaged 7,711 angler trips, a harvest of 4,886 LM Chinook, and 11,579 total Chinook encounters (Table OcnS-1). The highest retained catch and total encounters for this fishery occurred in 2012 (Figure OcnS-1).

This fishery has averaged 1.6 Chinook released for every LM Chinook retained (Table OcnS-2). This fishery has the lowest average percent retained that are illegal (0.8%) of all MSFs monitored. Otherwise, the fishery evaluation statistics for this fishery are typical of most summer MSFs in Puget Sound.

FRAM Comparison: FRAM has over-predicted total Chinook encounters and legal-size encounters compared to monitoring program estimates for this fishery (Table OcnS-3). FRAM predictions for encounters have generally followed the trends shown by monitoring program estimates (Figure OcnS-2A). Marked and unmarked Chinook mortalities have been over-predicted by FRAM each year (Figure OcnS-2B). Monitoring program estimates of the marked-to-unmarked ratio have been rather consistent in this fishery at about 2.0 (Figure OcnS-3) and FRAM has predicted this ratio with relatively small %Error (< ±30%). FRAM predictions of the sublegal-to-legal ratio for this fishery were very close to monitoring program estimates in 2010 and 2012.

Table OcnS-1. Summary of angler effort and Chinook encounter estimates for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.

Fishery Dates	Year	Effort (angler trips)	Retained Chinook				Released Chinook				Total Encounters
			LM	LU	SM	SU	LM	LU	SM	SU	
June 12 - 30	2010	10,004	5,018	19	0	0	750	2,604	1,797	1,168	11,356
June 18 - 25	2011	5,032	2,301	35	0	0	344	1,247	2,759	1,462	8,148
June 9 - 22, 16 - 30	2012	8,096	7,339	43	0	0	1,097	3,531	1,771	1,453	15,234
June (varies by area)	2013										
<b>Average</b>		7,711	4,886	32	0	0	730	2,461	2,109	1,361	11,579

Table OcnS-2. Fishery evaluation statistics for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.

Fishery Dates	Year	# Rel./ # LM Ret.	% of Encntrs that are LM	% of Retained that are Illegal	Total Rel. Morts. per LM Retained	Unmrkd Rel. Morts. per LM Retained
June 12 - 30	2010	1.26	50.8%	0.4%	0.18	0.11
June 18 - 25	2011	2.53	32.5%	1.5%	0.35	0.16
June 9 - 22, 16 - 30	2012	1.07	55.4%	0.6%	0.15	0.10
June (varies by area)	2013					
<b>Average</b>		1.62	46.2%	0.8%	0.23	0.12

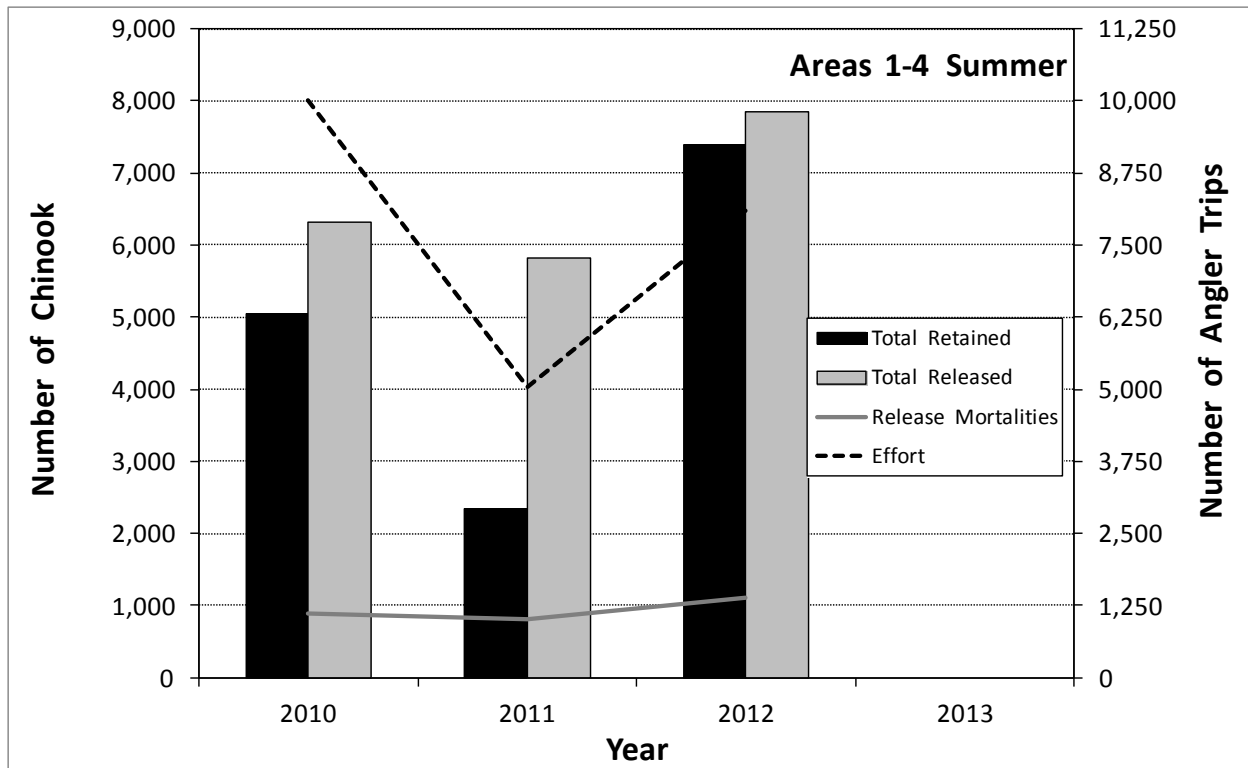


Figure OcnS-1. Annual summary of estimates of angler effort, total number of Chinook retained, total number of Chinook released, and total number of Chinook release mortalities for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.

Table OcnS-3. Comparison of FRAM pre-season projections to monitoring program estimates for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.

		Encounters				Encounters		Mortalities	
Year	Source	LM	LU	SM	SU	Total	Legal	Marked	Unmarked
2010	FRAM	13,375	4,543	3,650	2,100	23,668	17,918	13,059	1,470
	Estimated	5,768	2,623	1,797	1,168	11,356	8,391	5,375	547
	% Error	131.9%	73.2%	103.1%	79.8%	108.4%	113.5%	143.0%	168.7%
2011	FRAM	5,492	2,092	1,743	1,300	10,627	7,584	5,124	492
	Estimated	2,644	1,281	2,759	1,462	8,146	3,925	2,735	414
	% Error	107.7%	63.3%	-36.8%	-11.1%	30.5%	93.2%	87.3%	18.8%
2012	FRAM	9,101	4,164	3,750	2,379	19,394	13,265	9,063	1,196
	Estimated	8,435	3,575	1,771	1,453	15,234	12,010	7,740	741
	% Error	7.9%	16.5%	111.7%	63.7%	27.3%	10.4%	17.1%	61.4%

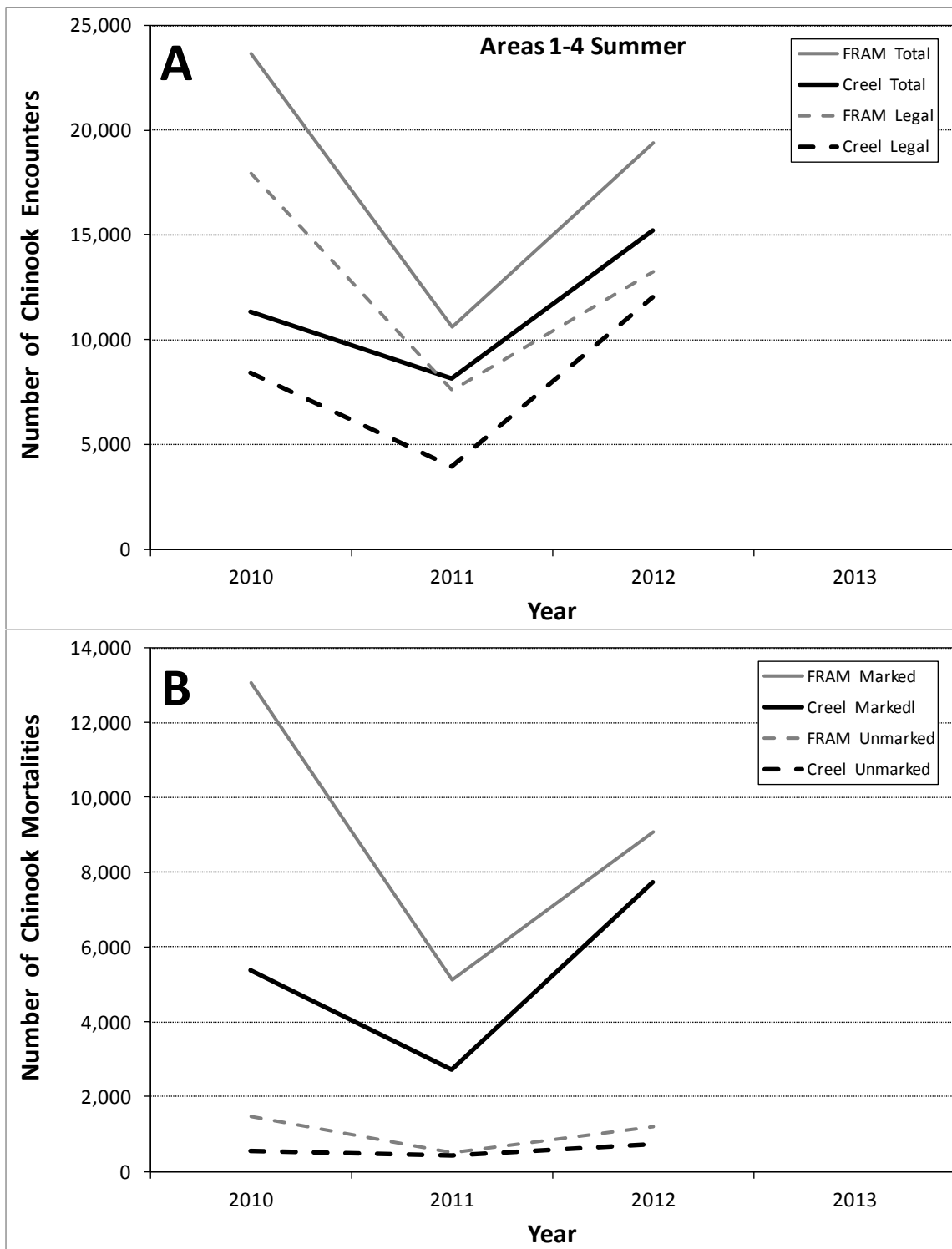


Figure OcnS-2. Comparison of monitoring program estimates to FRAM pre-season projections for (A) total Chinook encounters and total legal-size Chinook encounters and (B) total number of marked and unmarked Chinook mortalities, for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.

