Appendix 12L
Winter-Run Chinook Salmon Life Cycle Modeling

APPENDIX 12L
Winter-Run Chinook Salmon Life Cycle Modeling

12L.1 Overview

This appendix provides a summary of modeling performed to simulate survival and abundance throughout the life-cycle and all life stages of the winter-run Chinook salmon population. The Interactive Object-oriented Simulation (IOS) winter-run Chinook salmon life-cycle model, developed by Cramer Fish Sciences, was used for the Sacramento River for the North-of-the-Delta Offstream Storage Draft Environmental Impact Report/Environmental Impact Statement (NODOS DEIR/EIS). A description of the IOS model and the results used in the detailed evaluation of the proposed Project action alternatives (alternatives) are included. Results were used or referenced in Chapter 12 Aquatic Biological Resources. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B and 12C.

12L.1.1 Introduction

The analytical framework used to evaluate the alternatives is summarized in Chapter 5 Guide to the Resource Analyses and Appendix 6B. Assumptions used in modeling the alternatives are summarized in Appendix 6A.

IOS simulates survival and abundance throughout the life-cycle and all life stages of the winter-run Chinook salmon population, from spawning in the upper reaches of the Sacramento River, migrating downriver and through the Sacramento-San Joaquin Delta (Delta) to the Pacific Ocean, and then returning to the upper Sacramento River to spawn again. IOS results include the annual number of returning spawners, and the annual survival rates for the life-stages from egg to fry and smolt rearing, and annual survival rates for passage through the Delta. The report, "Interactive Object-oriented Salmon Simulation (IOS) for the NODOS" by Cramer Fish Sciences, is included as part of this appendix.

IOS uses the daily flow outputs from the Upper Sacramento River Daily Operations Model (USRDOM) and the daily temperature outputs from the Upper Sacramento River Water Quality Model (USRWQM). The USRDOM model is described in Appendix 6C and the USRWQM model is described in the Appendix 7E.

12L.2 Results

This section includes the results of the IOS winter-run Chinook salmon life-cycle model for the alternatives evaluated in the NODOS DEIR/EIS. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B and 12C.

12L.2.1 Introduction

IOS annual survival and abundance results for the winter-run Chinook salmon life-cycle are included in this appendix. This document includes summary tables and exceedance plots comparing the results. Summary tables and exceedance probability charts are included for the following parameters for Sacramento River winter-run Chinook salmon:

- Annual Returning Spawners
- Annual Egg to Fry Survival Rates

- Annual Fry to Smolt Rearing Survival Rates
- Annual Overall Delta Survival Rates

Summary tables include long-term average and averages by water year type (SWRCB D-1641 40-30-30 Index). The tables also include the absolute and relative differences between alternatives.

IOS results are not intended to predict specific numbers of Chinook salmon, but rather to indicate a trend in salmon survival and abundance in response to the alternative evaluated. Further guidance on the appropriate use of model results is presented in Appendix 6B.

12L.2.2 Comparisons

For each parameter, a report is provided for the following seven comparisons:

- No Project/No Action Alternative compared to Existing Conditions
- Alternative A compared to Existing Conditions
- Alternative A compared to No Project/No Action Alternative
- Alternative B compared to Existing Conditions
- Alternative B compared to No Project/No Action Alternative
- Alternative C compared to Existing Conditions
- Alternative C compared to No Project/No Action Alternative

Interactive Object-oriented Salmon Simulation (IOS) for the NODOS

Cramer
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Interactive Object-oriented Salmon Simulation (IOS) for the NODOS

by

Brad Cavallo, Paul Bergman, Kris Jones, Steven Zeug and Jenny Melgo

4/14/2011

Introduction

It is widely recognized by both fisheries scientists and management agencies that the overall viability of the ESA-listed winter-run Chinook salmon population in California's Central Valley is impacted by water management actions which affect temperature, flow, and exports (Kjelson and Brandes 1989; NMFS 1997; Brandes and McLain 2001; Brown and Kimmerer 2002; NRDC 2008; NMFS 2009), and which also influence route selection for salmon migrating through the Delta (Perry et al 2010). However, there is also considerable disagreement over the nature and magnitude of management actions taken to aid in population recovery.

It has been acknowledged for some time that modeling can play a powerful role in evaluating the interrelationships among individual factors that give rise to broad patterns in population dynamics, and that understanding the processes that produce such patterns is key to developing principles of management (Levin 1992). Ruckelshaus et al. (2002) even go so far as to say that using better models in making management decisions is one obvious way to change how risks to salmon populations are managed.

The Interactive Object-oriented Simulation (IOS) model detailed here is a life-cycle model developed by Cramer Fish Sciences. It is used for comparing the relative impact of different flow, temperature, and water export scenarios on the winter-run Chinook population that spawns in the upper reaches of California's Sacramento River, migrates downriver and through the Sacramento-San Joaquin Delta to the Pacific Ocean, and returns to the upper Sacramento River to spawn. We applied IOS in order to assess how winter run Chinook salmon might be influenced by NODOS operational scenarios.

IOS is a life-cycle model that simulates all life stages of winter-run Chinook salmon and models individual daily cohorts of fish through their entire life cycle. Individual life stages are modeled using functional relationships, whose form and parameters values are informed by the best available information from literature. These functional relationships for each life stage are then linked together to form a complete life cycle model that estimates the daily number of eggs for each brood year and progresses them through life stage transitions until spawning at age 3 or 4 where the process begins again for the next generation. Uncertainty is explicitly modeled in the IOS model by incorporating environmental stochasticity and estimation error where data is available.

Survival and abundance estimates generated by IOS are not intended to predict future outcomes or to predict actual survival. Rather, IOS provides an estimate of relative of survival and abundance which is useful for making comparisons between proposed operation alternatives. While IOS has been calibrated to the best available information, in most cases it is not possible to validate IOS results against actual fish abundance or survivals values because such data does not exist. Where suitable data is available (e.g. spawning escapement abundance) observed values are the result of past habitat conditions, predator abundance and other factors which are not representative of future conditions expected with NODOS proposed alternatives. Generally, IOS results are appropriately reported as averages or as probability distributions by years, by months, and/or by Water Year Type, but not as comparisons between specific days, months or years.

Model Description

In the following section we provide a brief description of the methods used in the construction of the IOS model.

Flow Data: Modeled flow and temperature data output for each of the 5 NODOS scenarios were used to inform the daily conditions experienced by salmon in the model. Environmental data for the following locations (with corresponding life stages) were input into the model:

Location	Input Data	Life Stage
Sac River - Bend Bridge	Temperature	Egg/Alevin
Sac River - Bend Bridge	Flow	Egg/Alevin
Yolo Bypass	Flow	Smolt Delta Migration
Sac River - Hood	Flow	Smolt Delta Migration
Sutter and Steamboat Sloughs	Flow	Smolt Delta Migration
Sac River - above DCC	Flow	Smolt Delta Migration
Delta Cross Channel	Flow	Smolt Delta Migration
Sac River - below Georgiana Slough	Flow	Smolt Delta Migration
Georgiana Slough	Flow	Smolt Delta Migration
Sac River - Below Rio Vista	Flow	Smolt Delta Migration
San Joaquin River at Mossdale	Flow	Smolt Delta Migration
San Joaquin River at Stockton	Flow	Smolt Delta Migration
Old River at head of Old River	Flow	Smolt Delta Migration
Total Exports	Flow	Smolt Delta Migration

Spawning: We fit a Ricker stock-recruitment curve to determine the total number of emergent fry using both the estimated number of female spawners from carcass survey data as well as the number of juveniles caught at the rotary screw traps at RBDD (between 1996-1999 and 2002-2007). The Ricker curve is used to predict the current year's fry production based on the estimated number of female spawners from the carcass survey. The mean fry production is predicted from the number of female spawners using the stock-recruitment relationship; the predicted mean fry production along with the confidence intervals for the predicted values were used to define a normal probability distribution, which was then randomly sampled to determine the annual fry production. The data available to fit the Ricker curve did not cover a wide range of escapement values and density dependence could not be identified in the fitted model. Thus, we limited the total number of successful spawners to 20,000 which was the highest observed escapement during the last 30 years. In order to ensure that developing fish experience the correct environmental conditions, the daily observed proportion of carcasses observed from carcass surveys are used to determine the distribution of egg deposition in each year current year. A total of 8 years of carcass survey data are included in the model and the particular distribution of carcasses in each year is a randomly selected variable that is resampled for each year of the simulation.

