

DRAFT

Total Encounters and Mortality Estimates for Puget Sound Recreational Chinook Mark-Selective Fisheries Monitored using Baseline Sampling: 2017-2018

Draft – 1/12/2020

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INTRODUCTION

Based on agreements between the State of Washington and the Northwest Treaty tribes, the Washington Department of Fish and Wildlife (WDFW) has been conducting pilot¹ recreational mark-selective Chinook fisheries (MSFs) in the marine catch areas of Puget Sound since 2003. The goal of these fisheries is to allow increased angling opportunities on hatchery-raised, marked (adipose fin-clipped) salmon while limiting impacts on unmarked (adipose fin intact) natural-origin stocks of conservation concern, particularly ESA-listed Puget Sound Chinook salmon (Chinook).

To monitor each fishery, WDFW's Puget Sound Sampling Unit (PSSU) implements one of the four following sampling designs: *i*) Full Murthy Estimate Design, *ii*) Reduced Murthy Estimate Design, *iii*) Aerial-Access Design or *iv*) Baseline Sampling Design. The design selected depends on area and season considerations, the magnitude of the fishery and State-Tribal agreements made prior to the start of the fishing season. For a complete description of the methods associated with these sampling designs, see WDFW's "Methods Report: Monitoring Mark-Selective Recreational Chinook Fisheries in the Marine Catch Areas of Puget Sound (Areas 5 through 13)" (WDFW 2012).

Except for Baseline Sampling, all above sampling designs are characterized as comprehensive, "intensive" monitoring programs and have been tailored to reliably estimate the critical parameters needed for evaluating mark-selective fisheries (WDFW 2012). In addition, PSSU has acquired and analyzed relevant data characterizing other aspects of the pilot MSFs, including descriptors of fishing effort, fishing success (catch [landed Chinook] per unit effort), recreational fishing methods, the length and age composition of encountered Chinook salmon, and the overall intensity of our sampling efforts. As such, the data collected through these comprehensive monitoring programs allow biologists to produce weekly or bi-weekly in-season estimates and to finalize post-season estimates of effort, catch, total encounters and fishery impacts in a timely manner.

Baseline Sampling, however, is a scaled-back monitoring program that is currently implemented in lower-magnitude MSFs as well as during year-round non-salmon focused sport fisheries throughout Puget Sound. Samplers collect data on salmon catch (retained and released) and effort via dockside sampling and angler interviews and obtain on-water encounter rate data from voluntary salmon trip reports (STR) submitted by private anglers. In contrast to the three comprehensive monitoring programs, the data collected through Baseline Sampling does not allow for in-season or immediate post-season estimates of effort, landed catch, total encounters, or fishery impacts.

Between 2011 and 2013, a framework was developed to estimate total Chinook salmon encounters for a given MSF relying only on Baseline Sampling data and Catch Record Card (CRC) estimates of Chinook harvest (WDFW and NWIFC 2013). Two methods were

¹ As stated in state-tribal agreement documents (e.g., WDFW and NWIFC 2009): "The purpose of the 'pilot' fishery is to collect information necessary to enable evaluation and planning of potential future mark-selective fisheries. The 'pilot' fishery provides a basis for determining if the data needed to estimate critical parameters can be collected and if the sample sizes needed to produce these estimates with agreed levels of precision can be realistically obtained."

established to estimate total Chinook encounters. The first method, the “M2” approach, requires an estimate of legal-marked Chinook harvest and an estimate of the proportion of legal-marked Chinook (p_{LM}) in the target population, derived from test fishing or STR data. Total encounters are then partitioned into size and mark-status groups using size/mark-status proportions from the test fishing or STR data. If the precision of total encounters estimates is too high due to small sample sizes in test fishing or STR data, the “M1” approach should be employed, which estimates total encounters using CRC-based Chinook harvest estimates and the ratio of encountered Chinook to retained Chinook observed during dockside sampling efforts. In the absence of sufficient test fishing or STR data, size/mark-status proportions are estimated using a “product method” where the mark-rate and legal proportion are estimated independently using dockside sampling data and combined to provide an estimate of the proportion for each group.

As of the date of this report, finalized CRC-based Chinook harvest estimates were available through the close of the 2018 summer season, which ran through September 2018. Contained in the following sections is a full analysis of fishery-total encounters and mortalities associated with the four Puget Sound Chinook MSFs that occurred and were sampled on a Baseline level only during the time period covered by this report; October 1, 2017 through September 30, 2018. For previous Baseline-sampled fisheries, see WDFW 2013c. The appropriate estimation method was selected by referring to the decision support schematic provided in WDFW and NWIFC (2013). Estimates of the following parameters are presented below:

- i) total Chinook harvested (by size [legal or sublegal] and mark-status [marked or unmarked] group),
- ii) total Chinook released (by size and mark-status group),
- iii) total Chinook mortalities (by size and mark-status group),
- iv) comparisons of Chinook encounters and mortalities with pre-season expectations (based on Fishery Regulation Assessment Model [FRAM] predictions),
- v) *dockside* sample rate for harvested Chinook, and
- vi) total mortality of marked and unmarked double index tag (DIT) CWT stocks.

The beta regression was updated to include data from all intensively monitored fisheries through the 2019 summer season (Figure 1) having more than twenty encounters in the fishery’s STR or test-fishing program. Three parameters resulting from the beta regression were used to estimate the proportion of legal Chinook in the targeted population, based on the number of retained and released Chinook in the dockside sampling and interview data: the intercept (β_0) = 1.055, slope (β_1) = -1.058 and precision (Φ) = 13.85 (for further information see WDFW & NWIFC 2013).