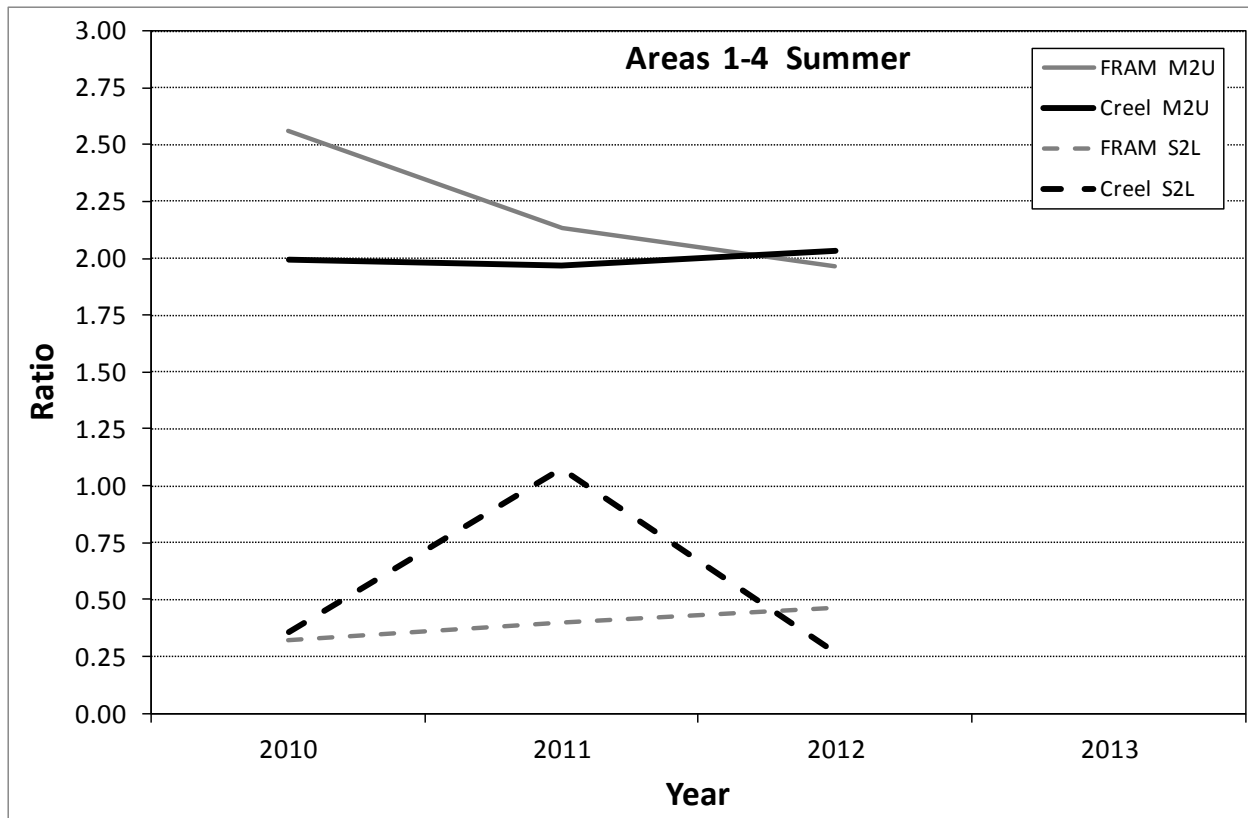


Figure OcnS-3. Comparison of FRAM projections to monitoring program estimates of the ratio of marked-to-unmarked Chinook encountered in the fishery (M2U ratio) and the ratio of sublegal-to-legal Chinook encountered in the fishery (S2L ratio) for mark-selective fisheries conducted in ocean Areas 1 to 4 during the summer season.



## COMPARISONS ACROSS AREAS AND SEASONS

Summaries by area were presented in the Results section. This section of the report compares mark-selective fisheries estimates across areas and seasons. Two different sets of fishery statistics are examined:

1. A comparison of the results for the MSFs conducted which includes comparisons of effort, total Chinook encounters, total number of legal-size and marked Chinook retained, total number of release mortalities, and total number of release mortalities of unmarked Chinook.
2. A comparison of the five fishery evaluation statistics presented in each area-specific summary.

### Comparison of MSF Effort and Catch Estimates

Box-and-whiskers plots<sup>9</sup> are used to compare fishery effort and catch estimates across areas and seasons. Because the number of days each mark-selective fishery was opened varied considerably, comparisons are made for estimated seasonal totals and for seasonal totals standardized by the number of days a MSF was open in a season.

#### Angler Effort:

Angler effort is much higher in summer MSFs compared to winter fisheries (Figure 4A). The MSF in Area 11 during the summer annually receives the highest amount of angler effort on a season basis (Figure 4A). However, the summer MSF in Area 9 is the most intense as measured by angler-trips per day the fishery is open (Figure 4B). The summer MSFs in areas 5, 10, 11 and the ocean areas (areas 1-4) are also relatively intense fisheries compared to the other MSFs. The Area 7 winter MSF consistently has the highest angler effort per day open when compared to other winter MSFs.

#### Chinook Encounters:

Total Chinook encounters for a season have been highest in the summer MSFs in areas 5, 9, 11, and the ocean areas (Figure 5A). The summer MSFs in the ocean areas have had by far the greatest number of Chinook encounters per day open (Figure 5B). The summer MSFs in areas 5, 9, and 10 also have relatively high numbers of Chinook encounters per day open compared to the other MSFs.

#### Legal-size and Marked Chinook Retained:

On a season basis, the total numbers of LM Chinook retained have been the highest in the summer MSFs in areas 5, 9, 11, and the ocean areas (Figure 6A). The winter MSFs in Area 7 have had relatively high numbers of LM Chinook retained compared to the other winter MSFs. The summer MSFs in the ocean areas have had by far the greatest number of LM Chinook retained per day open (Figure 6B).

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<sup>9</sup> Box-and-whiskers plots encompass the central quartiles of the data (the central 50% of the data values) in a box with the median value indicated by a heavy black line in the box. The box whiskers include all data values not considered outliers or extreme values. Outliers are marked with open circles and are values between 1.5 and 3 box lengths from the upper or lower edges of the box (Hoaglin et al. 1983). Extreme values are marked by asterisks and are more than three box lengths from the upper or lower edges of the box.

