ALTERNATIVE NMFS-PROPOSED LOSS-BASED "SALMONID FACTOR" TO THE WY 2019 WATER INFRASTRUCTURE IMPROVEMENTS FOR THE NATION ACT SECTION 4003 OPERATIONS PLAN

JANUARY 16, 2019

Brief Background on the WIIN Act

The Water Infrastructure Improvements for the Nation (WIIN) Act, passed in December 2016, directs the Secretaries of Interior and Commerce to provide the maximum quantity of water supplies practicable to Central Valley Project (CVP) and State Water Project (SWP) water users. The WIIN Act identifies some specific identified areas of flexibility to maximize water supply, including the potential for modifications to Delta operations requirements in the 2009 Biological Opinion on the Long-term Operation of the CVP and SWP (2009 NMFS BiOp) provided there are not additional adverse effects to species. .

Section 4003 targets actions related to Old and Middle River (OMR) flow management[1] in the U.S. Fish & Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) Biological Opinions during storm events:

> *"SEC. 4003. Temporary operational flexibility for storm events.*
>
> *(a) In general.—*
>
> *(1) Nothing in this subtitle authorizes additional adverse effects on listed species beyond the range of the effects anticipated to occur to the listed species for the duration of the smelt biological opinion or salmonid biological opinion, using the best scientific and commercial data available.*
>
> *(2) When consistent with the environmental protection mandate in paragraph (1) while maximizing water supplies for Central Valley Project and State Water Project contractors, the Secretary of the Interior and the Secretary of Commerce, through an operations plan, shall evaluate and may authorize the Central Valley Project and the State Water Project, combined, to operate at levels that result in OMR flows more negative than the most negative reverse flow rate prescribed by the applicable biological opinion…to capture peak flows during storm-related events."*

Recent Coordination on WIIN Act Implementation Procedures and Loss-based Salmonid Factors

On 12/132018, the NMFS West Coast Region (NMFS WCR) provided comments on the "[Draft/Anticipated] WY 2019 Water Infrastructure Improvements for the Nation Act Section 4003 Operations Plan" (Draft 4003 Ops Plan). In addition to clarifying the language in Salmonid Factor 2 and Salmonid Factor 3 for clarity and consistency with the 2009 NMFS BiOp, NMFS WCR suggested an alternative to Salmonid Factor 4, to read:

[1] For a brief background on OMR management in the NMFS BiOp, see Attachment A.

4. Has the monthly loss of winter-run-sized Chinook salmon at the CVP and SWP exceeded 1% (January), 2% (February), or 6% (March) of the ITL for winter-run-sized Chinook salmon?

Each monthly threshold represents 50% of the average observed loss of non-adipose-fin-clipped (unclipped) winter-run-sized Chinook salmon. The loss is expressed as a percentage of the Incidental Take Limit (ITL), that is, as a percentage of 2% of the Juvenile Production Estimate (JPE)[2] and observed monthly loss was calculated based on data for Water Years 2010-2018 (all years of data during implementation of the 2009 NMFS BiOp). For example, average loss during March was 12% of the ITL; half of that results in the 6% offramp trigger for March.

On 1/14/19, a comprehensive draft rationale for NMFS-proposed Salmonid Factor 4 (dated 1/13/19) was provided to the five agencies [U.S. Bureau of Reclamation (Reclamation), USFWS, NMFS, California Department of Water Resources (CDWR) and California Fish and Wildlife (CDFW)] for discussion on the 1/14/19 Directors Call. That document explained that NMFS considers historical loss rates as a surrogate to OMR limits that could be used to manage operations under a potential OMR storm flex per Section 4003 of the WIIN Act. Putting a cap on monthly loss that is scaled to the average loss rates observed during 2009 NMFS BiOp implementation is designed to meet the WIIN Act requirement to avoid "additional adverse effects on listed species beyond the range of the effects anticipated to occur … for the duration of the … salmonid biological opinion.". In general terms, NMFS could support one or more OMR storm flexes each month during the January through March period as long as the total monthly loss of unclipped winter-run-sized Chinook salmon does not exceed the average loss rates observed during the historical record under implementation of the 2009 NMFS BiOp.