Egg to Fry (survival and maturation): Although the Ricker Stock-recruitment curve predicts the annual fry production, we wanted to account for temperature-related egg mortality and variation in maturation times of incubating eggs in response to daily temperatures. We used data from the experimental work of the USFWS (1999), which explored the relationship between temperature and the mortality of developing winter-run chinook (from fertilization to emergence). In order to apply these temperature effects to the IOS model, we needed to convert the predicted proportional mortality over the entire incubation period to a daily mortality rate. This conversion allowed us to apply the temperature-mortality relationship on a daily time step in the IOS model. We adjusted the intercept of the daily mortality function from the laboratory data to have temperature induced mortality only occur at temperatures outside the range observed during the period used to develop the Ricker model (1996-1999,

2002-2007). The 95th percentile of the mean daily temperatures observed during the incubation period (May-August) was 57^{o}F for the years used to construct the Ricker model. Therefore, we adjusted the intercept of the daily mortality function so that temperature-related mortality begins at temperatures above 57^{o}F.

In the IOS model, each day the mean proportional mortality of the incubating eggs is predicted from the daily water temperature; as described previously, the predicted mean mortality along with the confidence intervals from the predicted values were used to define a normal probability distribution, which was then randomly sampled to determine the daily egg mortality

In many previous studies salmon egg maturation time has been found to be negatively related to water temperatures (Murray and McPhail 1988; Beacham and Murray 1989; Crisp 1988; Geist et al. 2006). Using data from the aforementioned experiments looking at temperature effects on development (Murray and McPhail 1988; Beacham and Murray 1989) we examined the relationship between maturation time and water temperature. In the IOS model, each day the mean maturation rate of the incubating eggs is predicted from the daily temperature using the above linear function; the predicted mean maturation rate along with the confidence intervals of the predicted values (e.g., prediction intervals) were used to define a normal probability distribution, which was then randomly sampled to determine the daily maturation rate.

Fry to Smolt (survival and maturation): Using data from the study by USFWS (1999), we were able to incorporate information regarding the effects of temperature on mortality during the fry-smolt rearing period. In their study, fish were reared under three temperature regimes (temperatures were kept constant over the treatment period), and the rearing phase was ended when 100% mortality occurred or fish reached a mean fork length of 85-90 mm. Juvenile chinook >75 mm are generally considered smolts (see Miller et al. 2010), therefore fish were reared for 113 days in the model, as this was the amount of time it took for fish in the experiment to reach ~75 mm. As described above, we needed to convert the predicted proportional mortality over the entire rearing period to a daily mortality rate; we used the result from the temperature-mortality relationship (USFWS 1999) to calculate a daily mortality (see Bartholow and Heasley 2006). This conversion allowed us to apply the temperature-mortality relationship on a daily time step in the IOS model.

In the model, each day the mean proportional mortality of the rearing fish is predicted from the daily temperature; as described above, the predicted mean mortality along with the confidence intervals of the predicted values were used to define a normal probability distribution, which was then randomly sampled to determine the daily mortality of the rearing fish.

Hatchery Inputs: In addition to in-river production, smolt production from the Livingston Stone hatchery was represented by injecting 200,000 smolts each year. These smolts are not subject to temperature related mortality and maturation but are inserted into the model just prior to the Delta Migration section of the model.

Delta Migration: The smolt Delta migration portion of the life cycle is identical to that described for winter run Chinook in the Delta Passage Model (DPM; Cramer Fish Sciences). The DPM is based on a detailed accounting of migratory pathways and reach-specific mortality as Chinook salmon smolts travel through a simplified network of reaches and junctions in the Delta. The DPM is composed of 10 reaches and four junctions selected to represent primary salmonid migration corridors where high quality fish and hydrodynamic data are available. For simplification, Sutter Slough and Steamboat Slough are combined

as the reach SS and the forks of the Mokelumne River and Georgiana Slough are combined as Geo/DCC. The Geo/DCC reach can be entered by Mokelumne River fall-run at the head of the South and North Forks of the Mokelumne River or by Sacramento runs through the combined junction of Georgiana Slough and Delta Cross Channel. The Interior Delta reach can be entered from the Sacramento River via the Geo/DCC junction. The three distributary junctions depicted in the DPM are: A) Sacramento River at Freemont Weir (head of Yolo Bypass), B) Sacramento River at head of Sutter and Steamboat Sloughs, and C) Sacramento River at the combined junction with Georgiana Slough and Delta Cross Channel.

The DPM operates on a daily time step using simulated daily average flows and Delta exports as model inputs. The DPM does not attempt to represent sub-daily flows or diel salmon smolt behavior in response to the interaction of tides, flows and specific channel features. The DPM is intended to represent the net outcome of migration and mortality occurring over days, not three dimensional movements occurring over minutes or hours like that described in Blake and Horn (2003).

Ocean Survival: Following Cramer et al. (2007) we utilize the following values for ocean mortality and sexual maturation:

- Winter Mortality for age 3 and 4 groups is 20% (Grover *et al.*, 2004). Winter mortality for age 2 fish is modified by ocean productivity as described in Wells et al. (2007). The value of Wells' index of ocean productivity in the IOS model is a randomly selected variable based on values from 1979-2006 and is resampled for each year of the simulation.
- Smolt to Age 2 Mortality is 96%.
- Age 2 Ocean Harvest Mortality is 0% (Grover *et al.*, 2004).
- The proportion of Age 2 Returning Spawners (precocious) is 8% (Grover *et al.*, 2004).
- Age 3 Ocean Harvest Mortality is 21% (Grover *et al.*, 2004).
- The proportion of Age 3 Returning Spawners is 96% (Grover *et al.*, 2004).
- Age 4 Ocean Harvest Mortality is 66% (Grover *et al.*, 2004).
- The proportion of Age 4 Returning Spawners is 100% (Grover *et al.*, 2004)

Model Runs: Winter-run Chinook salmon population dynamics were modeled across 80 years under 5 different NODOS flow scenarios. The first four years of the model run were each seeded with 5,000 adult spawners.

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No Action Alternative Compared to Existing Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
Existing Conditions	0.79	0.36	0.28
No Action Alternative	0.79	0.36	0.29
Difference	0.00	0.00	0.01
Percent Difference[3]	0	-1	2
Water Year Types[2]			
Wet (32.5%)			
BST NAA (070510)	0.91	0.37	0.29
No Action Alternative	0.91	0.36	0.30
Difference	0.00	-0.01	0.01
Percent Difference	0	-2	2
Above Normal (12.5%)			
BST NAA (070510)	0.90	0.35	0.29
No Action Alternative	0.90	0.34	0.30
Difference	0.01	0.00	0.01
Percent Difference	1	-1	3
Below Normal (17.5%)			
BST NAA (070510)	0.86	0.37	0.30
No Action Alternative	0.86	0.36	0.31
Difference	0.00	-0.01	0.01
Percent Difference	0	-2	3
Dry (22.5%)			
BST NAA (070510)	0.78	0.38	0.28
No Action Alternative	0.76	0.38	0.29
Difference	-0.01	0.00	0.01
Percent Difference	-2	-1	2
Critical (15%)			
BST NAA (070510)	0.36	0.31	0.26
No Action Alternative	0.38	0.32	0.26
Difference	0.02	0.00	0.01
Percent Difference	4	1	3