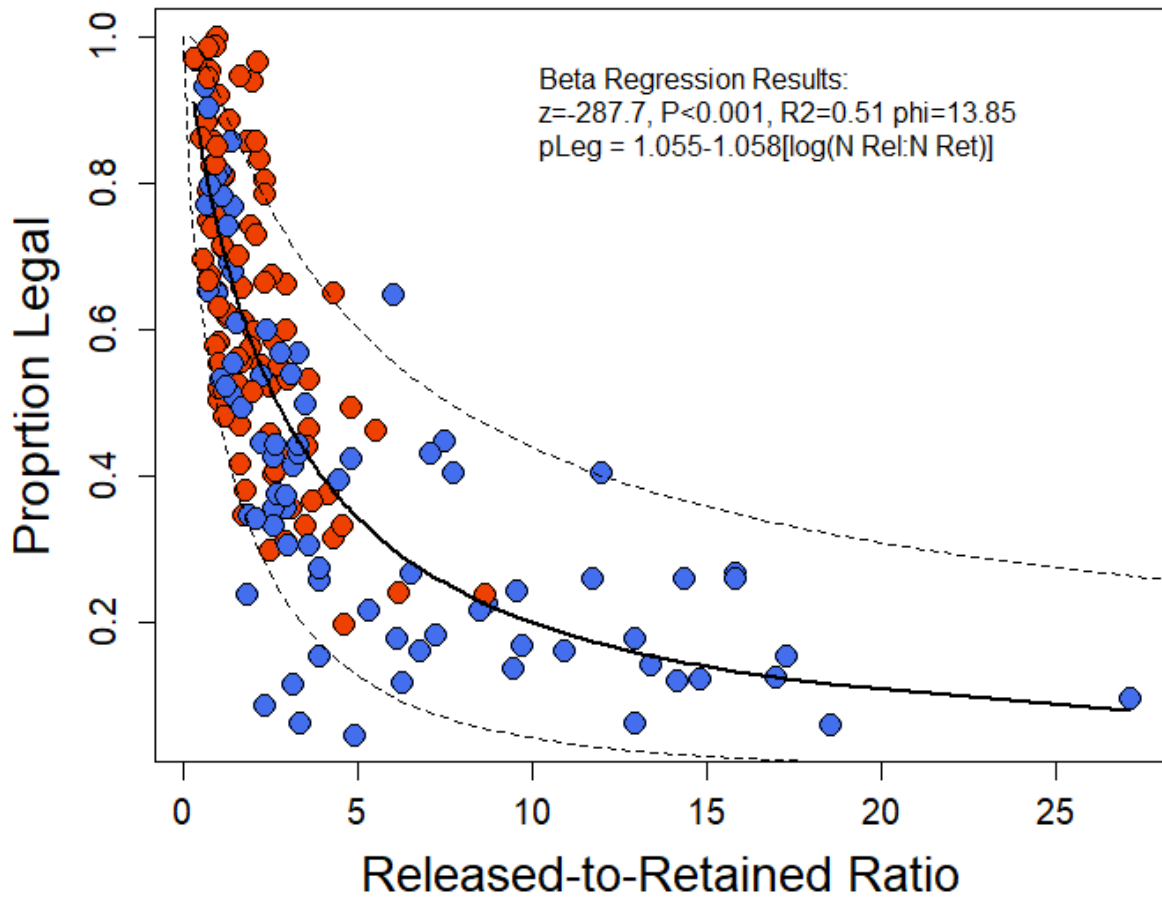


Figure 1 Beta regression results describing the relationship between released-to-retained ratio from dockside sampling data and proportion of legal Chinook from test fishery or STR data, including parameters resulting from beta regression model. Dotted lines represent 95% confidence bounds.

RESULTS

Winter 2017-18

1) 2017-18 Marine Area 5 Winter Mark-Selective Chinook Fishery

WDFW implemented a fifth consecutive winter Chinook MSF in Marine Area 5 from March 16 through April 30, 2018, which was monitored using baseline sampling. In the following section we present estimates of total encounters and mortalities for this fishery. These data are meant to accompany section 1 of the 2017-2018 winter post-season report for MSFs in Puget Sound (WDFW 2013a), which includes information regarding sample sites, dockside sampling and interview data, and voluntary salmon trip reports (STR) related to the fishery. Sample sizes of STR encounters were insufficient to provide the desired level of precision in total encounters estimates, requiring the estimation of total encounters using the M1 approach (WDFW and NWIFC 2013).

Table 1.1 Number of Chinook retained and released by mark-status, number of other salmon (positively identified species other than Chinook) released and number of salmon of unidentified species released, from dockside interviews conducted during Baseline Sampling of the Area 5 Chinook MSF from March 16 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked, UK = unknown mark.

Time Period	Chinook Retained		Chinook Released			Other Salmon Released	Unidentified Salmon Released
	AD	UM	AD	UM	UK		
Mar. 16 – Apr. 30	183	1	227	60	75	5	0

Table 1.2 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 5 Chinook MSF March 16 – April 30, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	0	0	9	0	9
Dockside Harvest	178	1	3	0	182

Table 1.3 Summary of season-wide fishery impact estimates for the Area 5 Chinook MSF from March 16 – April 30, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	1149	753	396	59	812	39,692	199	422 - 1203	25
LU	189	4	184	28	32	1428	38	0 - 106	119
SM	828	13	815	163	176	4,201	65	49 - 303	37
SU	136	0	136	27	27	2463	50	0 - 124	183
Total	2,302	770	1532	277	1047	49,258	222	612 - 1482	21

Table 1.4 Comparison of modeled and estimated total Chinook encounters for the Area 5 Chinook MSF from March 16 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	608	112	496	3
	AD	1084	415	669	361
	Total	1,692	527	1165	364
	% Marked	64	79	57	99
Estimated (Creel) Encounters	UM	324	189	136	4
	AD	1,977	1149	828	766
	Total	2,302	1338	964	770
	% Marked	86	86	86	99

Table 1.5 Comparison of modeled and estimated total Chinook mortalities for the Area 5 Chinook MSF from March 16 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	119	521	640	59	988	1047
Released Legal	17	26	43	28	59	87
Released Sublegal	99	134	233	27	163	190
Landed Only	3	361	364	4	766	770