On 1/15/19, on another Directors Call, some additional alternatives were discussed. One of Reclamation's primary concerns expressed during both calls was NMFS's proposal to set the monthly thresholds (whether based on isolated monthly loss with a fresh start each month or cumulative seasonal loss) to 50% of the average loss rates. NMFS's intent in proposing that approach for the monthly thresholds is to allow "room" for additional loss to occur during and after an OMR storm flex, and reduce the chance of total monthly loss exceeding 100% of the average monthly loss. A secondary concern of Reclamation was the "monthly loss with fresh start" approach that NMFS proposed; NMFS was supportive of either the "monthly loss with fresh start" or "cumulative seasonal loss" approach as long a buffer to minimize the risk of exceeding 100% of loss was included in the criteria.

This document describes a modified approach that uses Reclamation's preferred "cumulative seasonal loss" approach, and addresses NMFS buffer concerns by shifting from monthly criteria to half-month criteria, rather than by "pro-rating" loss by setting a monthly criteria to 50% of observed average loss.

[2] NMFS has not yet issued the JPE letter for WY 2019, and associated incidental take limit (ITL) for winter-run Chinook salmon. The 12/21/18 DOSS advice regarding interim JPE-based triggers for OMR management estimated the WY 2019 JPE as 46% of the estimated passage to date of Brood Year (BY) 2018 winter-run Chinook salmon past the Red Bluff Diversion Dam (RBDD) rotary screw trap. Using that method, and the most recent RBDD data (for the period 12/17/18-12/31/18), the interim WY 2019 JPE is estimated to be 1,115,920*0.46=513,323.

NMFS-proposed Salmonid Factor based on cumulative seasonal loss per half-month periods

This proposal sets separate loss-based criteria, for each half-month[3] period from January 1 to March 31, based on the average historical cumulative seasonal loss up to the beginning of each half-month period ("cumulative loss through period t minus 1") or the end of each half-month period (the "cumulative loss through period t"). Consistent with previous alternatives proposed by both Reclamation and NMFS, loss is expressed as a percentage of the winter-run-sized incidental take limit[4] (ITL), which is 2% of the Juvenile Production Estimate (JPE). This approach provides a buffer in that no OMR flex is allowed during the half-month period unless there is "room" for loss during the half-month period that is not projected to exceed the "loss in period t".

Operationally, NMFS proposes the following process for each half month period:

- If the cumulative seasonal loss is less than the "cumulative loss through period t minus 1", an OMR storm flex may proceed without any conferencing.
- If the cumulative seasonal loss is greater than the "cumulative loss through period t minus 1", but less than the "cumulative loss through period t", the five agencies conference. For the conference discussion, Reclamation and DWR should provide a projection of loss through the rest of the half-month period based on average loss rates observed during the past 5 days. In general, unless there are circumstances that indicate otherwise (for example, an expectation that the production release of hatchery winter-run might be transiting the Delta in the upcoming week) NMFS expects to allow OMR storm flexes to be initiated/continue during the rest of the half-month period as long as loss is not projected to exceed the "loss in period t".
- If, at any time during the half-month period, the cumulative seasonal loss exceeds the "cumulative loss through period, any ongoing OMR storm flex must be offramped as soon as practicable, and no more OMR storm flexes can be initiated for the rest of the half-month period.

Table 1 provides the resulting thresholds for January through March 2019.

Table 1: Observed cumulative seasonal loss for all half-month periods in January through March (WY 2010-WY 2018) based on Method A (data from all years), Method B (data from all years but WY 2014 and WY 2015) and Method C (data from all years but WY 2014, WY 2015, and WY 2017). Yellow-highlighted cells represent the 4%, 9%, and 26% thresholds proposed by Reclamation (using Reclamation's method of always rounding up).

Half-month period	Cumulative seasonal loss by the end of each half-month period ("cumulative loss in period t") – all	Cumulative seasonal loss

[3] Half months defined as the 1st through the 15th, and 16th through the rest of the month.

[4] NMFS has not yet issued the JPE letter for WY 2019, and associated incidental take limit (ITL) for winter-run Chinook salmon. The 12/21/18 DOSS advice regarding interim JPE-based triggers for OMR management estimated the WY 2019 JPE as 46% of the estimated passage to date of Brood Year (BY) 2018 winter-run Chinook salmon past the Red Bluff Diversion Dam (RBDD) rotary screw trap. Using that method, and the most recent RBDD data (for the period 12/17/18-12/31/18), the interim WY 2019 JPE is estimated to be 1,115,920*0.46=513,323, and therefore the interim ITL for winte-run-sized Chinook salmon for WY 2019 is 10,267.