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

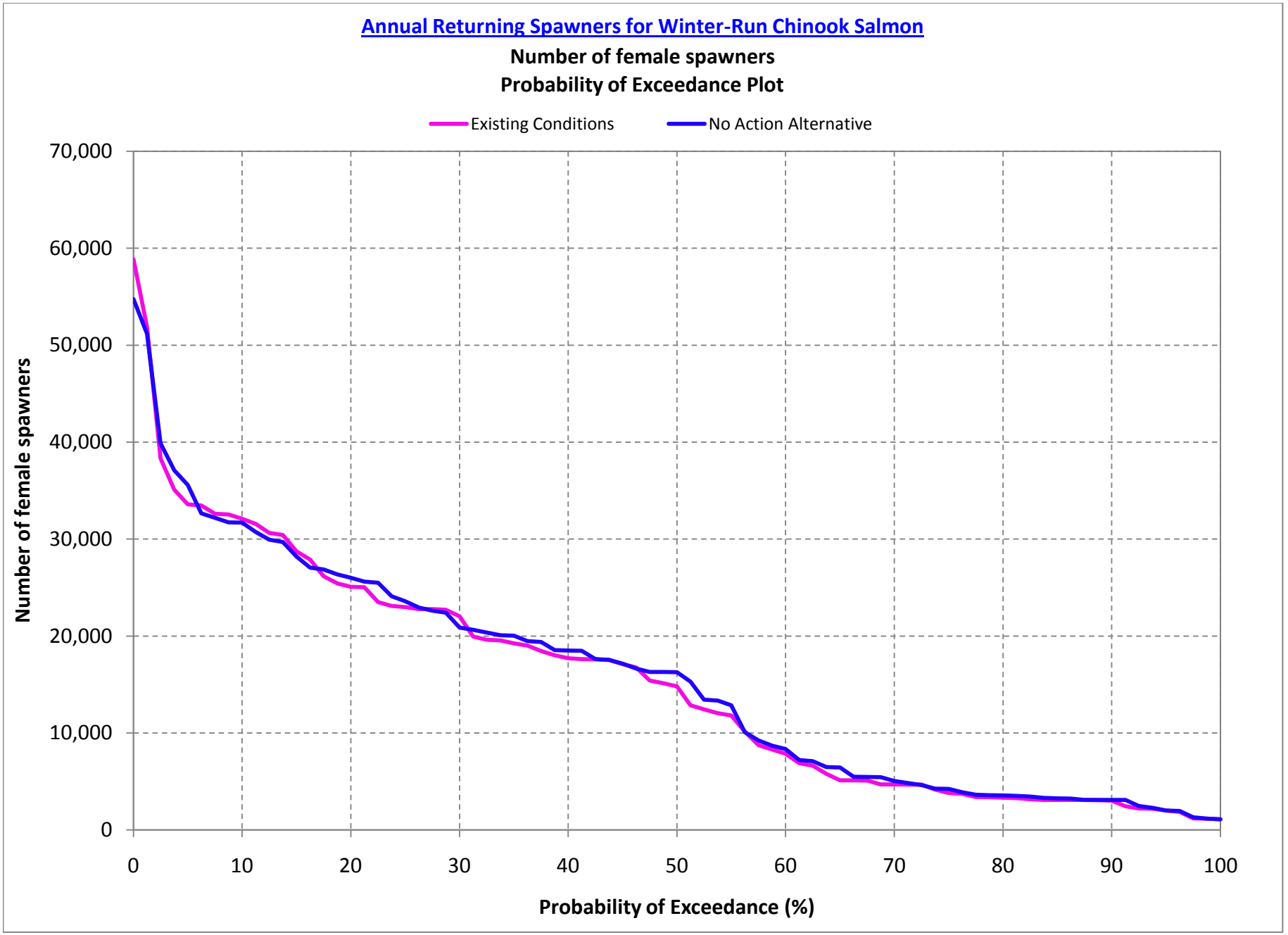
Long-term Average and Average by Water Year Type Annual Returning Spawners

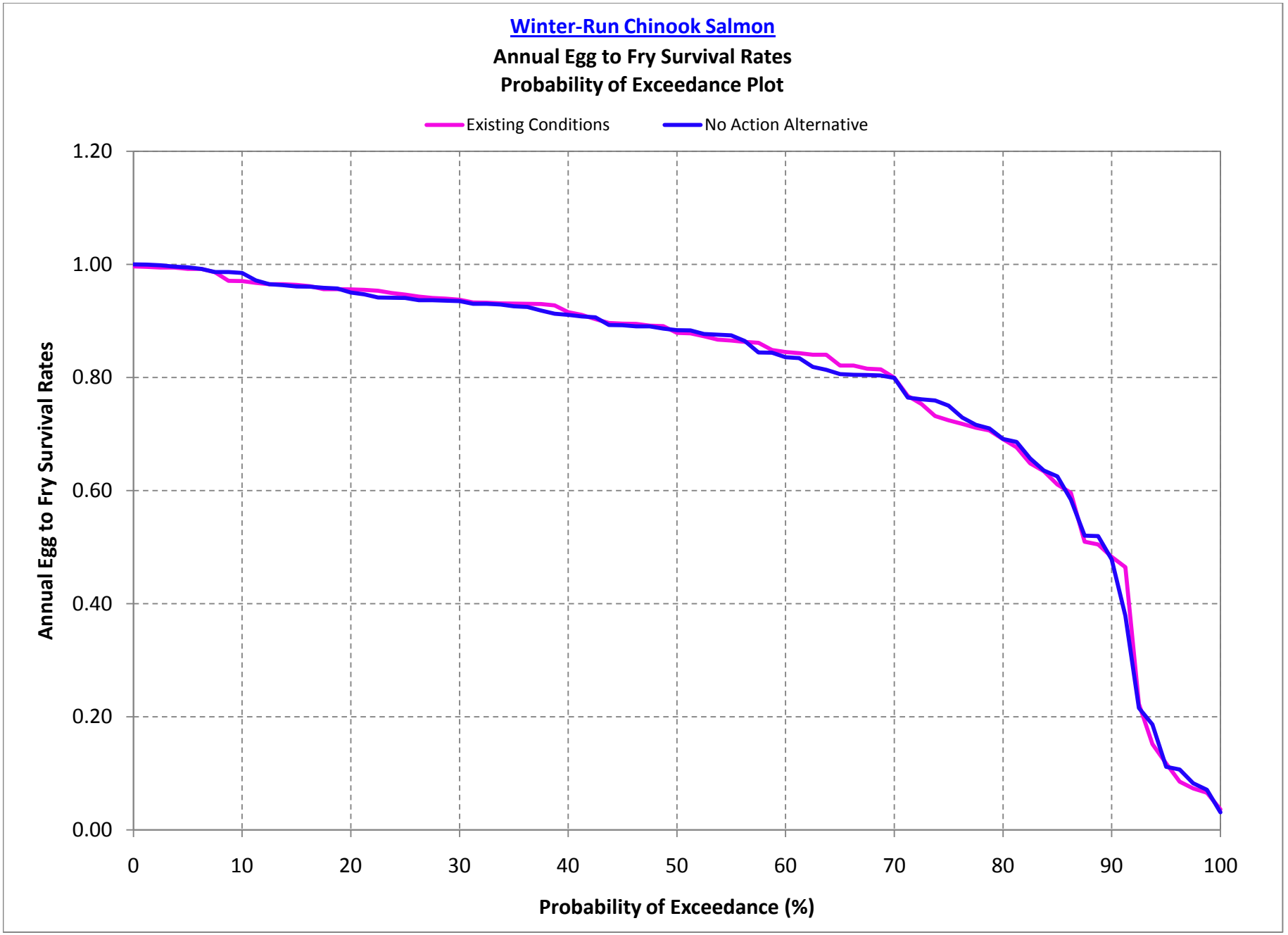
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
Existing Conditions	15,322
No Action Alternative	15,636
Difference	314
Percent Difference[3]	2
Water Year Types[2]	
Wet (32.5%)	
BST NAA (070510)	18,586
No Action Alternative	18,717
Difference	131
Percent Difference	1
Above Normal (12.5%)	
BST NAA (070510)	12,829
No Action Alternative	13,331
Difference	501
Percent Difference	4
Below Normal (17.5%)	
BST NAA (070510)	13,506
No Action Alternative	14,002
Difference	497
Percent Difference	4
Dry (22.5%)	
BST NAA (070510)	15,369
No Action Alternative	15,604
Difference	235
Percent Difference	2
Critical (15%)	
BST NAA (070510)	12,586
No Action Alternative	13,030
Difference	443
Percent Difference	4