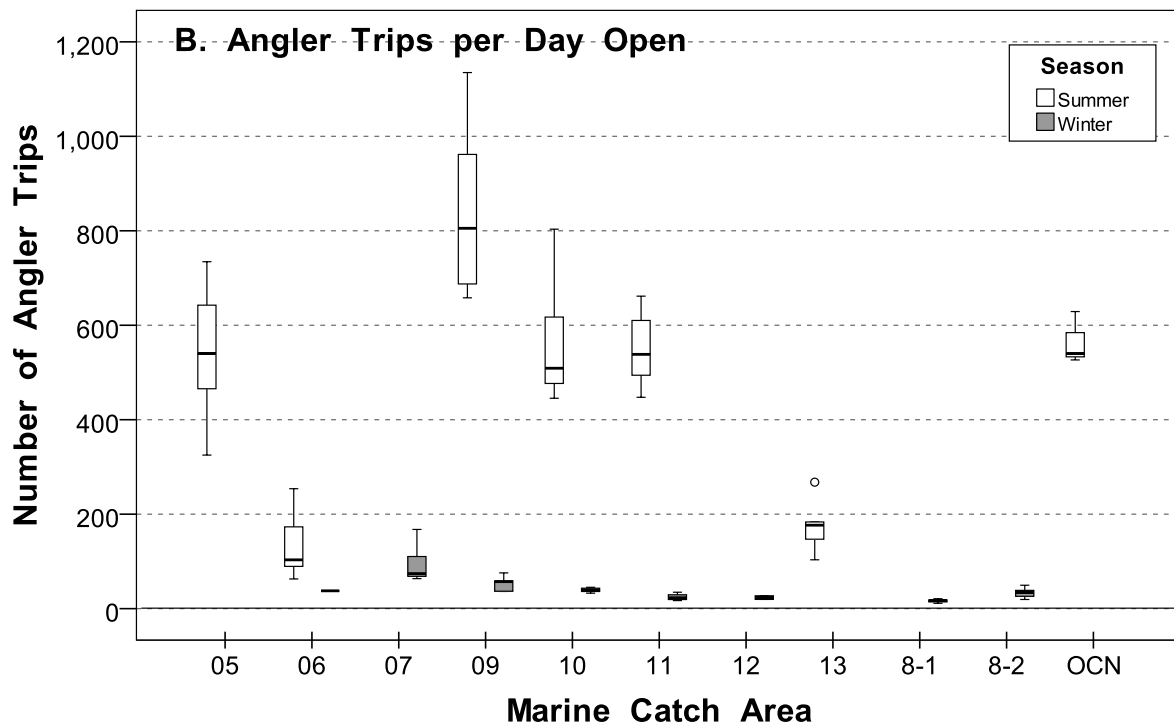
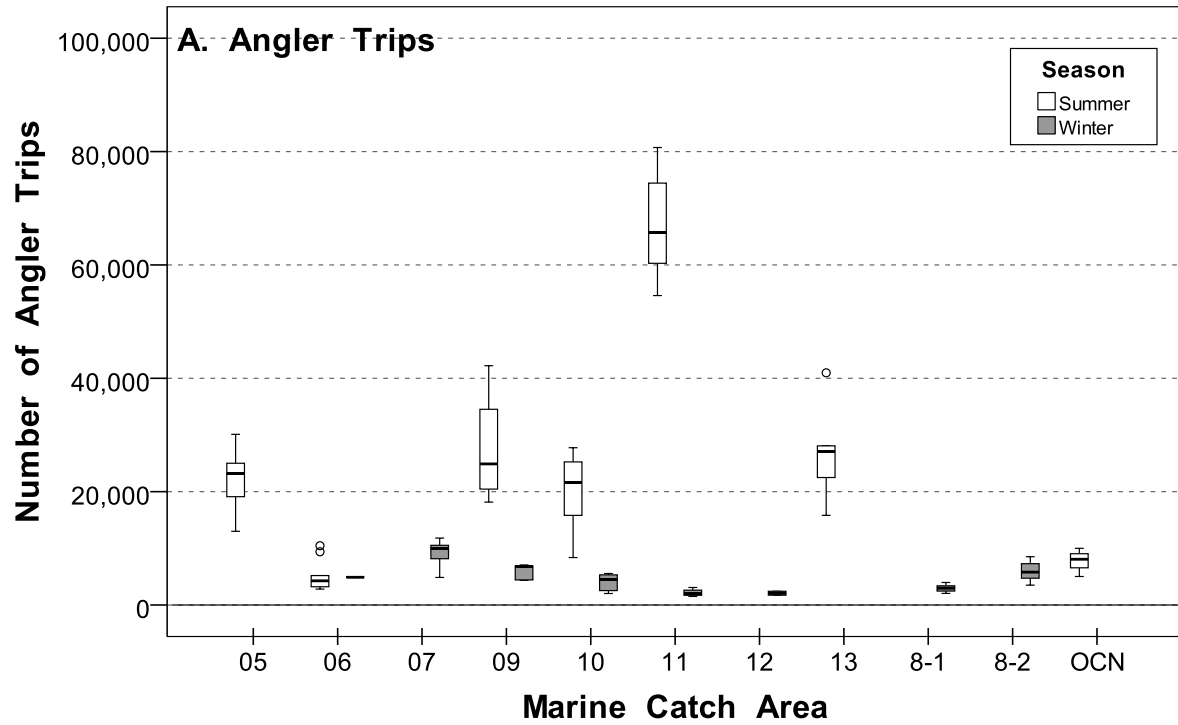


Figure 4. Comparison of angler effort estimates for Chinook mark-selective fisheries by marine catch area and season. Angler effort shown for (A) total angler trips and (B) angler trips per day open (OCN = marine catch areas 01-04 combined).

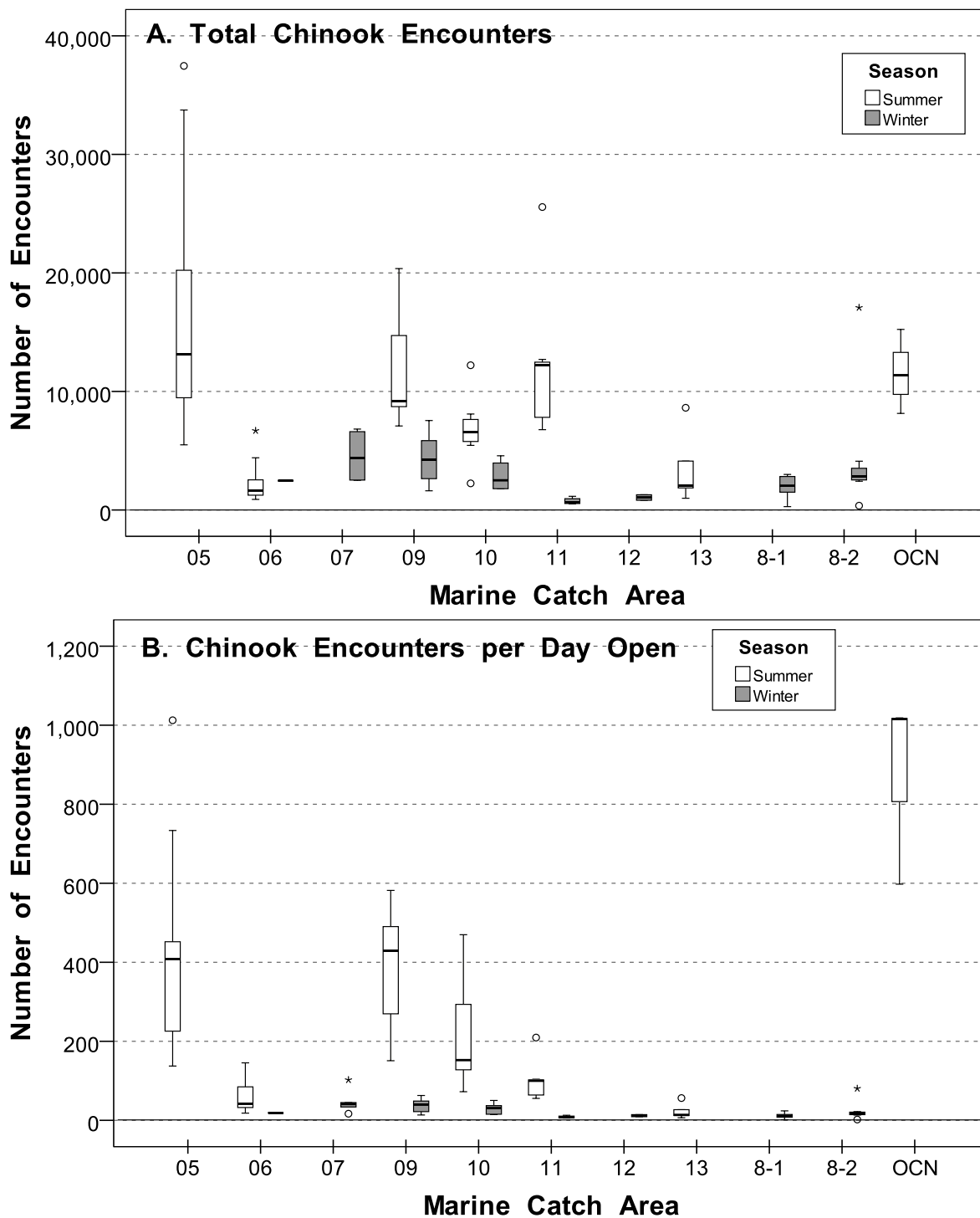


Figure 5. Comparison of total Chinook encounter estimates for Chinook mark-selective fisheries by marine catch area and season. Total encounters shown for (A) total Chinook encounters and (B) total Chinook encounters per day open (OCN = marine catch areas 01-04 combined).