	values rounded to the nearest integer (non-rounded value)			observed in WY 2019
	Method A: Data from all years	**Method B:** Data from all years but WY 2014 and WY 2015	**Method C:** Data from all years but WY 2014, WY 2015, and WY 2017.	
October-December	1% (0.98)	1% (1.01)	1% (1.06)	0.05%[5]
January 1-15	2% (1.78)	2% (1.88)	2% (2.07)	0.30%[6]
January 16-31	3% (2.57)	3% (2.83)	3% (3.18)	
February 1-15	3% (3.17)	3% (3.49)	4% (3.78)	
February 16-28 (or 29 in a leap year)	6% (6.28)	8% (7.50)	8% (8.46)	
March 1-15	12% (12.34)	15% (15.14)	17% (17.38)	
March 16-31	18% (17.96)	22% (22.31)	26% (25.69)	

Attachment B provides a summary of the observed loss of non-adipose-fin-clipped (unclipped) winter-run-sized Chinook salmon for WY 2010 through WY 2018, and Attachment C provides a summary of the proposed thresholds for Methods A, B, and C. During this period, the CVP and SWP operated to the 2009 NMFS BiOp requirements (including OMR flow management), with occasional short-term exceptions related to litigation or drought. Specifically, NMFS calculated the observed monthly loss during each half-month period in October through March to generate criteria for all half-month periods in January, February, and March[7]. January, February, and March are the 3 months during which an OMR storm flex is most likely, and NMFS focused on winter-run-sized Chinook salmon because winter-run Chinook salmon are (a) the most vulnerable of the ESA-listed salmonids covered by the 2009 NMFS BiOp, and (b) the salmonid run most likely to be present in the Delta in the January through March timeframe. The observed loss was expressed as a percentage of the winter-run-sized ITL, which itself is scaled to the JPE in each water year, so that high production years did not have disproportionate weight.

[5] (5.2/10,266)*100=0.05
[6] (31.15/10,266)*100=0.30
[7] While an OMR storm flex might be implemented during December, there is no OMR limit in effect during December under the 2009 NMFS BiOp, so no Salmonid Factors are necessary for December.

ATTACHMENT A:

Background on OMR Flow Management in the 2009 NMFS BiOp

The USFWS and NMFS BiOps each contain a Reasonable and Prudent Alternative (RPA) that describes actions necessary to avoid jeopardy to species listed under the Endangered Species Act (ESA). RPA actions were developed based on the species'[1] biological requirements. In general, these actions include consideration of individual populations, life stage, life-history traits, and timing of species' needs throughout the year. The biological rationale for each action is clearly articulated in the respective RPA.

The NMFS RPA includes more actions than the USFWS RPA; primarily because the scope of the ESA consultation with NMFS including more species, more populations within those species, and a considerably broader action area within the Central Valley.

Table A-1 (below) summarizes the overlap in timing of some of the key Delta-related RPA actions in the 2008 USFWS BiOp and the 2009 NMFS BiOp with species presence. Details on each action, including the flexibilities (e.g., dry year exceptions, duration limits), are included in the respective BiOp. Section 4003 of the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016 direct the Secretaries of the Interior and Commerce to consider modifications to existing BiOp OMR flow management.

[1] ESA-listed species included in the NMFS' BiOp: Sacramento River winter-run Chinook salmon (endangered), Central Valley spring-run Chinook salmon (threatened), California Central Valley steelhead (threatened), the Southern Distinct Population Segment of North American green sturgeon (threatened), and Southern Resident killer whales (endangered). ESA-listed species included in the USFWS's BiOp: Delta smelt (endangered).

Table A-1: Summary of species presence in the Delta and within-year timing and overlap of some key RPA actions in the USFWS and NMFS BiOps, including OMR flow management.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Species presence in the Delta	Juvenile winter-run												
	Juvenile spring-run												
	Juvenile steelhead												
	Delta smelt												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
OMR management in FWS and NMFS BiOps	**NMFS Action IV.2.3** (juvenile migration and entrainment)										*June 15 or temperature offramp*		
	FWS Action 1-A (adult migration and entrainment)			*Dec 1-20*									
	FWS Action 1-B (adult migration and entrainment)			*After Dec 20*									
	FWS Action 2 (adult migration and entrainment)			*Follows Action 1*									
	FWS Action 3 (larval entrainment)												
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Other actions in NMFS BiOp	**NMFS Action IV.1.2** (Delta Cross Channel operations)												
	NMFS Action IV.2.1 (I:E ratio)												