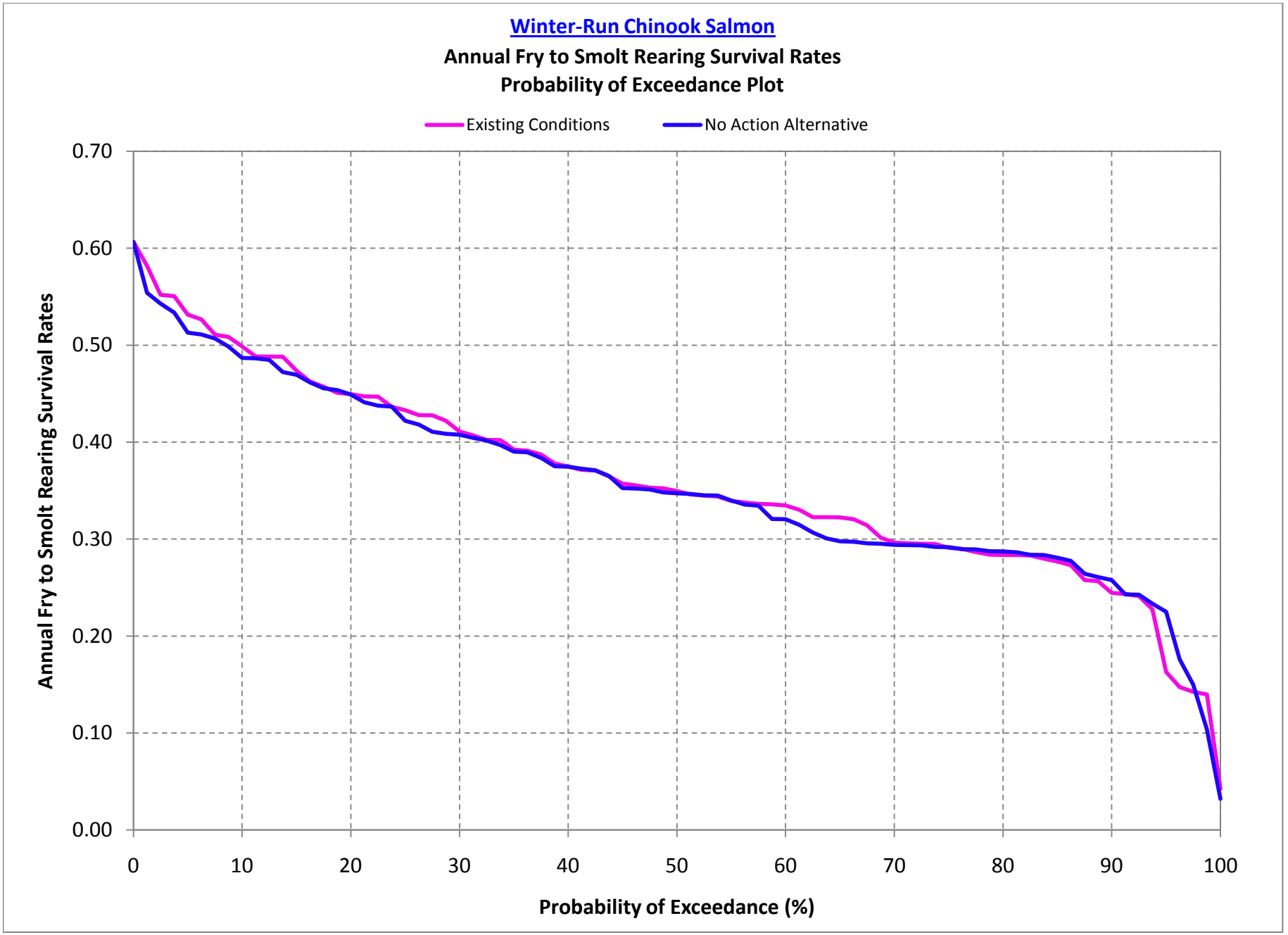
1 Based on the 80-year simulation period

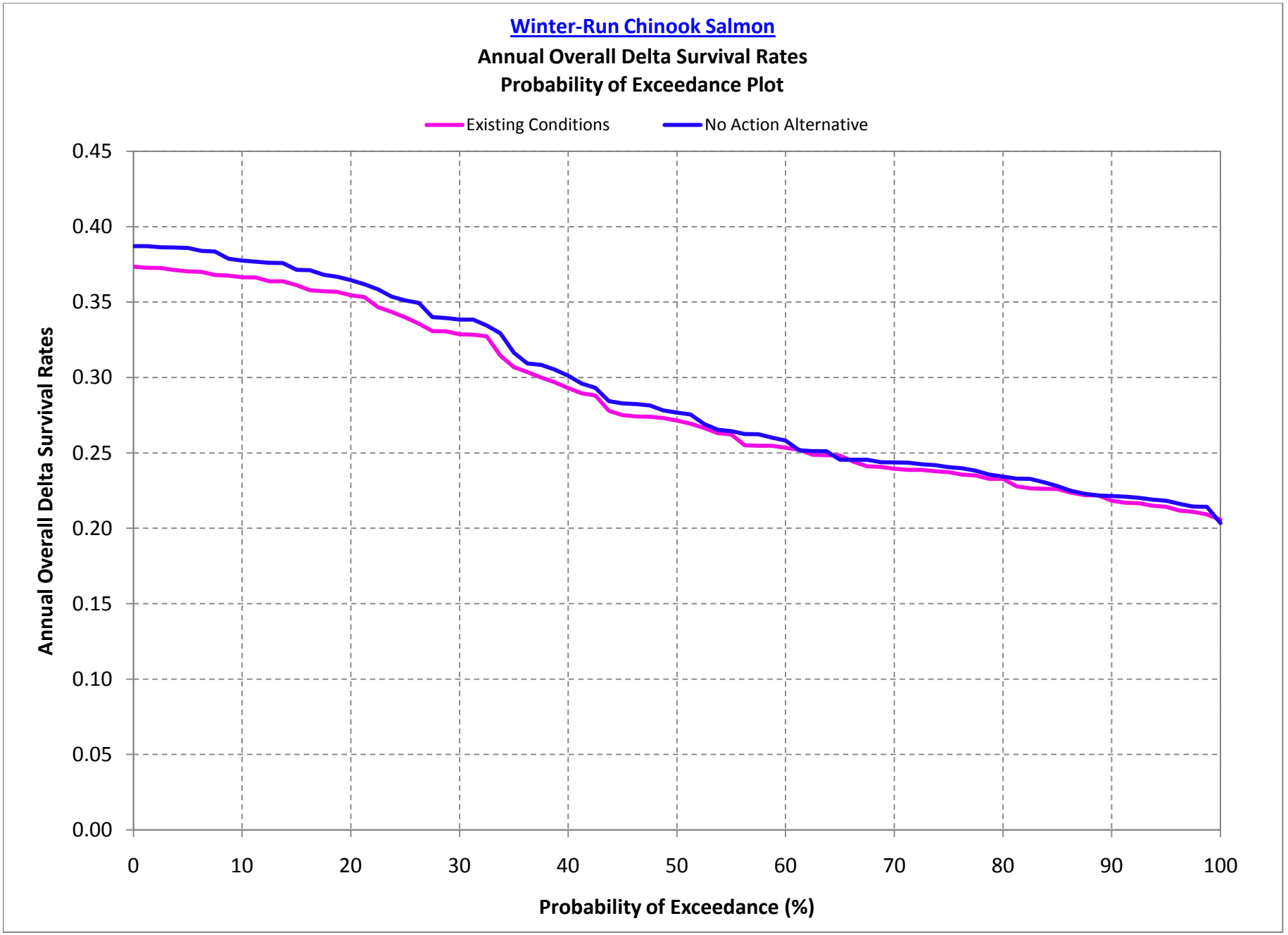
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	No Action Alternative (%)	Absolute Difference (%)	Relative Difference (%)
0.0	58,860	54,752	-4,108	-7.0
1.3	51,867	51,177	-690	-1.3
2.5	38,332	39,882	1,550	4.0
3.8	35,102	37,103	2,001	5.7
5.0	33,579	35,571	1,992	5.9
6.3	33,475	32,659	-816	-2.4
7.5	32,610	32,197	-413	-1.3
8.8	32,534	31,724	-810	-2.5
10.0	32,103	31,697	-406	-1.3
11.3	31,563	30,728	-835	-2.6
12.5	30,644	29,946	-698	-2.3
13.8	30,420	29,705	-715	-2.4
15.0	28,719	28,202	-517	-1.8
16.3	27,879	27,063	-816	-2.9
17.5	26,176	26,870	694	2.7
18.8	25,419	26,345	926	3.6
20.0	25,089	26,001	912	3.6
21.3	25,021	25,608	587	2.3
22.5	23,508	25,492	1,984	8.4
23.8	23,093	24,110	1,017	4.4
25.0	22,996	23,586	590	2.6
26.3	22,775	22,947	172	0.8
27.5	22,768	22,610	-158	-0.7
28.8	22,704	22,406	-298	-1.3
30.0	22,028	20,875	-1,153	-5.2
31.3	19,940	20,642	702	3.5
32.5	19,609	20,366	757	3.9
33.8	19,556	20,091	535	2.7
35.0	19,242	20,041	799	4.2
36.3	19,022	19,476	454	2.4
37.5	18,450	19,386	936	5.1
38.8	18,021	18,557	536	3.0
40.0	17,712	18,497	785	4.4
41.3	17,609	18,484	875	5.0
42.5	17,597	17,617	20	0.1
43.8	17,523	17,541	18	0.1
45.0	17,118	17,151	33	0.2
46.3	16,755	16,652	-103	-0.6
47.5	15,422	16,296	874	5.7
48.8	15,132	16,282	1,150	7.6
50.0	14,811	16,278	1,467	9.9
51.3	12,851	15,297	2,446	19.0
52.5	12,438	13,439	1,001	8.0
53.8	12,048	13,334	1,286	10.7
55.0	11,798	12,845	1,047	8.9
56.3	10,149	10,085	-64	-0.6
57.5	8,736	9,235	499	5.7
58.8	8,288	8,704	416	5.0
60.0	7,855	8,351	496	6.3
61.3	6,890	7,208	318	4.6