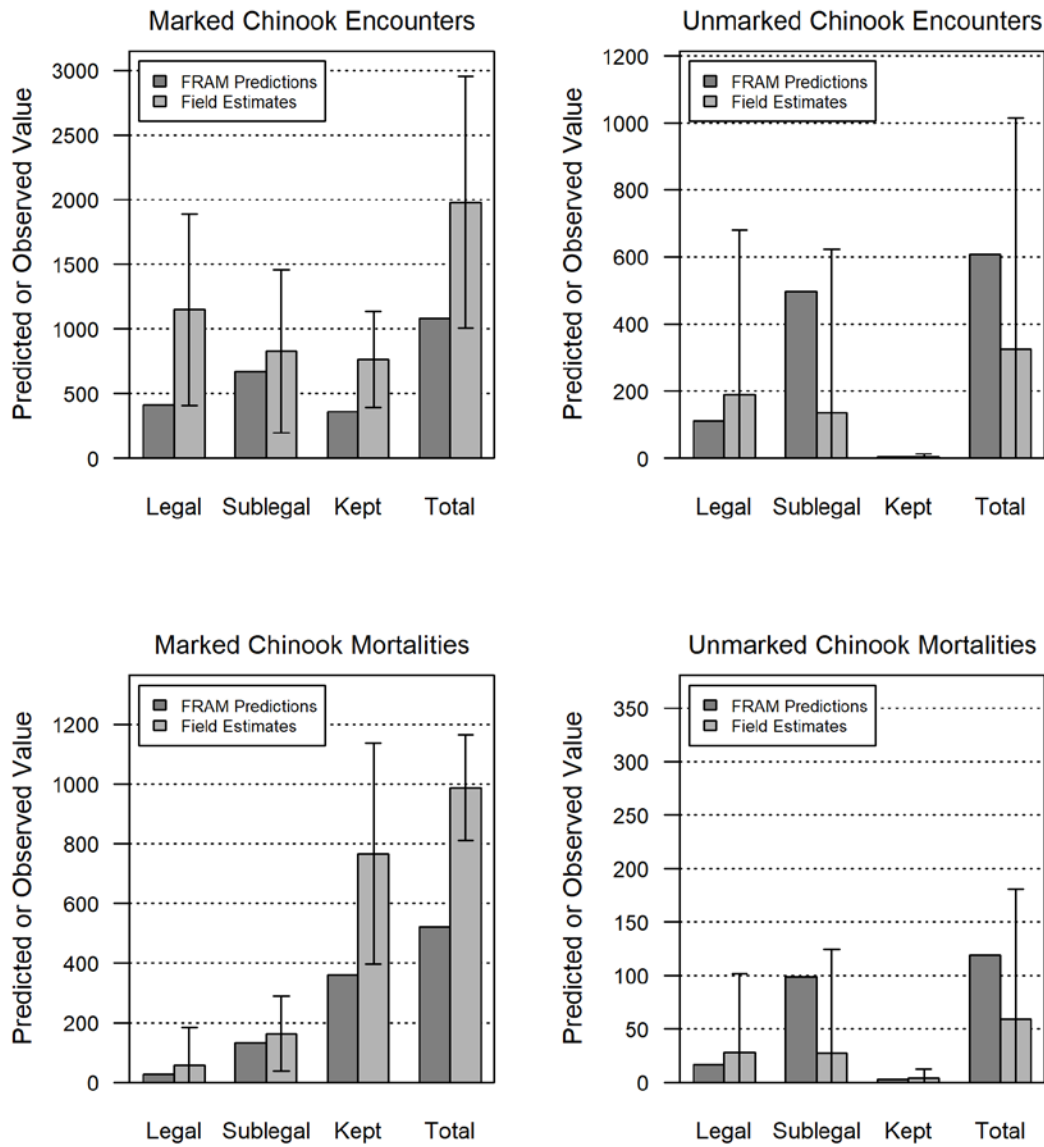


Figure 1.1 Comparison of modeled and estimated Chinook encounters and mortalities for the Area 5 Chinook MSF from March 16 – April 30, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 1.6 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 5 Chinook MSF from February 16 – April 30, 2017. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
Mar. 16 – Apr. 30	766	4	770	181	1	182	23.60%

Table 1.7 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 5 Chinook MSF from March 16 – April 30, 2018 AD = marked (adipose-clipped), UM = unmarked.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
Bernie Gobin Hatch	2015	1	4.2	13.67	4.2	0.4	0.138	0.37
Grovers Cr Hatchery	2014	1	4.2	13.67	4.4	0.4	0.145	0.38
Wallace R Hatchery	2013	1	4.2	13.67	4.3	0.4	0.141	0.38
Total		3	12.7	41.01	12.9	1.3	0.423	1.13

2) 2017-18 Marine Area 12 Winter Mark-Selective Fishery

WDFW implemented a ninth consecutive winter Chinook MSF in Marine Area 12 from October 1, 2017 – April 30, 2018, which was monitored using baseline sampling. In the following section we present estimates of total encounters and mortalities for this fishery. These data are meant to accompany section 8 of the 2017-2018 winter post-season report for MSFs in Puget Sound (WDFW 2013a), which includes information regarding sample sites, dockside sampling and interview data, and voluntary salmon trip reports (STR) related to the fishery. Sample sizes of STR encounters were insufficient to provide the desired level of precision in total encounters estimates, requiring the estimation of total encounters using the M1 approach (WDFW and NWIFC 2013).

Table 2.1 Number of Chinook retained and released by mark-status, number of other salmon (positively identified species other than Chinook) released and number of salmon of unidentified species released, from dockside interviews conducted during Baseline Sampling of the Area 12 Chinook MSF October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked, UK = unknown mark.

Time Period	Chinook Retained		Chinook Released			Other Salmon Released	Unidentified Salmon Released
	AD	UM	AD	UM	UK		
Oct. 1 – Apr. 30	70	0	296	69	57	1107	8

Table 2.2 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	2	0	8	0	10
Dockside Harvest	64	0	2	0	66

Table 2.3 Summary of season-wide fishery impact estimates for the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	804	438	366	55	493	11,184	106	286 - 700	21
LU	157	0	157	24	24	2367	49	0 - 119	206
SM	2004	14	1990	398	412	10,931	105	207 - 617	25
SU	392	0	392	78	78	4,423	67	0 - 209	85
Total	3,357	452	2,905	555	1007	29,226	171	672 - 1342	17

Table 2.4 Comparison of modeled and estimated total Chinook mortalities for the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	70	25	45	1
	AD	830	282	548	246
	Total	900	307	593	247
	% Marked	92	92	92	100
Estimated (Creel) Encounters	UM	549	157	392	0
	AD	2,808	804	2004	452
	Total	3,357	961	2396	452
	% Marked	84	84	84	100

Table 2.5 Comparison of modeled and estimated total Chinook mortalities for the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	13	373	386	102	905	1007
Released Legal	3	17	20	24	55	78
Released Sublegal	9	110	119	78	398	476
Landed Only	1	246	247	0	452	452