Relevance of OMR Flow to ESA-listed salmonids

CVP and SWP exports modify not only the magnitude, but also the direction, of flow in channels of the south Delta. Old River and Middle River are the main channels in the south Delta (Figure A-1), and they are naturally tidal. Absent CVP and SWP exports, both positive (downstream) and negative (upstream) flows would be expected to occur over the course of a day in those channels, with a positive net daily flow. During much of the year, CVP and SWP exports result in a negative net daily flow (i.e., "reverse flow") in portions of these channels, which leads to direct effects on salmonid survival (e.g., entrainment into and mortality at the export facilities themselves) and/or indirect effects on salmonid survival (e.g., disruption to migration cues or migration speed, which in turn may lead to increased mortality from predation or other stressors in the south Delta). OMR export limits are included in the NMFS RPA to limit the extent of reverse flows in Old and Middle River and minimize these indirect and direct effects on through-Delta survival of ESA-listed salmonids during rearing and outmigration.

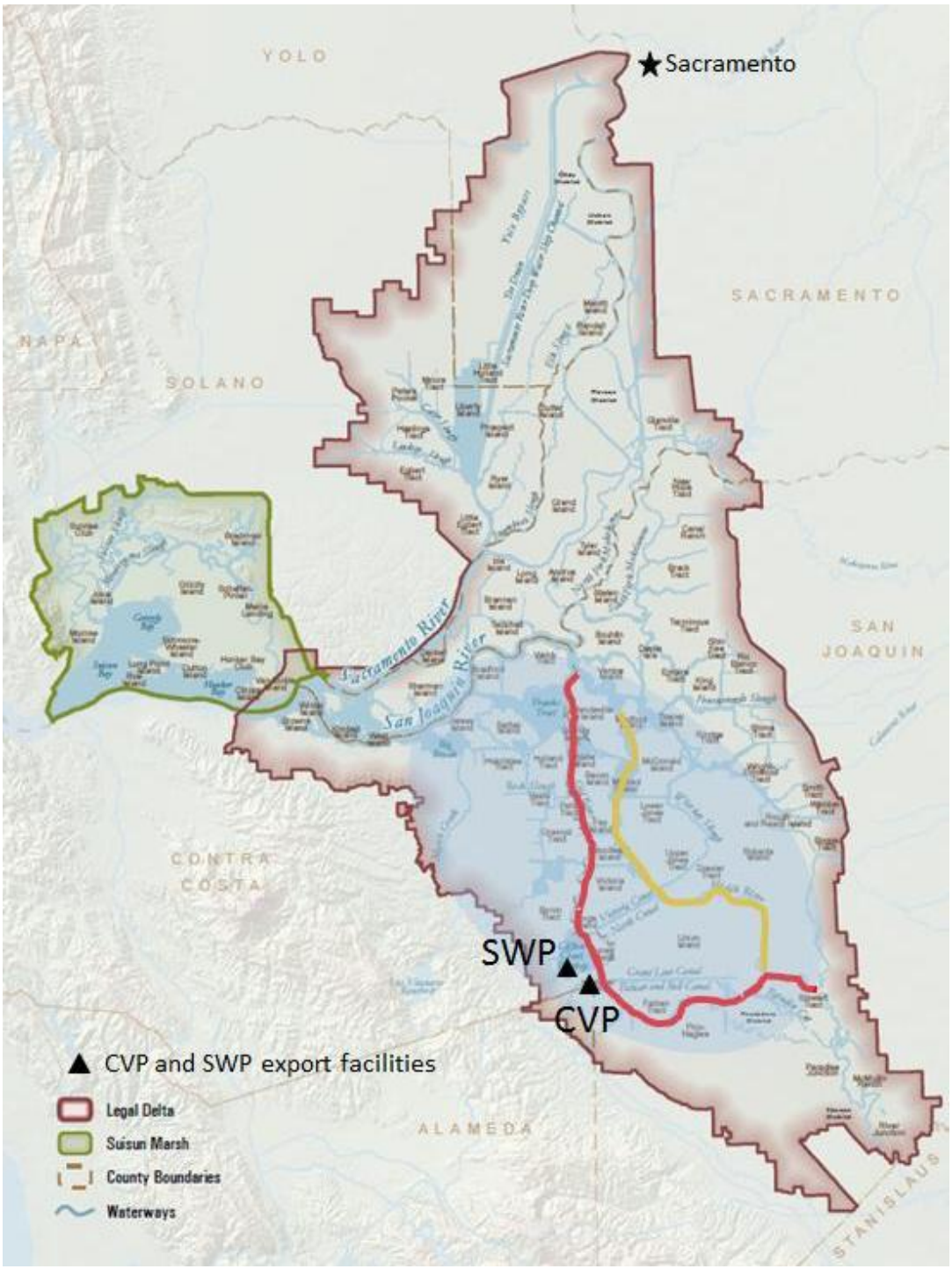

Figure A-1: Map of the Sacramento-San Joaquin Delta (Delta) modified from Figure 1-1 of the Delta Plan[2]. Old River (in red) and Middle River (in orange) are two of the key channels in the south Delta region (highlighted by the pale blue oval). Old River passes directly by the SWP export pumping facility (fronted by Clifton Court Forebay) and the CVP export facility.

[2] http://deltacouncil.ca.gov/delta-plan-0

Entrainment of salmon into the Federal and State water project export facilities is more likely to increase when local fish densities are high. The -5,000 cfs OMR flow management limit in the 2009 NMFS BiOp on the combined operations of the CVP and SWP begins on January 1st because it is intended to reduce the negative effects to the current year class of emigrating juvenile Sacramento River winter-run Chinook salmon, the majority