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	No Action Alternative (%)	Absolute Difference (%)	Relative Difference (%)
62.5	6,622	7,096	474	7.2
63.8	5,782	6,478	696	12.0
65.0	5,127	6,437	1,310	25.6
66.3	5,114	5,485	372	7.3
67.5	5,094	5,470	377	7.4
68.8	4,694	5,443	749	16.0
70.0	4,692	5,040	348	7.4
71.3	4,682	4,837	155	3.3
72.5	4,671	4,633	-38	-0.8
73.8	4,166	4,263	97	2.3
75.0	3,805	4,231	426	11.2
76.3	3,714	3,895	181	4.9
77.5	3,401	3,629	228	6.7
78.8	3,379	3,589	210	6.2
80.0	3,325	3,568	244	7.3
81.3	3,273	3,520	247	7.5
82.5	3,165	3,437	272	8.6
83.8	3,088	3,295	208	6.7
85.0	3,088	3,252	164	5.3
86.3	3,088	3,224	136	4.4
87.5	3,088	3,088	0	0.0
88.8	3,064	3,088	24	0.8
90.0	3,012	3,088	75	2.5
91.3	2,454	3,088	634	25.8
92.5	2,210	2,467	256	11.6
93.8	2,191	2,278	87	4.0
95.0	1,991	2,008	17	0.9
96.3	1,859	1,954	95	5.1
97.5	1,195	1,302	107	9.0
98.8	1,160	1,172	12	1.1
100.0	1,092	1,086	-6	-0.5
Min	1,092	1,086	-4,108	-7.0
Max	58,860	54,752	2,446	25.8
Mean	15,322	15,636	314	4.3
Median	14,811	16,278	256	4.0
P.I.	Percent of time -- (-1.1<X<1.1)			15.0
1.1<=X<10.0				60.0
X>=10.0				10.0
-10.0<X<=-1.1				16.3
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	0.4
1.3	1.00	1.00	0.00	0.4
2.5	0.99	1.00	0.00	0.4
3.8	0.99	1.00	0.00	0.2
5.0	0.99	0.99	0.00	0.3
6.3	0.99	0.99	0.00	0.0
7.5	0.99	0.99	0.00	0.1
8.8	0.97	0.99	0.02	1.6
10.0	0.97	0.98	0.01	1.4
11.3	0.97	0.97	0.00	0.4
12.5	0.97	0.97	0.00	0.0
13.8	0.96	0.96	0.00	-0.2
15.0	0.96	0.96	0.00	-0.3
16.3	0.96	0.96	0.00	-0.1
17.5	0.96	0.96	0.00	0.3
18.8	0.96	0.96	0.00	0.1
20.0	0.96	0.95	-0.01	-0.6
21.3	0.96	0.95	-0.01	-0.8
22.5	0.95	0.94	-0.01	-1.2
23.8	0.95	0.94	-0.01	-0.9
25.0	0.95	0.94	-0.01	-0.6
26.3	0.94	0.94	-0.01	-0.7
27.5	0.94	0.94	0.00	-0.4
28.8	0.94	0.94	0.00	-0.4
30.0	0.94	0.94	0.00	-0.2
31.3	0.93	0.93	0.00	-0.3
32.5	0.93	0.93	0.00	-0.2
33.8	0.93	0.93	0.00	-0.2
35.0	0.93	0.93	0.00	-0.5
36.3	0.93	0.92	-0.01	-0.6
37.5	0.93	0.92	-0.01	-1.2
38.8	0.93	0.91	-0.01	-1.6
40.0	0.92	0.91	0.00	-0.5
41.3	0.91	0.91	0.00	-0.3
42.5	0.90	0.91	0.00	0.4
43.8	0.90	0.89	0.00	-0.4
45.0	0.90	0.89	0.00	-0.3
46.3	0.89	0.89	0.00	-0.5
47.5	0.89	0.89	0.00	-0.1
48.8	0.89	0.89	0.00	-0.5
50.0	0.88	0.88	0.00	0.5
51.3	0.88	0.88	0.01	0.6
52.5	0.87	0.88	0.00	0.4
53.8	0.87	0.88	0.01	1.0
55.0	0.87	0.87	0.01	1.1
56.3	0.86	0.86	0.00	0.2
57.5	0.86	0.84	-0.02	-2.0
58.8	0.85	0.84	0.00	-0.5
60.0	0.84	0.84	-0.01	-1.0
61.3	0.84	0.83	-0.01	-1.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
62.5	0.84	0.82	-0.02	-2.6
63.8	0.84	0.81	-0.03	-3.2
65.0	0.82	0.81	-0.02	-1.9
66.3	0.82	0.80	-0.02	-2.0
67.5	0.82	0.80	-0.01	-1.4
68.8	0.81	0.80	-0.01	-1.3
70.0	0.80	0.80	0.00	-0.1
71.3	0.77	0.76	0.00	-0.4
72.5	0.75	0.76	0.01	1.1
73.8	0.73	0.76	0.03	3.7
75.0	0.72	0.75	0.03	3.6
76.3	0.72	0.73	0.01	1.6
77.5	0.71	0.72	0.01	0.7
78.8	0.71	0.71	0.00	0.5
80.0	0.69	0.69	0.00	0.0
81.3	0.68	0.69	0.01	1.4
82.5	0.65	0.66	0.01	1.4
83.8	0.63	0.64	0.00	0.2
85.0	0.61	0.63	0.01	2.4
86.3	0.60	0.58	-0.01	-2.0
87.5	0.51	0.52	0.01	2.1
88.8	0.50	0.52	0.01	2.9
90.0	0.48	0.48	0.00	-0.9
91.3	0.46	0.38	-0.09	-18.5
92.5	0.22	0.22	-0.01	-3.2
93.8	0.15	0.19	0.03	22.8
95.0	0.12	0.11	-0.01	-5.1
96.3	0.09	0.11	0.02	24.9
97.5	0.07	0.08	0.01	12.9
98.8	0.07	0.07	0.01	7.7
100.0	0.04	0.03	-0.01	-14.4
Min	0.04	0.03	-0.09	-18.5
Max	1.00	1.00	0.03	24.9
Mean	0.79	0.79	0.00	0.3
Median	0.88	0.88	0.00	-0.2
P.I.	Percent of time -- (-1.1<X<1.1)			62.5
1.1<=X<10.0				16.3
X>=10.0				3.8
-10.0<X<=-1.1				16.3
X<=-10.0				2.5