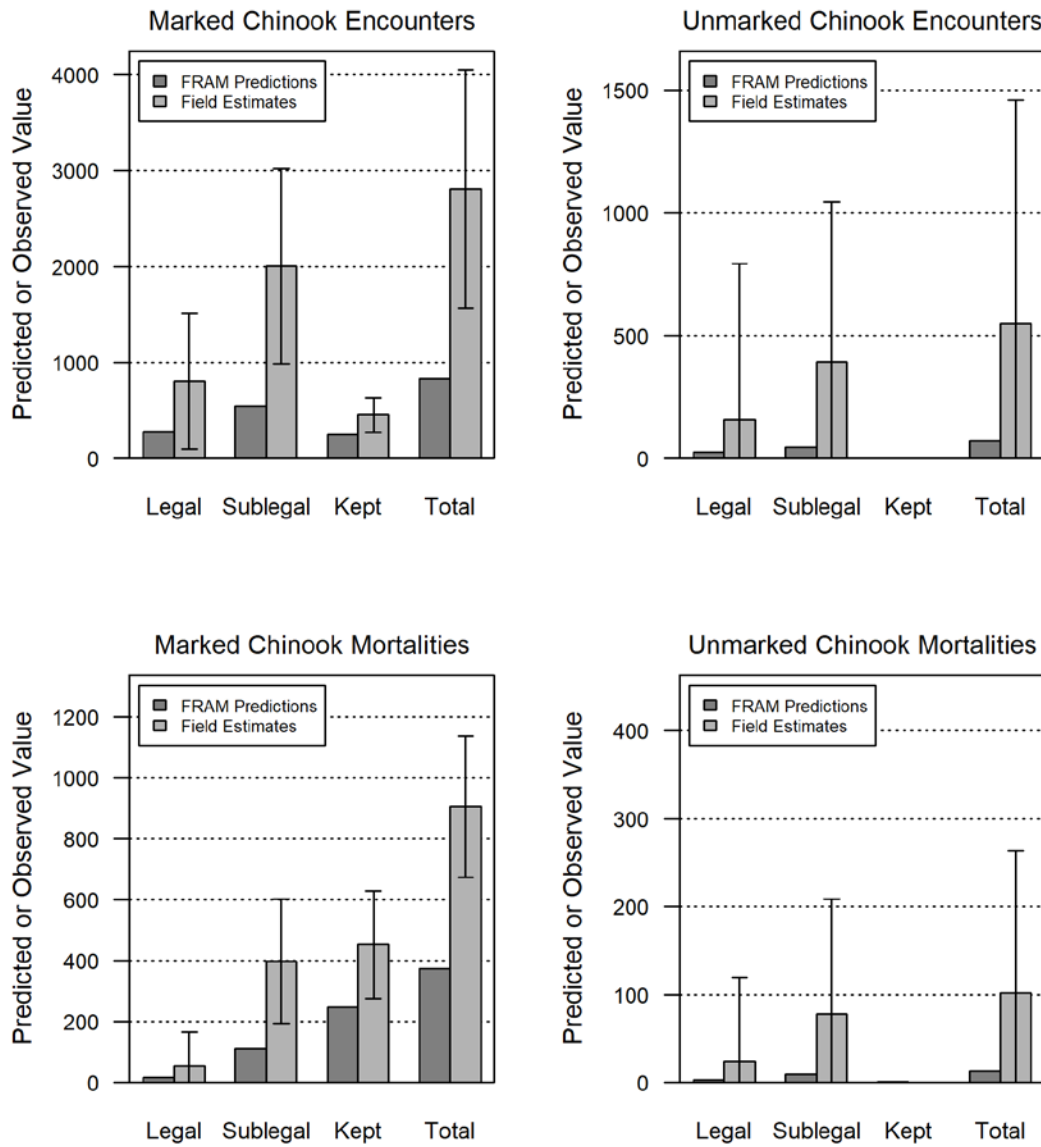


Figure 2.1 Comparison of modeled and estimated Chinook encounters and mortalities for the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 2.6 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
Oct. 1 – Apr. 30	452	0	452	66	0	66	14.60%

Table 2.7 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 12 Chinook MSF from October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
Bernie Gobin Hatch	2014	1	6.8	40.05	6.6	0.7	0.376	0.61
Total		1	6.8	40.05	6.6	0.7	0.376	0.61

3) 2017-18 Marine Area 13 Winter Mark-Selective Fishery

WDFW implemented a fourth consecutive winter Chinook MSF in Marine Area 13 from October 1, 2017 through April 30, 2018, which was monitored using baseline sampling. In the following section we present estimates of total encounters and mortalities for this fishery. These data are meant to accompany section 9 of the 2017-2018 winter post-season report for MSFs in Puget Sound (WDFW 2013a), which includes information regarding sample sites, dockside sampling and interview data, and voluntary trip reports (STR) related to the fishery. Sample sizes of STR encounters were insufficient to provide the desired level of precision in total encounters estimates, requiring the estimation of total encounters using the M1 approach (WDFW and NWIFC 2013).

Table 3.1 Number of Chinook retained and released by mark-status, number of other salmon (positively identified species other than Chinook) released and number of salmon of unidentified species released, from dockside interviews conducted during Baseline Sampling of the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked, UK = unknown mark.

Time Period	Chinook Retained		Chinook Released			Other Salmon Released	Unidentified Salmon Released
	AD	UM	AD	UM	UK		
Oct. 1 – Apr. 30	15	0	115	22	100	374	7

Table 3.2 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	8	5	35	3	51
Dockside Harvest	14	0	1	0	15

Table 3.3 Summary of season-wide fishery impact estimates for the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	539	263	276	41	305	9,604	98	113 - 497	32
LU	96	0	96	14	14	2655	52	0 - 115	358
SM	3525	19	3507	701	720	47,692	218	292 - 1148	30
SU	628	0	628	126	126	6,039	78	0 - 278	62
Total	4,789	282	4,507	883	1165	66,192	257	660 - 1669	22

Table 3.4 Comparison of modeled and estimated total Chinook encounters for the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	33	4	29	0
	AD	458	57	401	49
	Total	491	61	430	49
	% Marked	93	93	93	100
Estimated (Creel) Encounters	UM	724	96	628	0
	AD	4,065	539	3525	282
	Total	4,789	636	4153	282
	% Marked	85	85	85	100

Table 3.5 Comparison of modeled and estimated total Chinook mortalities for the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	7	133	140	140	1025	1165
Released Legal	1	4	5	14	41	56
Released Sublegal	6	80	86	126	701	827
Landed Only	0	49	49	0	282	282