of which will likely be in the Delta at this time. Historic data[3] across a wide range of year types (2001-2012) indicate that in most years, 25 to 50 percent of juvenile winter-run salmon have entered the Delta by January 1st. During the January 8, 2019, Delta Operations for Salmonids and Sturgeon (DOSS) technical team meeting, DOSS estimated that approximately 62-75% of the juvenile winter-run Chinook salmon from brood year 2018 are in the Delta. These fish will distribute themselves within the Delta and are expected to rear for 3 to 4 months before continuing their emigration to the ocean. During this time, they are vulnerable to entrainment at the Federal and State export facilities, as well as by the influences of altered hydrodynamics in the Delta created by export actions.

Loss of older juveniles at the CVP and SWP export facilities increases sharply at OMR flows of approximately -5,000 cfs (Figure A-2). For any given increase in OMR flows more negative than -5,000 cfs, there is a significant increase in the amount of fish that are 'lost' -- in other words, those that never make it out of the export facilities. Beyond -5,000 cfs, loss increases at a faster and faster rate as OMR gets more negative.

The effects of more negative OMR flows extend beyond fish seen at the facilities. More negative OMR flows also change hydrodynamics within the Delta. Those hydrodynamic effects may increase residence time or disrupt migratory cues in the Delta, even for fish not entrained into the export facilities, increasing their exposure to predation and other stressors within the central and south Delta. Impacts to fish seen at the pumps are just the 'tip of the iceberg'; more negative OMR flows alter broader Delta flow dynamics, resulting in increased indirect mortality of fish in the entire region.

[3] Catch data from rotary screw traps located at Knights Landing, just upstream of Sacramento.

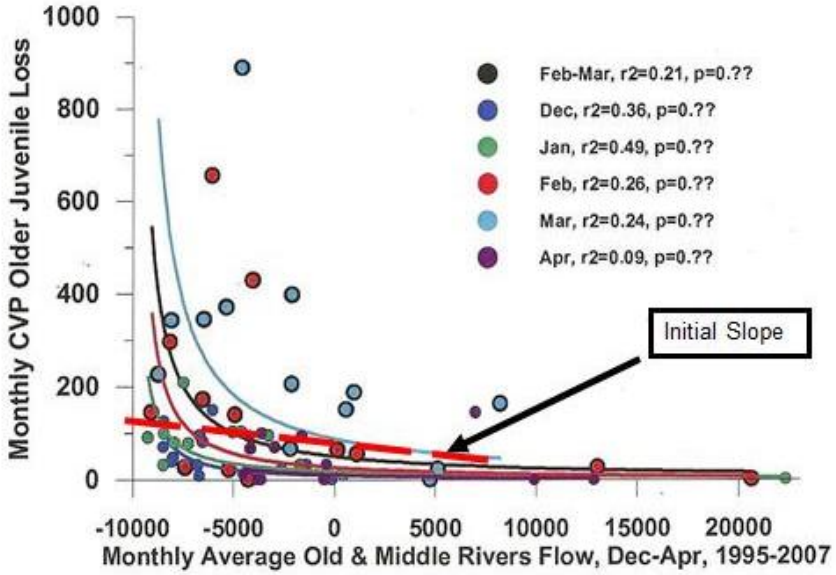

Figure 6-65. Relationship between OMR flows and entrainment at the CVP, 1995-2007 (DWR 2008).