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
0.0	0.61	0.61	0.00	0.0
1.3	0.58	0.55	-0.03	-4.8
2.5	0.55	0.54	-0.01	-1.7
3.8	0.55	0.53	-0.02	-3.1
5.0	0.53	0.51	-0.02	-3.5
6.3	0.53	0.51	-0.02	-3.0
7.5	0.51	0.51	0.00	-0.8
8.8	0.51	0.50	-0.01	-2.0
10.0	0.50	0.49	-0.01	-2.3
11.3	0.49	0.49	0.00	-0.4
12.5	0.49	0.48	0.00	-0.7
13.8	0.49	0.47	-0.02	-3.2
15.0	0.47	0.47	0.00	-0.9
16.3	0.46	0.46	0.00	-0.2
17.5	0.46	0.46	0.00	-0.4
18.8	0.45	0.45	0.00	0.6
20.0	0.45	0.45	0.00	-0.1
21.3	0.45	0.44	-0.01	-1.3
22.5	0.45	0.44	-0.01	-2.1
23.8	0.44	0.44	0.00	0.1
25.0	0.43	0.42	-0.01	-2.5
26.3	0.43	0.42	-0.01	-2.3
27.5	0.43	0.41	-0.02	-4.0
28.8	0.42	0.41	-0.01	-3.2
30.0	0.41	0.41	0.00	-0.8
31.3	0.41	0.40	0.00	-0.6
32.5	0.40	0.40	0.00	-0.2
33.8	0.40	0.40	-0.01	-1.3
35.0	0.39	0.39	0.00	-0.5
36.3	0.39	0.39	0.00	-0.4
37.5	0.39	0.38	0.00	-0.9
38.8	0.38	0.38	0.00	-0.7
40.0	0.37	0.37	0.00	-0.1
41.3	0.37	0.37	0.00	0.3
42.5	0.37	0.37	0.00	0.1
43.8	0.36	0.37	0.00	0.2
45.0	0.36	0.35	0.00	-1.2
46.3	0.36	0.35	0.00	-0.9
47.5	0.35	0.35	0.00	-0.5
48.8	0.35	0.35	0.00	-1.1
50.0	0.35	0.35	0.00	-0.7
51.3	0.35	0.35	0.00	0.2
52.5	0.34	0.35	0.00	0.1
53.8	0.34	0.34	0.00	0.3
55.0	0.34	0.34	0.00	0.2
56.3	0.34	0.34	0.00	-0.6
57.5	0.34	0.33	0.00	-0.5
58.8	0.34	0.32	-0.01	-4.4
60.0	0.33	0.32	-0.01	-4.2
61.3	0.33	0.31	-0.02	-4.7

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
62.5	0.32	0.31	-0.02	-4.9
63.8	0.32	0.30	-0.02	-6.8
65.0	0.32	0.30	-0.02	-7.6
66.3	0.32	0.30	-0.02	-7.2
67.5	0.31	0.30	-0.02	-6.0
68.8	0.30	0.30	-0.01	-2.1
70.0	0.30	0.29	0.00	-0.8
71.3	0.30	0.29	0.00	-0.6
72.5	0.30	0.29	0.00	-0.6
73.8	0.30	0.29	0.00	-1.1
75.0	0.29	0.29	0.00	0.3
76.3	0.29	0.29	0.00	-0.1
77.5	0.29	0.29	0.00	1.0
78.8	0.28	0.29	0.00	1.2
80.0	0.28	0.29	0.00	1.3
81.3	0.28	0.29	0.00	1.0
82.5	0.28	0.28	0.00	0.3
83.8	0.28	0.28	0.00	1.4
85.0	0.28	0.28	0.00	1.5
86.3	0.27	0.28	0.00	1.6
87.5	0.26	0.26	0.01	2.6
88.8	0.26	0.26	0.00	1.7
90.0	0.24	0.26	0.01	5.5
91.3	0.24	0.24	0.00	-0.2
92.5	0.24	0.24	0.00	0.5
93.8	0.23	0.23	0.01	2.6
95.0	0.16	0.22	0.06	38.1
96.3	0.15	0.18	0.03	19.5
97.5	0.14	0.15	0.01	5.2
98.8	0.14	0.10	-0.04	-25.7
100.0	0.04	0.03	-0.01	-24.4
Min	0.04	0.03	-0.04	-25.7
Max	0.61	0.61	0.06	38.1
Mean	0.36	0.36	0.00	-0.8
Median	0.35	0.35	0.00	-0.6
P.I.	Percent of time -- (-1.1<X<1.1)			50.0
1.1<=X<10.0				12.5
X>=10.0				2.5
-10.0<X<=-1.1				33.8
X<=-10.0				2.5

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
0.0	0.37	0.39	0.01	3.6
1.3	0.37	0.39	0.01	3.9
2.5	0.37	0.39	0.01	3.7
3.8	0.37	0.39	0.01	4.0
5.0	0.37	0.39	0.02	4.2
6.3	0.37	0.38	0.01	3.7
7.5	0.37	0.38	0.02	4.2
8.8	0.37	0.38	0.01	3.0
10.0	0.37	0.38	0.01	3.0
11.3	0.37	0.38	0.01	2.9
12.5	0.36	0.38	0.01	3.3
13.8	0.36	0.38	0.01	3.3
15.0	0.36	0.37	0.01	2.8
16.3	0.36	0.37	0.01	3.7
17.5	0.36	0.37	0.01	3.0
18.8	0.36	0.37	0.01	2.8
20.0	0.35	0.36	0.01	2.9
21.3	0.35	0.36	0.01	2.4
22.5	0.35	0.36	0.01	3.4
23.8	0.34	0.35	0.01	2.9
25.0	0.34	0.35	0.01	3.3
26.3	0.34	0.35	0.01	4.1
27.5	0.33	0.34	0.01	2.8
28.8	0.33	0.34	0.01	2.7
30.0	0.33	0.34	0.01	2.9
31.3	0.33	0.34	0.01	3.1
32.5	0.33	0.33	0.01	2.2
33.8	0.31	0.33	0.01	4.7
35.0	0.31	0.32	0.01	3.1
36.3	0.30	0.31	0.01	1.8
37.5	0.30	0.31	0.01	2.8
38.8	0.30	0.31	0.01	2.8
40.0	0.29	0.30	0.01	2.8
41.3	0.29	0.30	0.01	2.2
42.5	0.29	0.29	0.01	1.8
43.8	0.28	0.28	0.01	2.3
45.0	0.28	0.28	0.01	2.8
46.3	0.27	0.28	0.01	3.0
47.5	0.27	0.28	0.01	2.7
48.8	0.27	0.28	0.01	1.8
50.0	0.27	0.28	0.01	2.0
51.3	0.27	0.28	0.01	2.3
52.5	0.27	0.27	0.00	1.0
53.8	0.26	0.27	0.00	0.8
55.0	0.26	0.26	0.00	0.9
56.3	0.26	0.26	0.01	2.9
57.5	0.25	0.26	0.01	3.0
58.8	0.25	0.26	0.01	2.1
60.0	0.25	0.26	0.00	1.9
61.3	0.25	0.25	0.00	-0.1