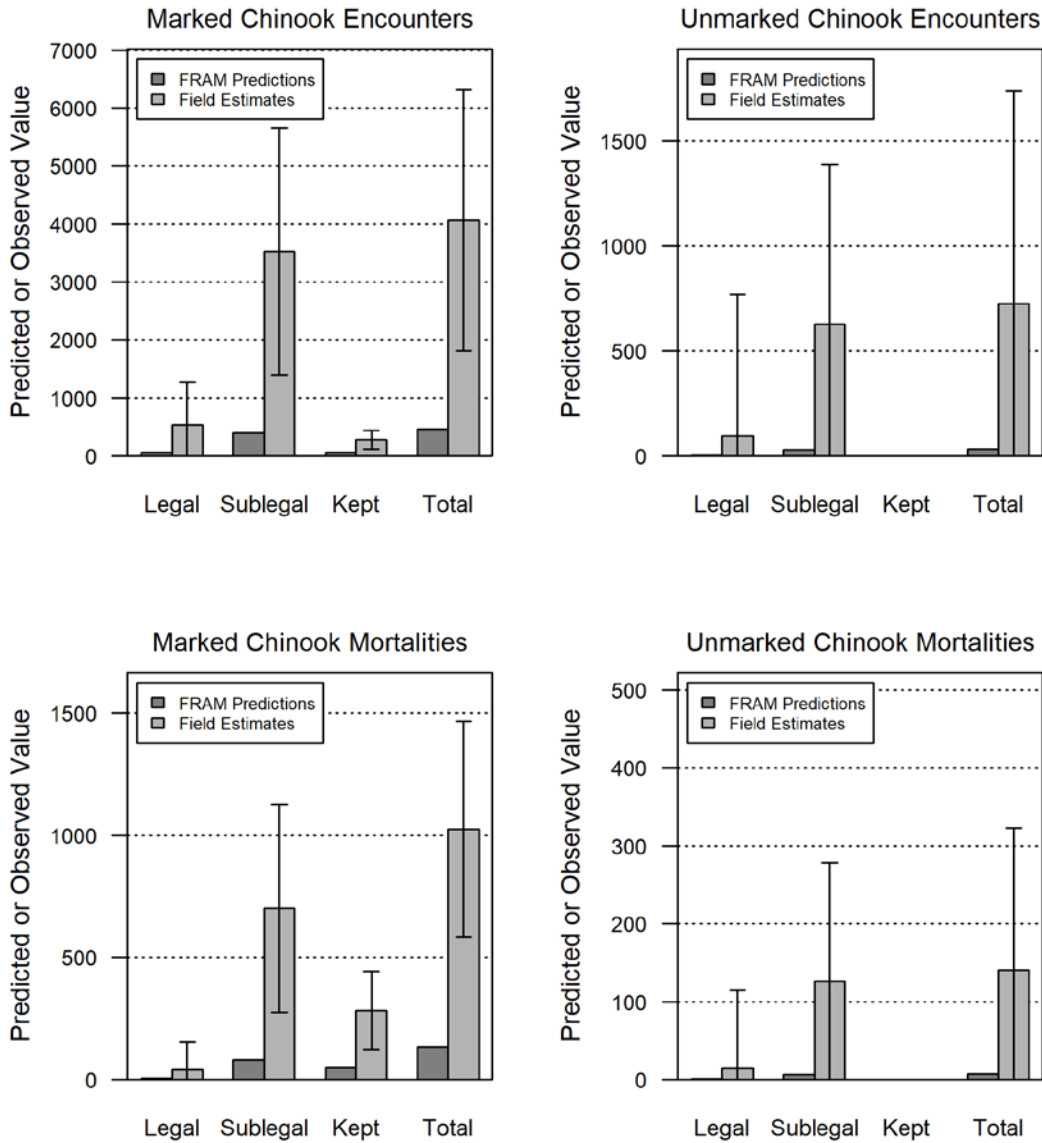


Figure 3.1 Comparison of modeled and estimated Chinook encounters and mortalities for the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 3.6 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
Oct. 1 – Apr. 30	282	0	282	15	0	15	5.30%

Table 3.7 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 13 Chinook MSF from October 1, 2017 – April 30, 2018. AD = marked (adipose-clipped), UM = unmarked

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
Grovers Cr Hatchery	2015	1	18.8	334.64	18.7	1.9	3.298	1.82
Total		1	18.8	334.64	18.7	1.9	3.298	1.82

Summer 2018

4) 2018 Marine Area 6 Summer Mark-Selective Chinook Fishery

WDFW implemented a seventeenth consecutive summer Chinook MSF in Marine Area 6 from July 3 through August 15, 2018. This fishery has been monitored using baseline sampling since 2008. In the following section we present estimates of total encounters and mortalities for this fishery. These data are meant to accompany section 2 of the 2018 summer post-season report for MSFs in Puget Sound (WDFW 2013b), which includes information regarding sample sites, dockside sampling and interview data, and voluntary salmon trip reports (STR) related to the fishery. Sample sizes of STR encounters were sufficient to provide the desired level of precision in total encounters estimates allowing the use of the bias-corrected M2 approach (WDFW and NWIFC 2013).

Table 4.1 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 6 Chinook MSF from July 3 - August 15, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	47	21	21	9	98
Dockside Harvest	1384	2	13	0	1399

Table 4.2 Summary of season-wide fishery impact estimates for the Area 6 Chinook MSF from July 3 - August 15, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	8,950	7,787	1164	175	7,961	162,287	403	7172 - 8751	5
LU	3999	11	3988	598	609	18,195	135	345 - 874	22
SM	3,999	73	3926	785	858	32,666	181	504 - 1213	21
SU	1714	0	1714	343	343	13358	116	116 - 569	34
Total	18,662	7,871	10,791	1901	9,772	228,079	478	8836 - 10708	5

Table 4.3 Comparison of modeled and estimated total Chinook encounters for the Area 6 Chinook MSF from July 3 - August 15, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	1,984	1361	623	14
	AD	6,996	4,859	2,137	4,227
	Total	8,980	6,220	2,760	4,241
	% Marked	78	78	77	100
Estimated (Creel) Encounters	UM	5,713	3999	1714	11
	AD	12,949	8,950	3,999	7,860
	Total	18,662	12,949	5,713	7,871
	% Marked	69	69	70	100

Table 4.4 Comparison of modeled estimated total Chinook mortalities for the Area 6 Chinook MSF from July 1 - August 15, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	341	4,961	5,302	952	8,819	9,772
Released Legal	202	307	509	598	175	773
Released Sublegal	125	427	552	343	785	1128
Landed Only	14	4,227	4,241	11	7,860	7,871

Table 4.5 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 6 Chinook MSF from July 1 - August 15, 2017. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
Jul. 3 – Aug. 15	7,860	11	7,871	1397	2	1399	17.80%