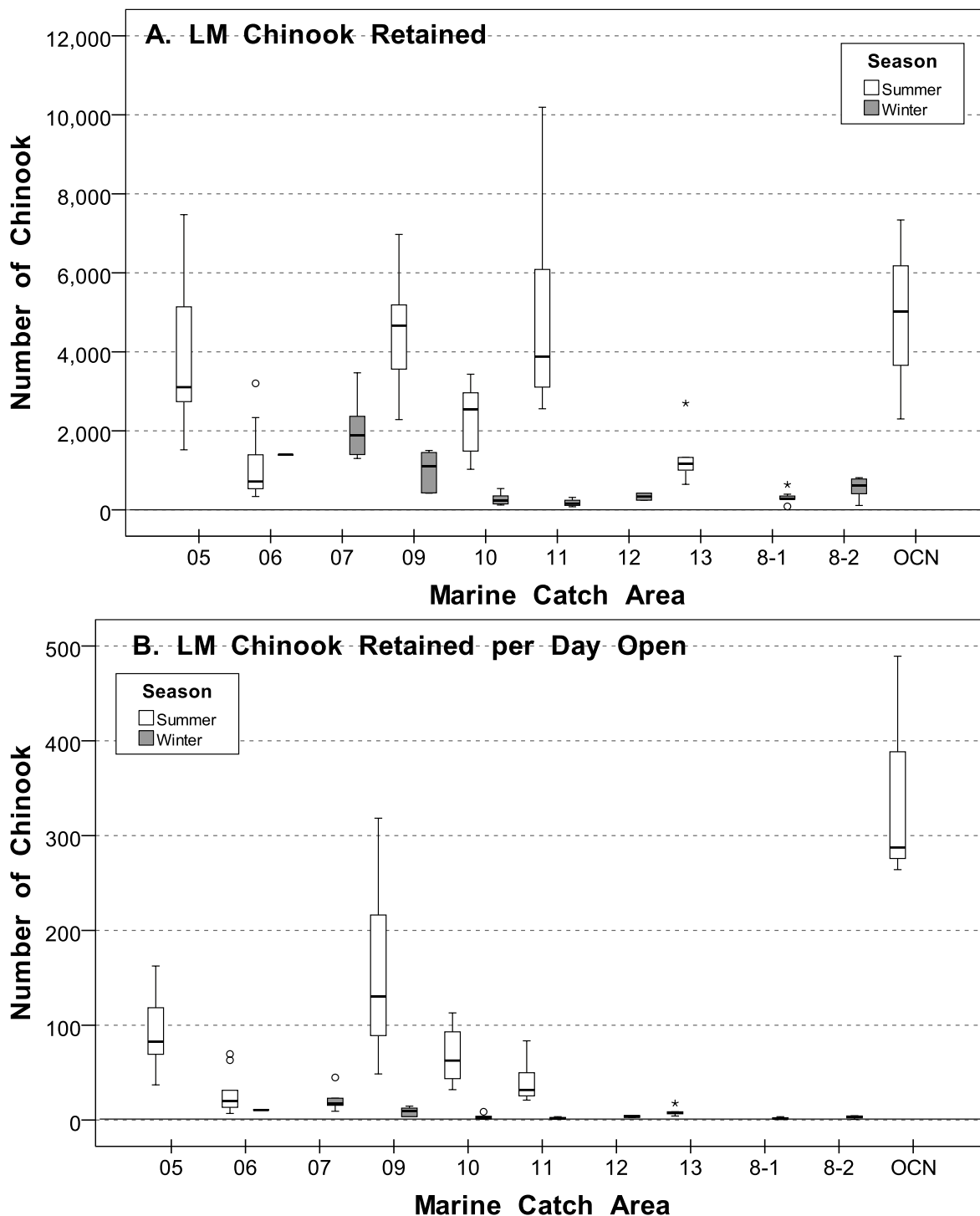


Figure 6. Comparison of total number of legal-size and marked (LM) Chinook retained estimates for Chinook mark-selective fisheries by marine catch area and season. Total LM Chinook retained shown for (A) total LM Chinook retained and (B) total LM Chinook retained per day open (OCN = marine catch areas 01-04 combined).

#### Chinook Release Mortalities:

On a season basis, the total numbers of Chinook release mortalities have been greatest in the summer MSFs in areas 5, 9, and 11 (Figure 7A). The summer MSFs in the ocean areas have had the greatest number of Chinook release mortalities per day open (Figure 7B).

#### Unmarked Chinook Release Mortalities:

On a season basis, the total numbers of unmarked Chinook release mortalities have been greatest in the summer MSFs in areas 5, 9, 11, and the ocean areas (Figure 8A). The summer MSFs in the Area 5 and the ocean areas have had the greatest number of unmarked Chinook release mortalities per day open (Figure 8B).

#### Comparison of MSF Evaluation Statistics

Box-and-whiskers plots were also used to compare fishery evaluation statistics across areas and seasons.

#### Number of Chinook Released per Legal-size and Marked Chinook Retained:

For most MSFs, more than one Chinook is typically released for each legal-size and marked (LM) Chinook retained (Figure 9). The number of Chinook released per LM retained tends to be higher in winter MSFs compared to summer MSFs. The MSFs in Area 10 during the winter have the highest number of Chinook released for each LM Chinook retained. For summer MSFs, Area 5 had relatively high values for this statistic.

#### Proportion of Encounters that are Legal-size and Marked:

The proportion of Chinook encounters that are LM Chinook ranged from below 0.20 for the Area 10 winter MSF to values  $> 0.60$  in some fisheries (Figure 10). The winter MSFs in Area 7 have a consistently high proportion of LM Chinook encountered compared to other winter MSFs. For summer MSFs, Area 5 had relatively low values for this statistic.

#### Proportion of Retained Chinook that are Illegal:

The proportion of retained Chinook that are illegal to keep (either less than the legal size limit and/or unmarked) tends to be higher in winter MSFs compared to summer MSFs (Figure 11). The summer MSFs in Area 6 and the ocean areas, and the winter MSF in Area 7, have relatively low values for this statistic. The Area 5 summer MSF has a relatively high value for this statistic compared to other summer MSFs.

#### Number of Chinook Release Mortalities per Legal-size and Marked Chinook Retained:

For most MSFs, there was less than one Chinook release mortality for each LM Chinook retained (Figure 12). The exception to this was for the Area 10 winter MSF where there was typically more than two release mortalities for each LM Chinook retained. This statistic tends to be higher in winter MSFs compared to summer MSFs.

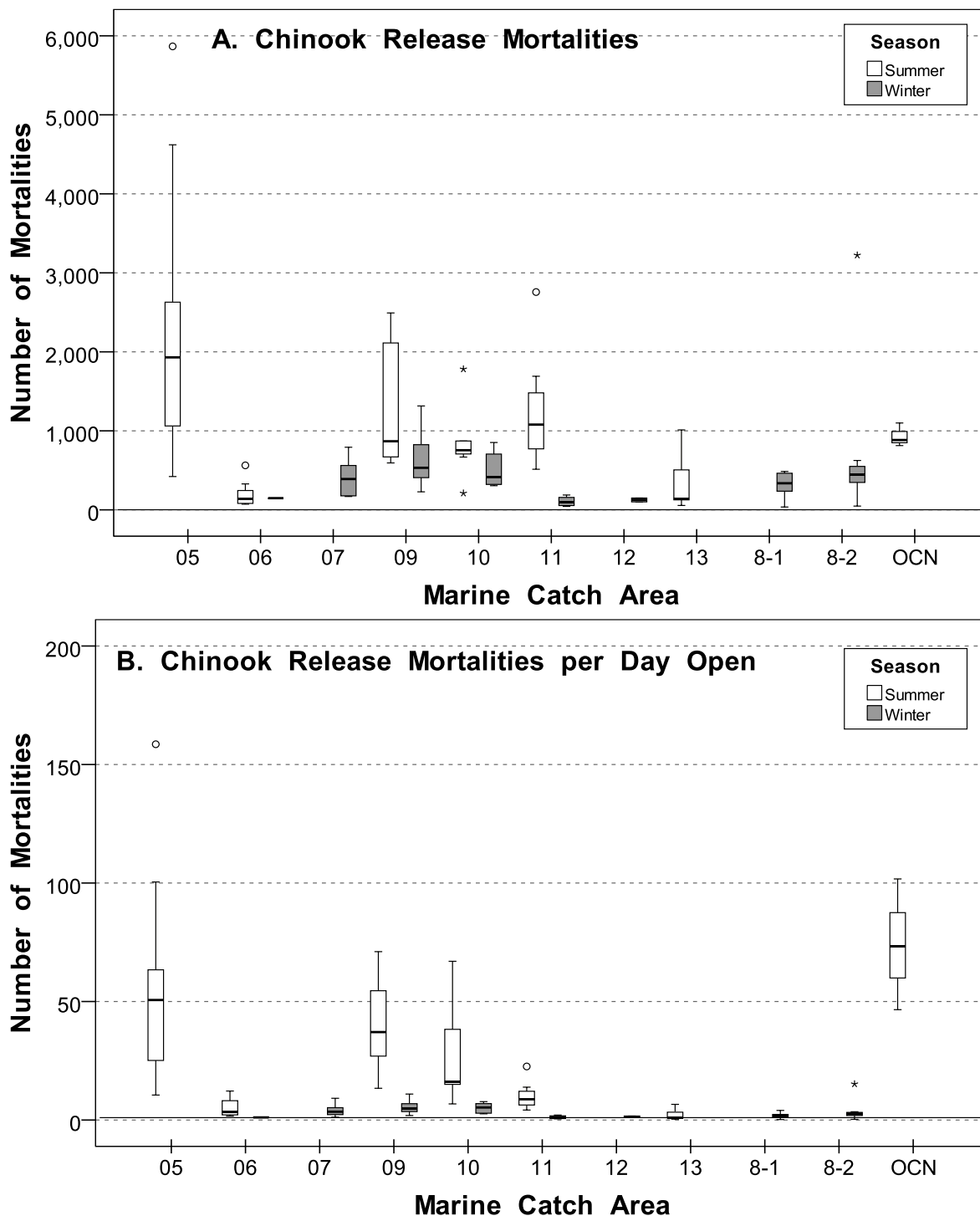


Figure 7. Comparison of total number of Chinook release mortalities in Chinook mark-selective fisheries by marine catch area and season. Chinook release mortalities shown for (A) total Chinook release mortalities and (B) total Chinook release mortalities per day open (OCN = marine catch areas 01-04 combined).