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
62.5	0.25	0.25	0.00	0.9
63.8	0.25	0.25	0.00	1.1
65.0	0.25	0.25	0.00	-1.1
66.3	0.24	0.25	0.00	0.5
67.5	0.24	0.25	0.00	1.8
68.8	0.24	0.24	0.00	1.3
70.0	0.24	0.24	0.00	1.8
71.3	0.24	0.24	0.00	2.0
72.5	0.24	0.24	0.00	1.6
73.8	0.24	0.24	0.00	1.7
75.0	0.24	0.24	0.00	1.4
76.3	0.24	0.24	0.00	1.7
77.5	0.24	0.24	0.00	1.3
78.8	0.23	0.24	0.00	1.2
80.0	0.23	0.23	0.00	0.6
81.3	0.23	0.23	0.01	2.2
82.5	0.23	0.23	0.01	2.8
83.8	0.23	0.23	0.00	1.9
85.0	0.23	0.23	0.00	0.8
86.3	0.22	0.22	0.00	0.5
87.5	0.22	0.22	0.00	0.3
88.8	0.22	0.22	0.00	-0.1
90.0	0.22	0.22	0.00	1.4
91.3	0.22	0.22	0.00	1.9
92.5	0.22	0.22	0.00	1.7
93.8	0.21	0.22	0.00	1.9
95.0	0.21	0.22	0.00	1.9
96.3	0.21	0.22	0.00	2.1
97.5	0.21	0.21	0.00	1.6
98.8	0.21	0.21	0.01	2.4
100.0	0.21	0.20	0.00	-1.0
Min	0.21	0.20	0.00	-1.1
Max	0.37	0.39	0.02	4.7
Mean	0.28	0.29	0.01	2.2
Median	0.27	0.28	0.01	2.2
P.I.	Percent of time -- (-1.1<X<1.1)			15.0
1.1<=X<10.0				85.0
X>=10.0				0.0
-10.0<X<=-1.1				1.3
X<=-10.0				0.0

Alternative A Compared to Existing Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
Existing Conditions	0.79	0.36	0.28
NODOS Alternative A	0.81	0.37	0.29
Difference	0.02	0.01	0.00
Percent Difference[3]	3	2	1
Water Year Types[2]			
Wet (32.5%)			
Existing Conditions	0.91	0.37	0.29
NODOS Alternative A	0.90	0.37	0.29
Difference	-0.01	0.00	0.00
Percent Difference	-1	1	1
Above Normal (12.5%)			
Existing Conditions	0.90	0.35	0.29
NODOS Alternative A	0.89	0.36	0.29
Difference	0.00	0.01	0.00
Percent Difference	0	3	1
Below Normal (17.5%)			
Existing Conditions	0.86	0.37	0.30
NODOS Alternative A	0.88	0.36	0.30
Difference	0.02	-0.01	0.01
Percent Difference	3	-2	2
Dry (22.5%)			
Existing Conditions	0.78	0.38	0.28
NODOS Alternative A	0.80	0.38	0.28
Difference	0.02	0.00	0.00
Percent Difference	3	-1	1
Critical (15%)			
Existing Conditions	0.36	0.31	0.26
NODOS Alternative A	0.48	0.37	0.26
Difference	0.11	0.06	0.00
Percent Difference	32	18	0

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

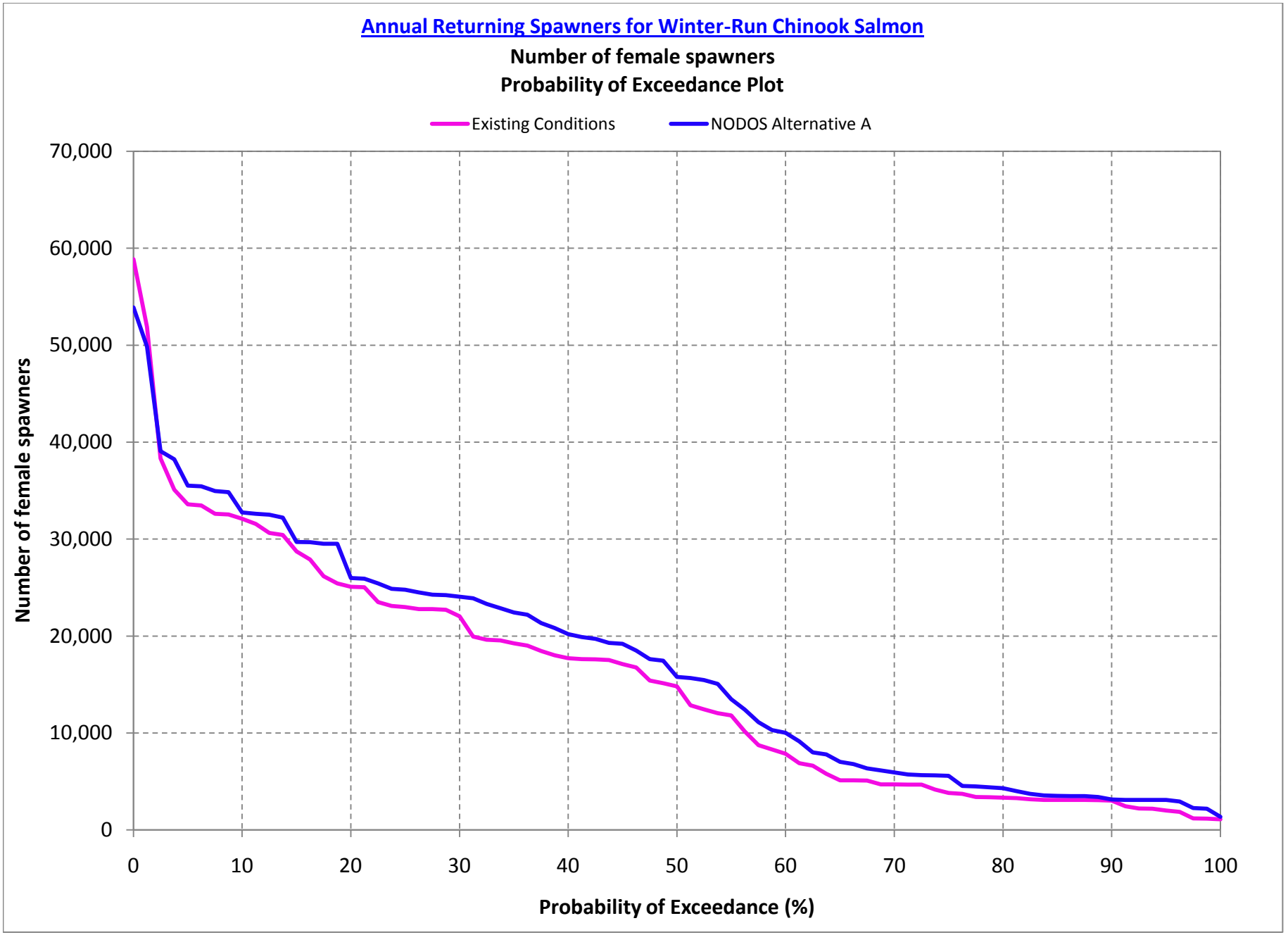
Long-term Average and Average by Water Year Type Annual Returning Spawners