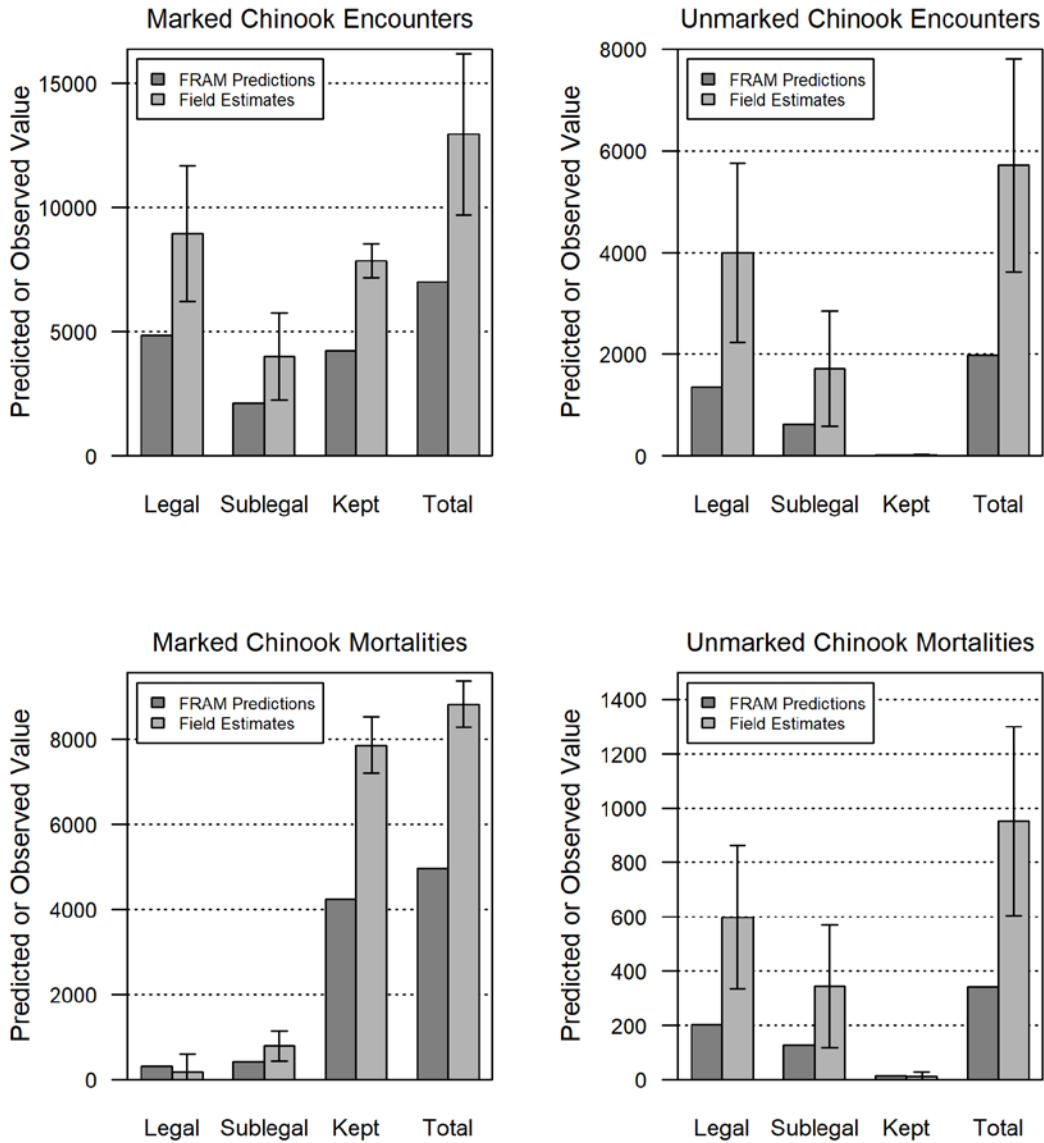


Figure 4.1 Comparison of and estimated Chinook encounters and mortalities for the Area 6 Chinook MSF from July 3 - August 15, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 4.6 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 6 Chinook MSF from July 1 - August 15, 2018. AD = marked (adipose-clipped), UM = unmarked.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
Clear Creek Hatchery	2014	3	16.9	78.08	17.1	1.7	0.802	1.55
George Adams Hatchery	2014	3	16.9	78.08	16.9	1.7	0.782	1.53
Grovers Cr Hatchery	2014	7	39.4	182.19	40.5	4.1	1.928	3.67
	2015	7	33.8	156.17	39.1	9	27.567	8.14
Total		20	106.9	494.52	113.6	16.4	31.078	14.9

5) 2018 Marine Area 12 Summer Mark-Selective Chinook Fishery

WDFW implemented a sixth consecutive summer Chinook MSF in Marine Area 12 from July 1 through September 30, 2018, which was monitored using baseline sampling. In the following section we present estimates of total encounters and mortalities for this fishery. These data are meant to accompany section 7 of the 2018 summer post-season report for MSFs in Puget Sound (WDFW 2013a), which includes information regarding sample sites, dockside sampling and interview data, and voluntary salmon trip reports (STR) related to the fishery. Sample sizes of STR encounters were insufficient to provide the desired level of precision in total encounters estimates, requiring the estimation of total encounters using the M1 approach (WDFW and NWIFC 2013).

Table 5.1 Number of Chinook retained and released by mark-status, number of other salmon (positively identified species other than Chinook) released and number of salmon of unidentified species released, from dockside interviews conducted during Baseline Sampling of the Area 12 Chinook MSF from July 1 – September 30, 2018. AD = marked (adipose-clipped), UM = unmarked, UK = unknown mark.

Time Period	Chinook Retained		Chinook Released			Other Salmon Released	Unidentified Salmon Released
	AD	UM	AD	UM	UK		
July. 1 – Sept. 30	159	0	60	22	20	11	3

Table 5.2 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 12 Chinook MSF from July 1 – September 30, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	1	4	23	8	36
Dockside Harvest	305	0	8	0	313

Table 5.3 Summary of season-wide fishery impact estimates for the Area 12 Chinook MSF from July 1 – September 30, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	3,087	2,458	629	94	2,552	261,370	511	1550 - 3554	20
LU	397	0	397	60	60	3,744	61	0 - 179	103
SM	779	53	726	145	198	8,419	92	18 - 378	46
SU	100	0	100	20	20	6,419	80	0 - 177	400
Total	4,363	2,511	1,852	319	2,830	288,657	537	1777 - 3883	19