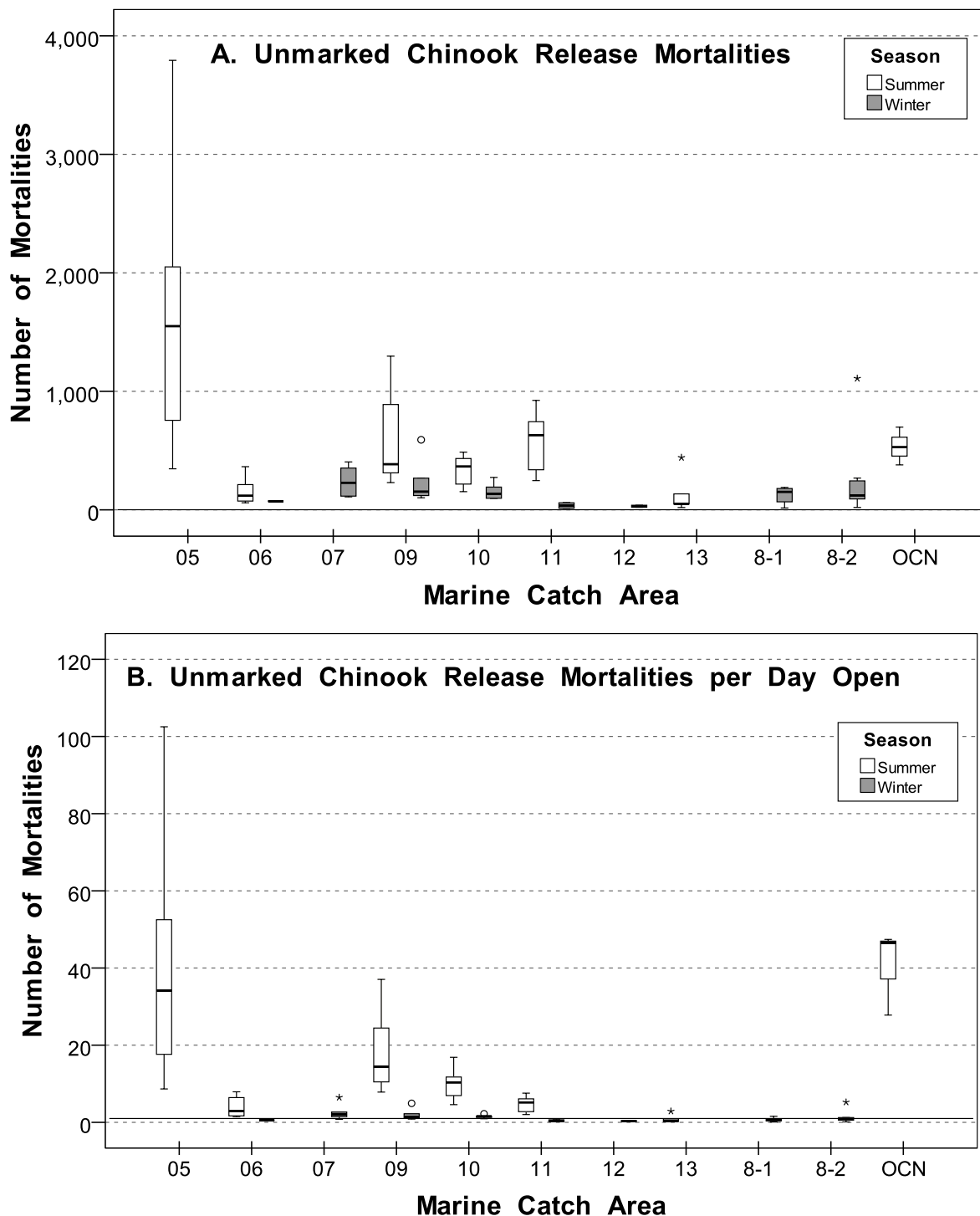


Figure 8. Comparison of total number of unmarked Chinook release mortalities in Chinook mark-selective fisheries by marine catch area and season. Unmarked Chinook release mortalities shown for (A) total unmarked Chinook release mortalities and (B) total unmarked Chinook release mortalities per day open (OCN = marine catch areas 01-04 combined).

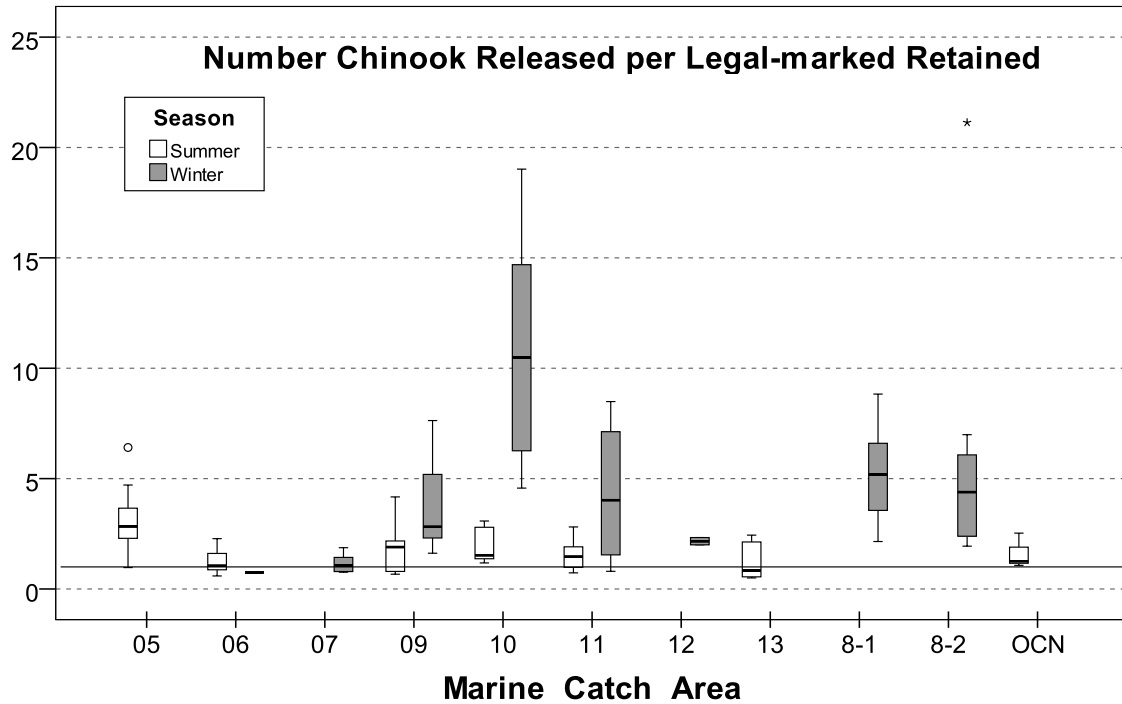


Figure 9. Comparison of the number of Chinook released for each legal-size and marked (LM) Chinook retained for Chinook mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined). Solid reference line is 1.0.

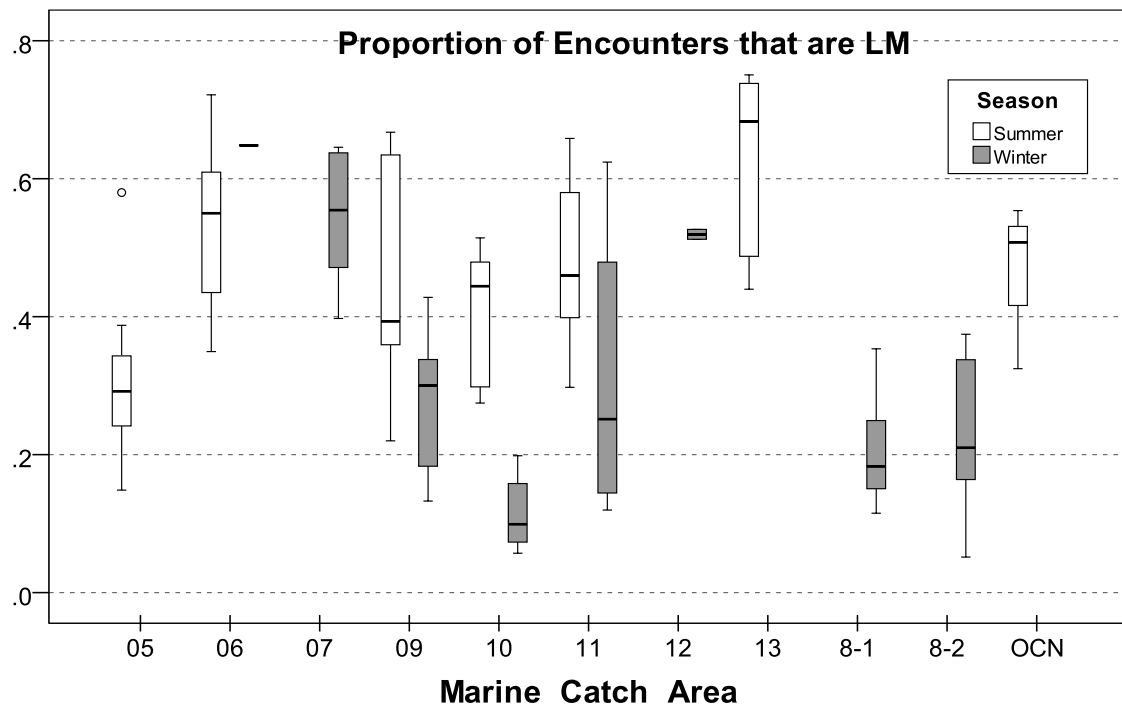


Figure 10. Comparison of the proportion of all Chinook encounters number that are legal-size and marked (LM) Chinook for Chinook mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).