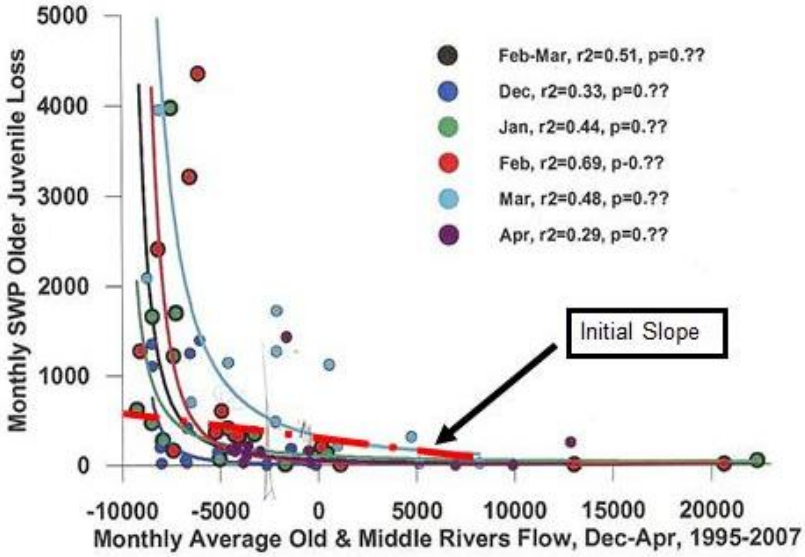

Figure 6-66. Relationship between OMR flows and entrainment at the SWP, 1995-2007 (DWR 2007).

Figure A-2: Figures 6-65 and 6-66 from the 2009 NMFS BiOp, showing the relationship between OMR flows and loss of older juvenile Chinook salmon at the CVP and SWP export facilities. Because juvenile Chinook salmon of different runs look the same, size is used to assign individuals to a run, and "older juveniles" is a size-based category that is intended to capture winter-run Chinook salmon young-of-year (the earliest spawned and thus the "oldest" juveniles for a given brood year) and any spring-run, fall-run, or late-fall-run yearlings from the previous brood year.

ATTACHMENT B:

Loss Data for half-month periods for WY 2010-WY 2018

WATER YEAR	WATER YEAR	PERIOD	JPE	WR-SIZED ITL (2% of JPE)	LOSS OF UNCLIPPED WR-SIZED CHINOOK	LOSS OF UNCLIPPED WR-SIZED CHINOOK as % of WR-SIZED ITL [(Monthly Loss/WR-SIZED ITL)*100]	CUMULATIVE LOSS OF UNCLIPPED WR-SIZED CHINOOK as % of WR-SIZED ITL BY END OF PERIOD ("loss in period t")
2010	2010	October-December	1179633	23592.66	3.01	0.01	0.01
2011	2011		332012	6640.24	244.09	3.68	3.68
2012	2012		162051	3241.02	0.00	0.00	0.00
2013	2013		532809	10656.18	238.57	2.24	2.24
2014	2014		1196387	23927.74	0.00	0.00	0.00
2015	2015		124521	2490.42	43.69	1.75	1.75
2016	2016		101716	2034.32	8.66	0.43	0.43
2017	2017		166189	3323.78	23.12	0.70	0.70
2018	2018		201409	4028.18	0.00	0.00	0.00
2010	2010	January 1-15	1179633	23592.66	0.00	0.00	0.01
2011	2011		332012	6640.24	354.55	5.34	9.02
2012	2012		162051	3241.02	0.00	0.00	0.00
2013	2013		532809	10656.18	3.19	0.03	2.27
2014	2014		1196387	23927.74	0.00	0.00	0.00
2015	2015		124521	2490.42	27.85	1.12	2.87
2016	2016		101716	2034.32	14.42	0.71	1.13
2017	2017		166189	3323.78	0.00	0.00	0.70
2018	2018		201409	4028.18	0.00	0.00	0.00
2010	2010	January 16-31	1179633	23592.66	153.24	0.65	0.66
2011	2011		332012	6640.24	296.31	4.46	13.48
2012	2012		162051	3241.02	11.59	0.36	0.36
2013	2013		532809	10656.18	63.44	0.60	2.86
2014	2014		1196387	23927.74	0.00	0.00	0.00
2015	2015		124521	2490.42	11.65	0.47	3.34
2016	2016		101716	2034.32	12.11	0.60	1.73
2017	2017		166189	3323.78	0.00	0.00	0.70
2018	2018		201409	4028.18	0.00	0.00	0.00
2010	2010	February 1-15	1179633	23592.66	199.61	0.85	1.51
2011	2011		332012	6640.24	50.84	0.77	14.24
2012	2012		162051	3241.02	39.72	1.23	1.58
2013	2013		532809	10656.18	6.77	0.06	2.93
2014	2014		1196387	23927.74	0.00	0.00	0.00
2015	2015		124521	2490.42	18.37	0.74	4.08
2016	2016		101716	2034.32	12.57	0.62	2.35
2017	2017		166189	3323.78	34.95	1.05	1.75
2018	2018		201409	4028.18	3.19	0.08	0.08
2010	2010	February 16-28 (or 29 in a leap year)	1179633	23592.66	228.14	0.97	2.48
2011	2011		332012	6640.24	1277.12	19.23	33.48
2012	2012		162051	3241.02	246.59	7.61	9.19
2013	2013		532809	10656.18	0.00	0.00	2.93
2014	2014		1196387	23927.74	0.00	0.00	0.00
2015	2015		124521	2490.42	0.00	0.00	4.08
2016	2016		101716	2034.32	2.88	0.14	2.49
2017	2017		166189	3323.78	0.00	0.00	1.75
2018	2018		201409	4028.18	3.88	0.10	0.18
2010	2010	March 1-15	1179633	23592.66	660.99	2.80	5.28
2011	2011		332012	6640.24	1189.66	17.92	51.39
2012	2012		162051	3241.02	880.67	27.17	36.36
2013	2013		532809	10656.18	227.14	2.13	5.06
2014	2014		1196387	23927.74	228.03	0.95	0.95
2015	2015		124521	2490.42	0.00	0.00	4.08
2016	2016		101716	2034.32	0.00	0.00	2.49
2017	2017		166189	3323.78	0.00	0.00	1.75
2018	2018		201409	4028.18	140.95	3.50	3.67
2010	2010	March 16-31	1179633	23592.66	365.79	1.55	6.83
2011	2011		332012	6640.24	890.94	13.42	64.81
2012	2012		162051	3241.02	743.22	22.93	59.30
2013	2013		532809	10656.18	171.89	1.61	6.67
2014	2014		1196387	23927.74	71.19	0.30	1.25
2015	2015		124521	2490.42	4.33	0.17	4.25
2016	2016		101716	2034.32	5.76	0.28	2.77
2017	2017		166189	3323.78	8.64	0.26	2.01
2018	2018		201409	4028.18	406.94	10.10	13.78

ATTACHMENT C:

Summary of half-month criteria under various WY combinations

Criteria per NMFS Method A (data from all years)				Criteria per NMFS Method B (data from all years but WY 2014 and WY 2015)				Criteria per NMFS Method C (data from all years but WY 2014, WY 2015, and WY 2017)			
AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1	AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1 (rounded)	AVERAGE CUMULATIVE LOSS IN PERIOD T	AVERAGE CUMULATIVE LOSS IN PERIOD T (rounded)	AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1	AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1 (rounded)	AVERAGE CUMULATIVE LOSS IN PERIOD T	AVERAGE CUMULATIVE LOSS IN PERIOD T (rounded)	AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1	AVERAGE CUMULATIVE LOSS IN PERIOD T MINUS 1 (rounded)	AVERAGE CUMULATIVE LOSS IN PERIOD T	AVERAGE CUMULATIVE LOSS IN PERIOD T (rounded)
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0.98	1%	1.78	2%	1.01	1%	1.88	2%	1.06	1%	2.07	2%
1.78	2%	2.57	3%	1.88	2%	2.83	3%	2.07	2%	3.18	3%
2.57	3%	3.17	3%	2.83	3%	3.49	3%	3.18	3%	3.78	4%
3.17	3%	6.28	6%	3.49	3%	7.50	8%	3.78	4%	8.46	8%
6.28	6%	12.34	12%	7.50	8%	15.14	15%	8.46	8%	17.38	17%
12.34	12%	17.96	18%	15.14	15%	22.31	22%	17.38	17%	25.69	26%

Attachment C