Table 5.4 Comparison of modeled and estimated total Chinook encounters for the Area 12 Chinook MSF from July 1 – September 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	285	116	169	9
	AD	3,581	1285	2296	1118
	Total	3,866	1401	2465	1127
	% Marked	93	92	93	99
Estimated (Creel) Encounters	UM	497	397	100	0
	AD	3,866	3,087	779	2,511
	Total	4,363	3,484	879	2,511
	% Marked	89	89	89	100

Table 5.5 Comparison of modeled and estimated total Chinook mortalities for the Area 12 Chinook MSF from July 1 – September 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	60	1658	1718	80	2,751	2,830
Released Legal	17	81	98	60	94	154
Released Sublegal	34	459	493	20	145	165
Landed Only	9	1118	1127	0	2,511	2,511

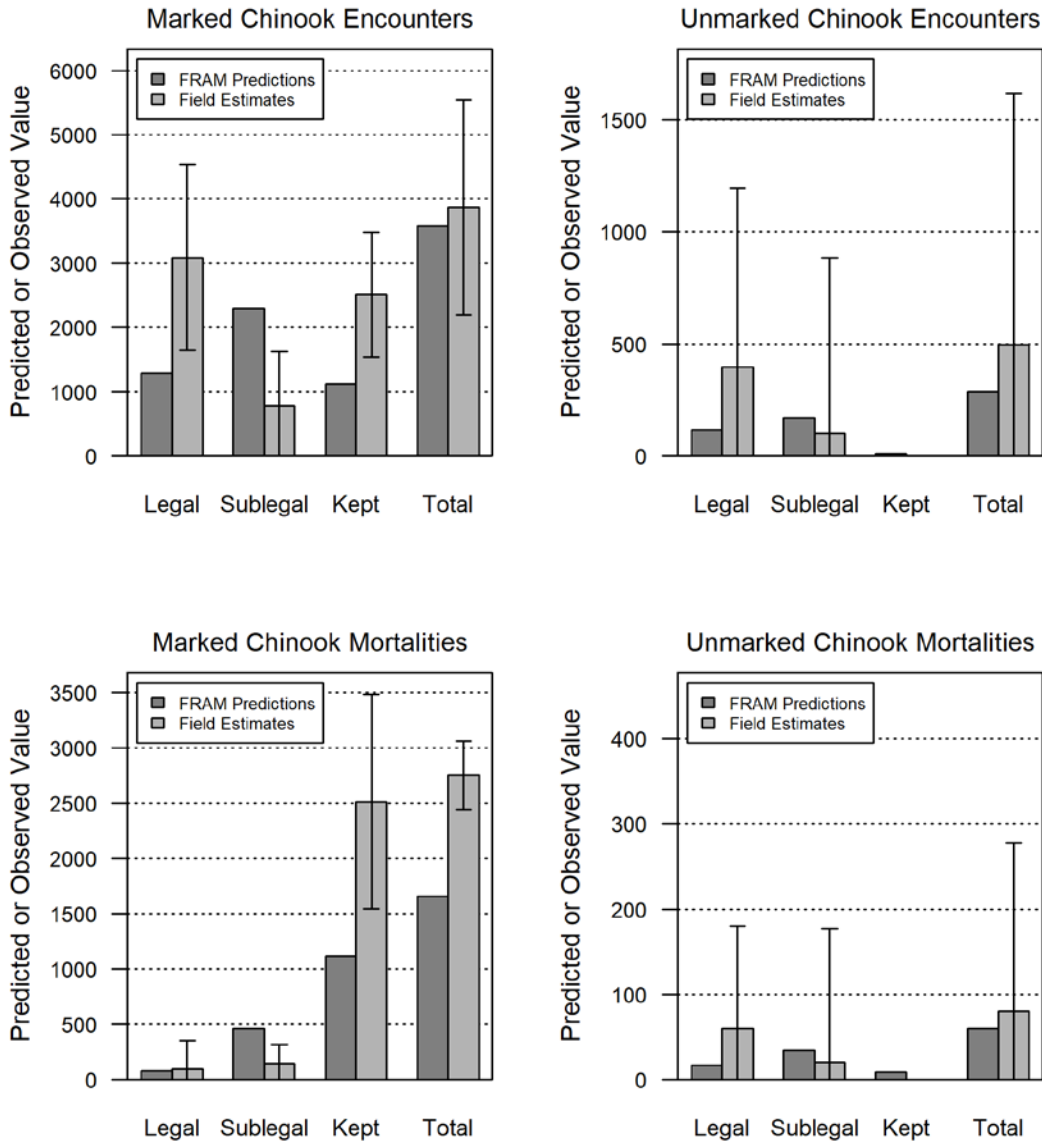


Figure 5.1 Comparison of modeled and estimated Chinook encounters and mortalities for the Area 12 Chinook MSF from July 1 – September 30, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 5.6 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 12 Chinook MSF from July 1 – September 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
Jul. 1 – Sep. 30	2,511	0	2,511	142	0	142	5.70%

Table 5.7 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 12 Chinook MSF from July 1 – September 30, 2018. AD = marked (adipose-clipped), UM = unmarked

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
George Adams Hatchery	2014	2	35.4	590.02	35.4	3.5	5.907	3.44
Total		2	35.4	590.02	35.4	3.5	5.907	3.44

6) 2018 Marine Area 13 Summer Mark-Selective Chinook Fishery

WDFW implemented an eleventh consecutive summer Chinook MSF in Marine Area 13 from May 1 through September 30, 2018. These data are meant to accompany section 8 of the 2018 summer post-season report for MSFs in Puget Sound (WDFW 2013b), which includes information regarding sample sites, dockside sampling and interview data, and voluntary trip reports (STR) related to the fishery. Sample sizes of STR encounters were sufficient to provide the desired level of precision in total encounters estimates allowing the use of the bias-corrected M2 approach (WDFW and NWIFC 2013).

Table 6.1 Summary of STR encounters and harvested Chinook sampled during dockside sampling for the Area 13 Chinook MSF from May 1 - April 30, 2018. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Data Type	LM	LU	SM	SU	Total
STR Encounters	39	2	23	7	71
Dockside Harvest	413	0	8	0	421

Table 6.2 Summary of season-wide fishery impact estimates for the Area 13 Chinook MSF from May 1 - September 30, 2018. Release mortality rate = 0.15 for legal fish and 0.20 for sublegal fish. Values may not add up exactly due to rounding error. LM = legal-sized marked, LU = legal-sized unmarked, SM = sublegal-sized marked, SU = sublegal-sized unmarked.