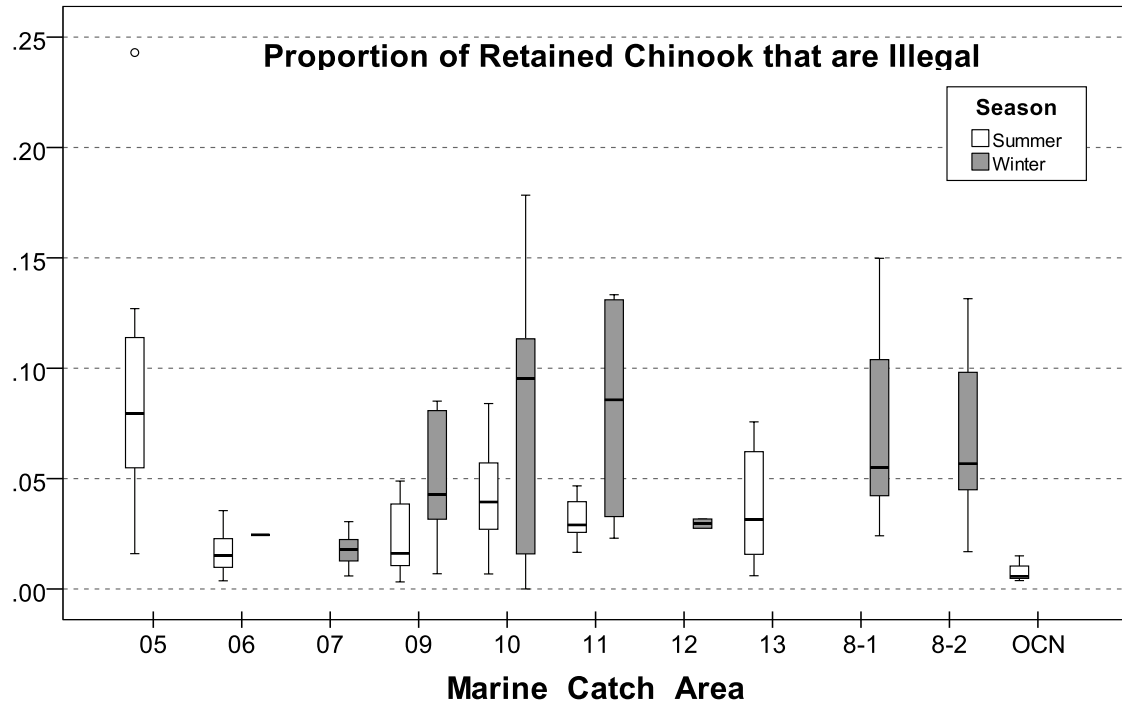


Figure 11. Comparison of the proportion of retained Chinook that are illegal for Chinook mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

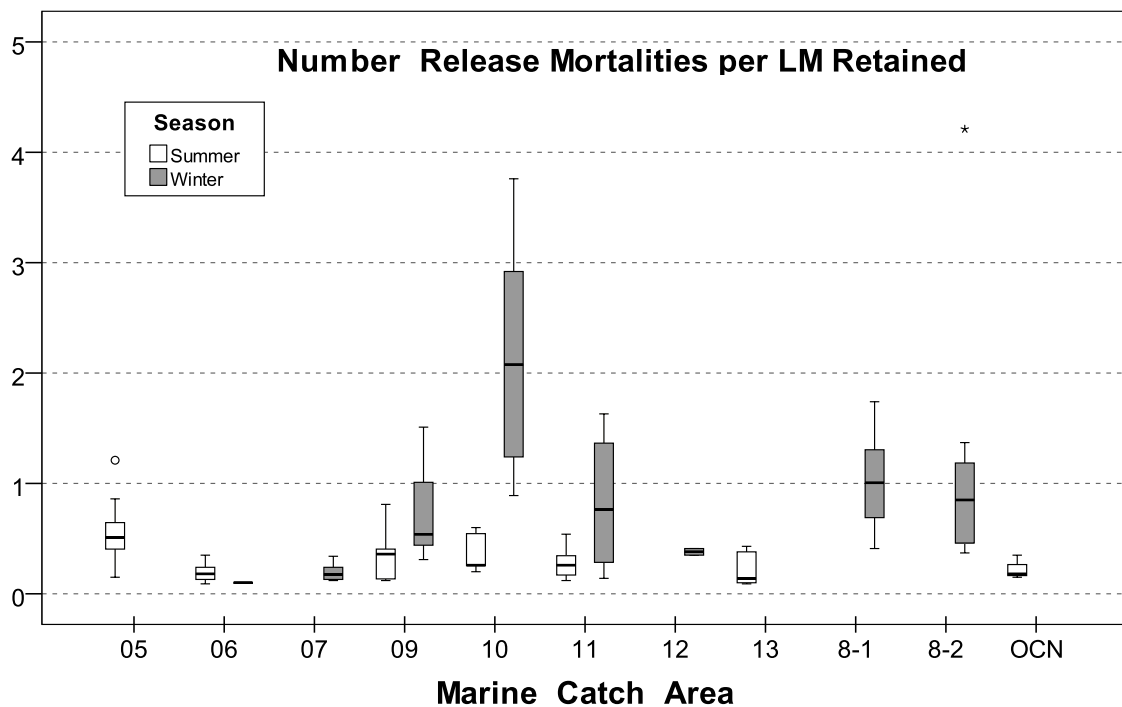


Figure 12. Comparison of the number of Chinook release mortalities for each legal-size and marked (LM) Chinook retained for Chinook mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

### Number of Unmarked Chinook Release Mortalities per Legal-size and Marked Chinook Retained:

For most MSFs, there were less than 0.5 unmarked Chinook release mortality for each LM Chinook retained (Figure 13). The exception to this was for the Area 10 winter MSFs where there were typically 0.5 to 1.0 release mortalities for each LM Chinook retained. Except for the summer MSF in Area 5, this statistic tends to be higher in winter MSFs compared to summer MSFs.

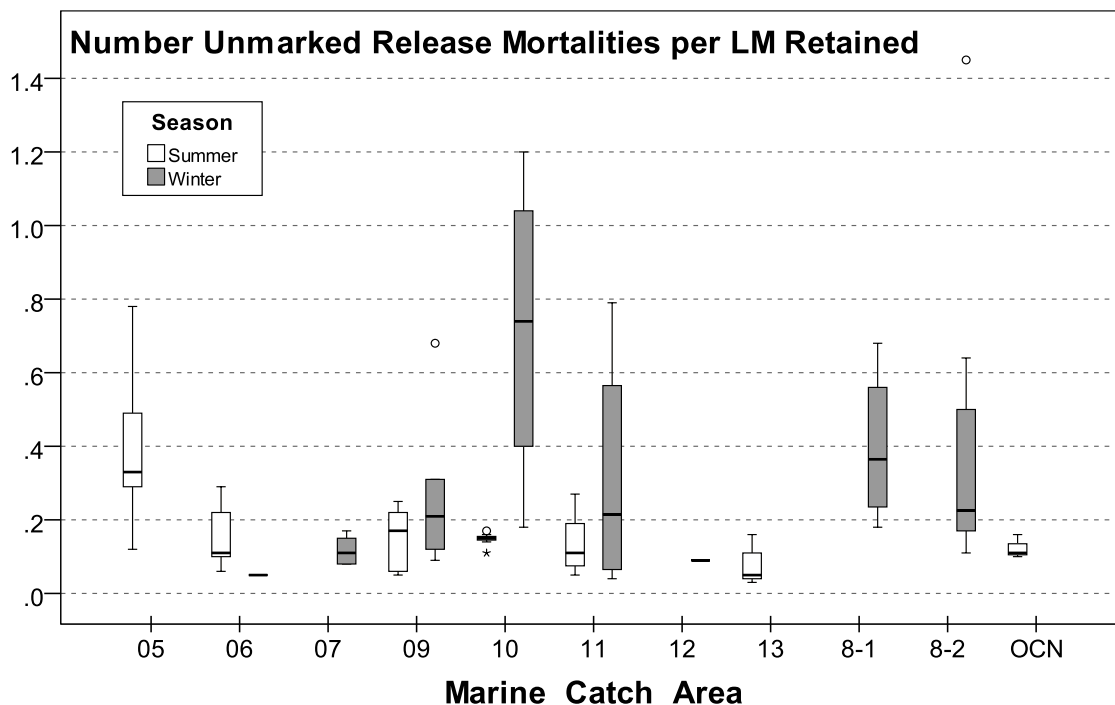


Figure 13. Comparison of the number of unmarked Chinook release mortalities for each legal-size and marked (LM) Chinook retained for Chinook mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

### Comparison of FRAM Projections

Box-and-whiskers plots were also used to compare three statistics assessing Chinook FRAM performance across areas and seasons:

1. Differences between FRAM projections of the total number of Chinook encounters in a fishery and monitoring program estimates (FRAM projection - monitoring program estimate),
2. Differences between FRAM projections of the total number of unmarked Chinook encounters in a fishery and monitoring program estimates (FRAM projection - monitoring program estimate), and
3. Differences in between FRAM projections of the total number of sublegal Chinook encounters in a fishery and monitoring program estimates (FRAM projection - monitoring program estimate).

These three statistics were selected as they reflect the performance of many of the other FRAM projections relative to monitoring program estimates presented in the area-specific results. Number of

encounters was used for these comparisons rather than relative error because large relative errors ( $>\pm 100\%$ ) can be associated with relatively small differences in the actual number of fish. Comparing differences in encounters indicates which fisheries FRAM does a poor job of projecting that may be important when assessing total impacts to stocks.

Figure 14 shows that generally FRAM over-predicts total Chinook encounters for most MSFs. The only consistent exceptions were the summer MSFs in areas 5 and 6; however, the differences for the Area 6 fishery were relatively small compared to most other MSFs. The largest over-predictions were for the Area 11 summer MSFs followed by the Area 8 winter MSFs. There was not a consistent pattern related to seasons.

Figure 15 shows that FRAM also generally over-predicts unmarked Chinook encounters. The exception was for the summer MSFs in Area 5 which also had the largest differences relative to the other MSFs. FRAM also had relatively large over-predictions for the Area 8 winter and Area 11 summer MSFs. There was not a consistent pattern related to seasons.

Figure 16 shows that FRAM consistently over-predicts sublegal-size Chinook encounters for all MSFs except for the summer MSFs in Area 5. FRAM also had relatively large over-predictions of the number of sublegal encounters for the Area 8 winter and Area 11 summer MSFs. There was not a consistent pattern related to seasons.

#### Assessment of Bias for FRAM Projections:

As mentioned in the Introduction, FRAM projections are the product of numerous stock-specific model inputs, fishery projections, and other manipulations internal to the model, we should not expect them to closely agree with the estimates produced by the monitoring programs. As general guidance,  $\%Error \leq \pm 50\%$  should be considered adequate. FRAM overestimates of the number of encounters and mortalities by a fishery might be viewed as conservative (making an error to the benefit of the resource) as the impacts of the fishery conducted were less than expected (based on pre-season FRAM model runs).

Figure 16 summarizes the percentage of years where FRAM has under- and over- predicted the total Chinook encounters, marked-to-unmarked Chinook ratio, and sublegal-to-legal ratio for the MSFs in this report. Ideally we would like to have 50% of the years to be under-predicted and 50% of the years to be over-predicted and a more-or-less random occurrence of each. It is evident that FRAM generally over-predicts total Chinook encounters. The exceptions are the Area 5 summer MSF and the Area 12 winter MSF (for which there are only two estimates). FRAM predictions of the marked-to-unmarked ratio are generally better than for total encounters as the percent of years under- or over- predicted is in the  $\pm 30\%$  to  $60\%$  range for most of the fisheries. Once again the exceptions are the Area 5 summer MSF and the Area 12 winter MSF in addition to the summer MSF in Area 9 and the winter MSFs in Area 8. Finally, FRAM generally over-predicts the sublegal-to-legal ratio. The exceptions are the Area 10 summer MSF, the summer MSFs in the ocean areas, and the Area 10 winter MSF.

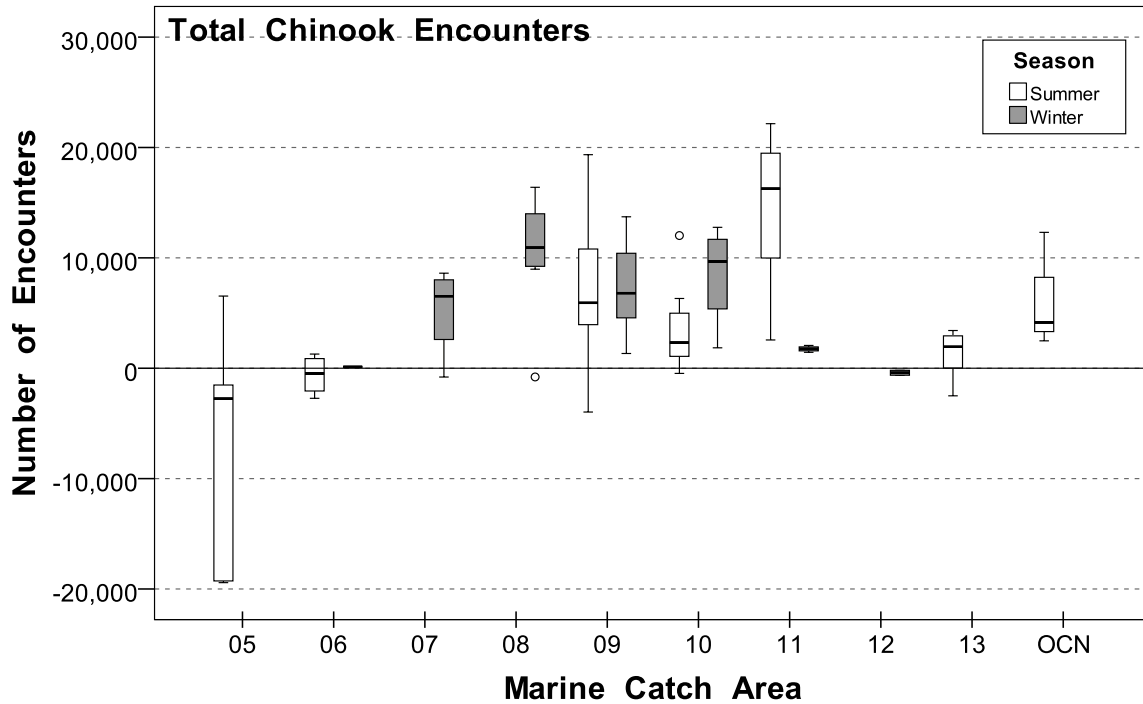


Figure 14. Comparison of annual differences between FRAM projections and monitoring program estimates of total Chinook encounters for mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

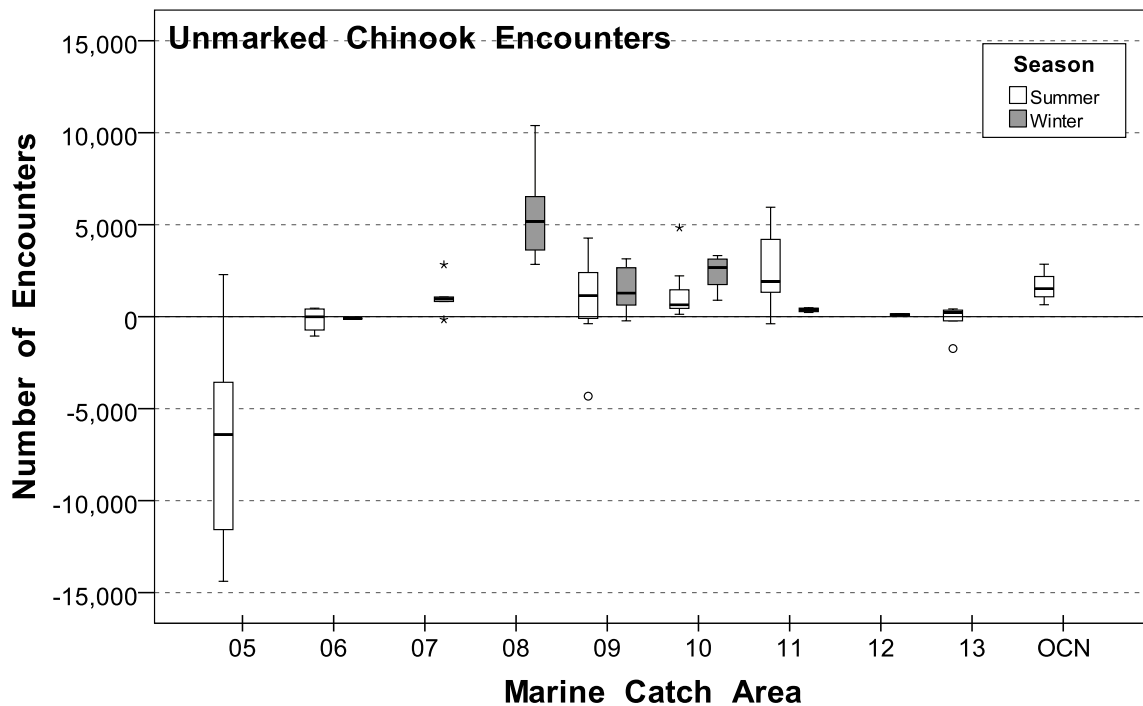


Figure 15. Comparison of annual differences between FRAM projections and monitoring program estimates of unmarked Chinook encounters for mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

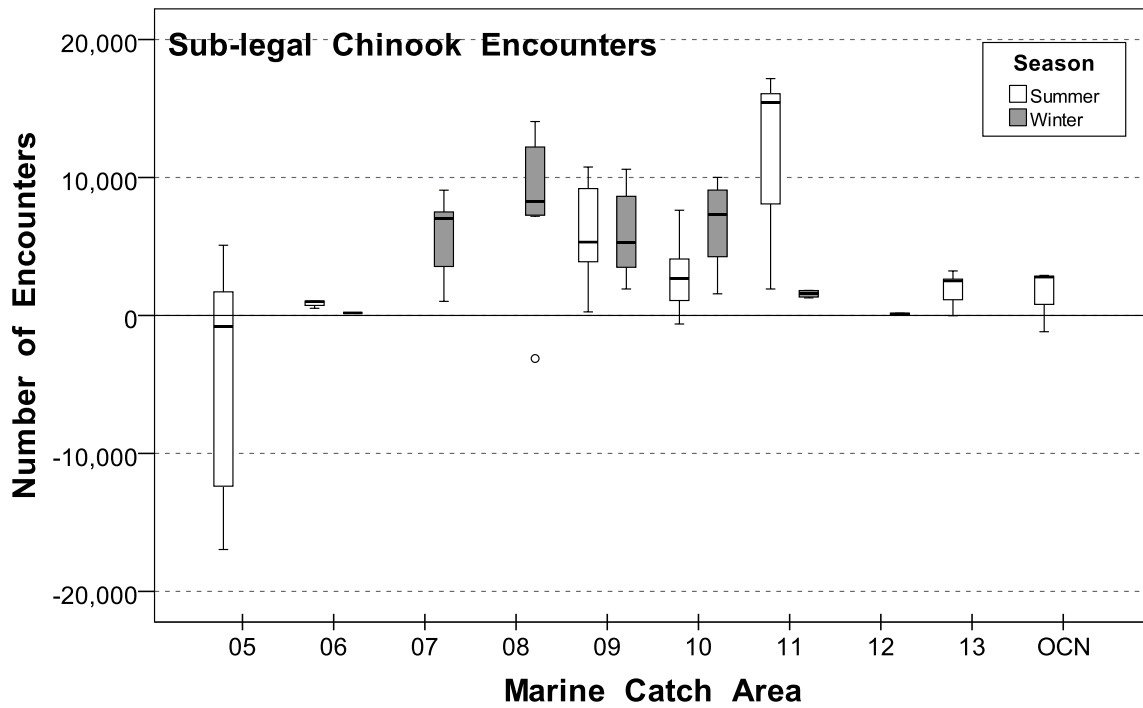


Figure 16. Comparison of annual differences between FRAM projections and monitoring program estimates of sublegal-size Chinook encounters for mark-selective fisheries by marine catch area and season (OCN = marine catch areas 01-04 combined).