Size/mark group	Encounters	Retained	Released	Release Mortality	Total Mortality	Var	SE	95% CI	CV (%)
LM	3,184	2770	414	62	2832	64,562	254	2334 - 3330	9
LU	163	0	163	24	24	301	17	0 - 59	71
SM	1878	54	1824	365	419	7,190	85	252 - 585	20
SU	572	0	572	114	114	1,922	44	28 - 200	38
Total	5,797	2824	2,973	566	3,390	75,442	275	2851 - 3928	8

Table 6.3 Comparison of modeled and estimated total Chinook encounters for the Area 13 Chinook MSF from May 1 - September 30, 2018. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Data Source	Group	Total Encounters	Legal	Sublegal	Landed Only
FRAM Encounters	UM	134	102	32	1
	AD	2,625	1,729	896	1504
	Total	2,759	1,831	928	1505
	% Marked	95	94	97	100
Estimated (Creel) Encounters	UM	735	163	572	0
	AD	5,062	3,184	1878	2824
	Total	5,797	3,348	2449	2824
	% Marked	87	95	77	100

Table 6.4 Comparison of modeled and estimated total Chinook mortalities for the Area 13 Chinook MSF from May 1 - September 30, 2017. Values may not add up exactly due to rounding error. AD = marked (adipose-clipped), UM = unmarked.

Mortality Category	FRAM Chinook Mortalities			Estimated Chinook Mortalities		
	UM	AD	Total	UM	AD	Total
Total (Landed + Released)	22	1,792	1,814	139	3,251	3,390
Released Legal	15	109	124	24	62	87
Released Sublegal	6	179	185	114	365	479
Landed Only	1	1504	1505	0	2824	2824

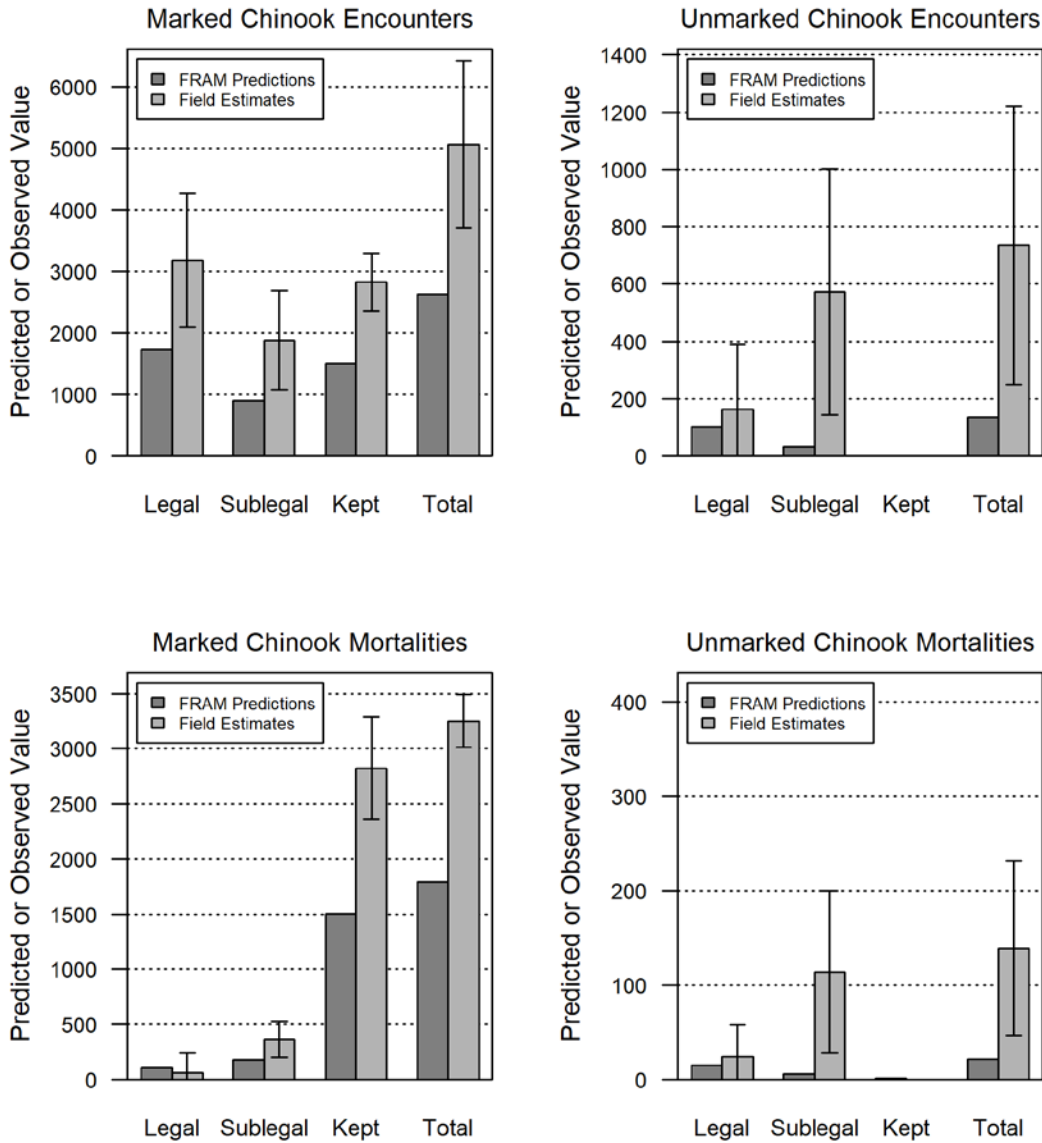


Figure 6.1 Comparison of modeled and estimated Chinook encounters and mortalities for the Area 13 Chinook MSF from May 1 - September 30, 2018. Error bars represent 95% confidence intervals for field estimates.

Table 6.5 Season total sample rate (Total retained Chinook sampled during baseline sampling / Estimated retained Chinook) in the Area 13 Chinook MSF from May 1 - September 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Time period	Estimated Retained Chinook			Number of Chinook Sampled			Sample Rate
	AD	UM	Total	AD	UM	Total	
May 1 – Sep. 30	2824	0	2824	421	0	421	14.90%

Table 6.6 Summary of double-index tagged (DIT) Chinook kept by anglers, and estimated total mortality of unmarked DIT Chinook due to hook-and-release impacts resulting from the Area 13 Chinook MSF from May 1 - September 30, 2018. AD = marked (adipose-clipped), UM = unmarked.

Hatchery	Brood Year	DITs Obs'd	AD DIT Harvest		UM DIT Enc.	UM DIT Mortality		
			Est.	var(Est.)		Est.	var(Est.)	SE(Est.)
No DITs Recovered								

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