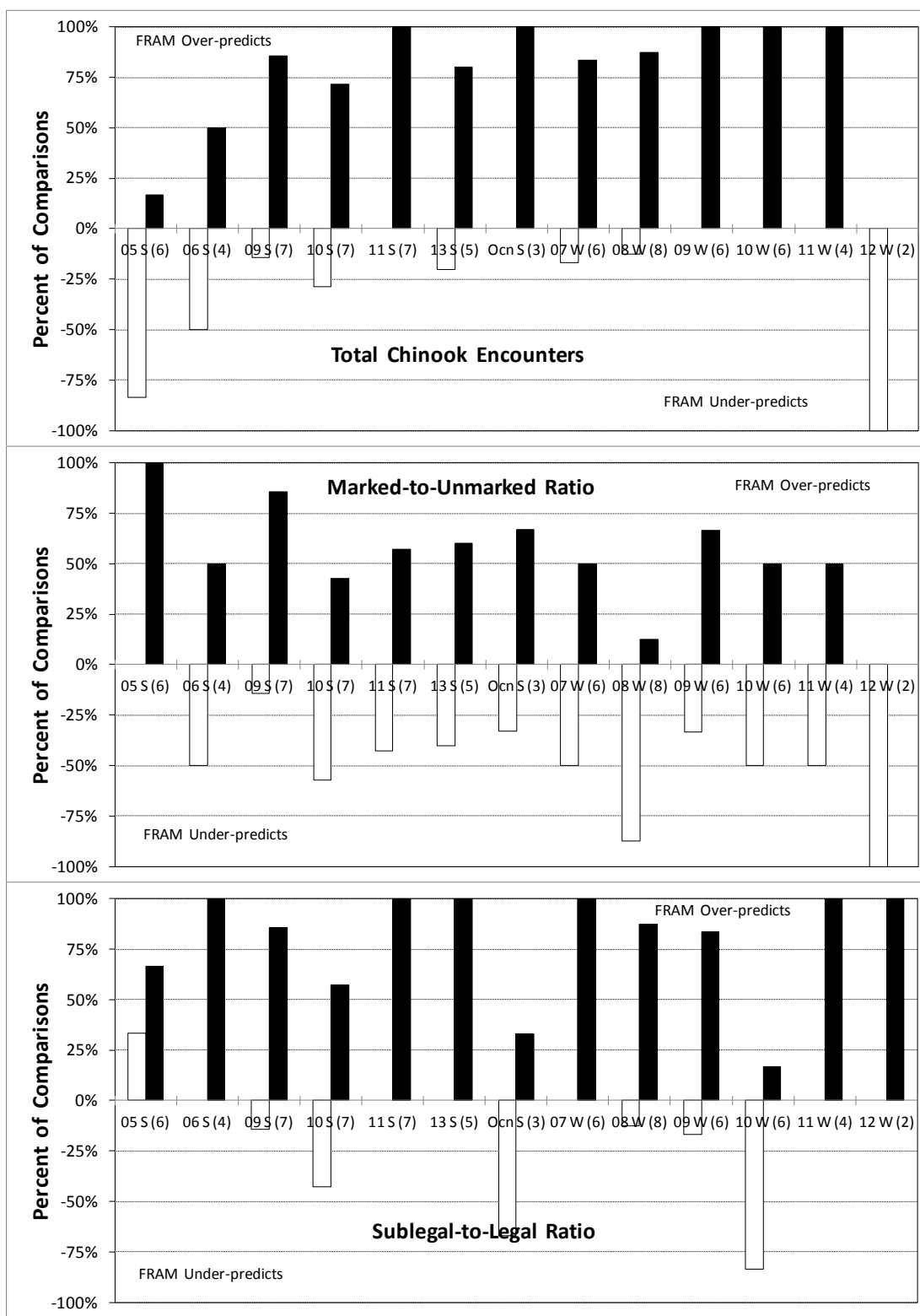


Figure 16. Assessment of bias in FRAM projections of total encounters, marked-to-unmarked ratio, and sublegal-to-legal ratio. Number in parentheses following the area and season (S = summer and W = winter) label is the number of years for which there are data.

## DISCUSSION

Bias in the FRAM projections, a consistent under- or over- prediction by FRAM relative to the monitoring program estimates, is a concern and one that in some instances can be addressed. McHugh et al. (2013) describe a way to use estimates of sublegal encounters to calibrate FRAM projections for fisheries where these estimates exist. This methodology has been reviewed by the Pacific Fisheries Management Council (PFMC) and approved for use in FRAM modeling. For the MSFs examined in this report, which have data on the number of sublegal encounters available, this methodology should be applied when there is consistent bias or large amount of error in the FRAM projections. Unfortunately for most of these fisheries the number of years of data with which to assess bias is relatively small (< 5 years), so unless all FRAM projections (or all but one year) have been consistently under- or over- predicted, it is difficult to conclude that bias exists. However, as this sublegal calibration methodology is applied over more years and areas, hopefully, we will see a decrease in the %Error between FRAM projections and monitoring program estimates.

While the previous sections of this report present summaries of total Chinook impacts (retained catch and release mortalities) by the mark-selective fisheries conducted in WDFW marine catch areas, it does not examine stock-specific impacts. This is an important analysis that needs to be conducted to determine if some MSFs have greater impacts on Chinook stocks of concern than are currently being modeled by FRAM. Both coded-wire tag (CWT) data and fin-clip DNA samples have been collected in these fisheries. However, the DNA samples have yet to be analyzed. Analyses to examine stock-specific impacts are recommended as the next step in evaluating these fisheries.

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**Appendix Table A.** Summary of days open to Chinook mark-selective fishery regulations for Washington marine catch areas 01 to 13.

AREA SEASON <sup>a</sup> YEAR	05		06 <sup>b</sup>		07		08		09		10		11		12		13		Ocean Areas (summer)				TOTALS <sup>c</sup>		
	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	01	02	03	04	S	W	Total
2003	30		30																				60	0	60
2004	39		39																				78	0	78
2005	41		41					212															82	212	294
2006	49		49					212															98	212	310
2007	36		36		29		182	16	91	13	62	122					153						376	364	740
2008	40		40		74		120	31	120	31	62	122					153						417	376	793
2009	37		37		151		181	47	120	47	123	122	89			89	153						443	753	1,196
2010	46		46		151		181	47	120	47	123	122	89			89	153		19	19	19	19	537	753	1,290
2011	46		46		152		182	47	120	47	123	122	90			90	153		8	8	8	8	493	757	1,250
2012	46		46	131	151		181	35	120	35	123	122	89			92	153		14	15	15	15	588	884	1,472
2013	46		46	131	151		181	20	120	34	123	122	89			92	153		14	15	11	11	564	884	1,448

<sup>a</sup> Season - S = summer: May thru September; W = Winter: October thru April.

<sup>b</sup> Only the western portion of Area 06 is open during the summer.

<sup>c</sup> Units are area-days open.

## Appendix B

Comparison of FRAM projections to monitoring program estimates for the mark-selective fisheries conducted in areas 05 and 06 (combined) during the summer, 2003 to 2007.

Year	Source	Encounters				Encounters		Mortalities	
		LM	LU	SM	SU	Total	Legal	Marked	Unmarked
2003	FRAM	3,045	7,976	2,815	4,585	18,421	11,021	3,595	2,688
	Estimated	3,669	4,793	1,933	5,277	15,672	8,462	3,830	1,838
	% Error	-17.0%	66.4%	45.6%	-13.1%	17.5%	30.2%	-6.1%	46.2%
2004	FRAM	3,043	7,993	2,690	4,935	18,661	11,036	3,569	2,761
	Estimated	3,879	4,842	1,405	2,473	12,599	8,721	3,888	1,225
	% Error	-21.6%	65.1%	91.5%	99.6%	48.1%	26.5%	-8.2%	125.4%
2005	FRAM	3,071	7,664	2,615	4,875	18,225	10,735	3,582	2,676
	Estimated	2,211	2,231	1,380	1,489	7,311	4,442	2,323	676
	% Error	38.9%	243.5%	89.5%	227.4%	149.3%	141.7%	54.2%	295.9%
2006	FRAM	3,238	5,699	3,625	3,570	16,132	8,937	3,950	1,979
	Estimated	3,957	3,629	1,208	2,227	11,021	7,586	3,920	1,010
	% Error	-18.2%	57.0%	200.1%	60.3%	46.4%	17.8%	0.8%	95.9%
2007	FRAM	3,757	5,850	3,805	3,625	17,037	9,607	4,504	2,023
	Estimated	4,235	2,943	1,667	1,212	10,057	7,178	4,330	785
	% Error	-11.3%	98.8%	128.3%	199.1%	69.4%	33.8%	4.0%	157.7%