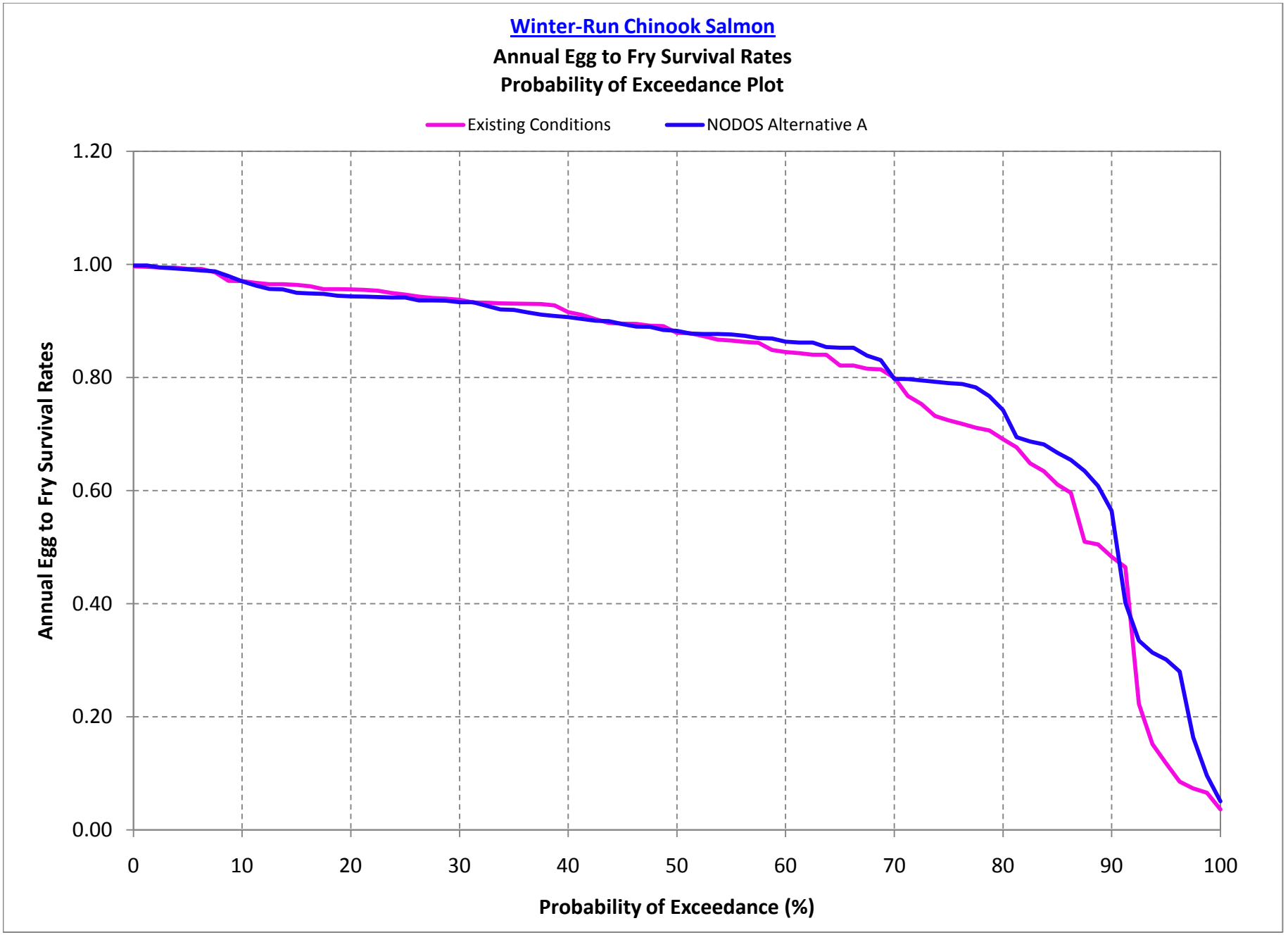
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
Existing Conditions	15,322
NODOS Alternative A	16,902
Difference	1,580
Percent Difference[3]	10
Water Year Types[2]	
Wet (32.5%)	
Existing Conditions	18,586
NODOS Alternative A	20,433
Difference	1,847
Percent Difference	10
Above Normal (12.5%)	
Existing Conditions	12,829
NODOS Alternative A	15,022
Difference	2,193
Percent Difference	17
Below Normal (17.5%)	
Existing Conditions	13,506
NODOS Alternative A	14,244
Difference	739
Percent Difference	5
Dry (22.5%)	
Existing Conditions	15,369
NODOS Alternative A	16,718
Difference	1,349
Percent Difference	9
Critical (15%)	
Existing Conditions	12,586
NODOS Alternative A	14,355
Difference	1,768
Percent Difference	14

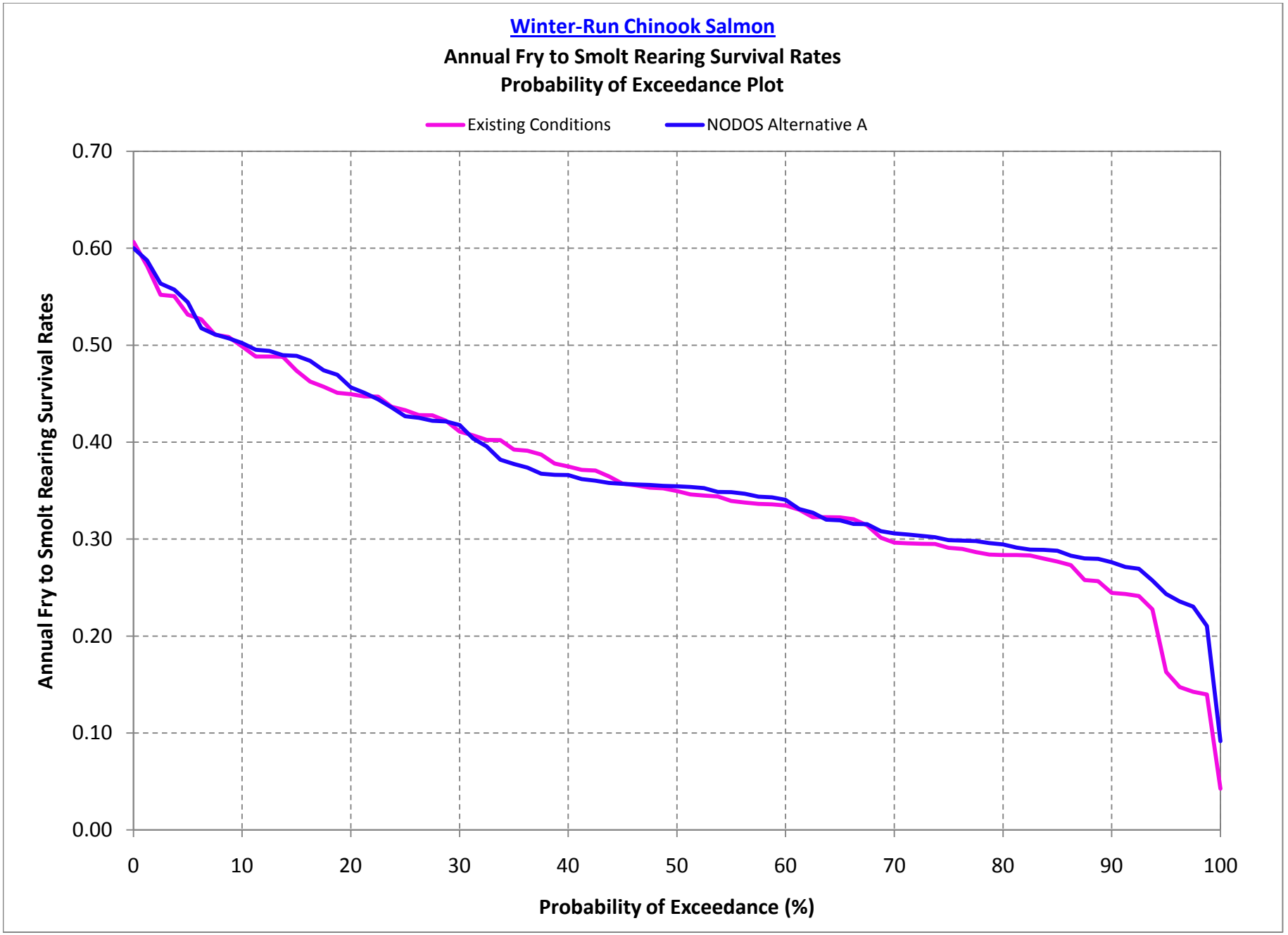
1 Based on the 80-year simulation period

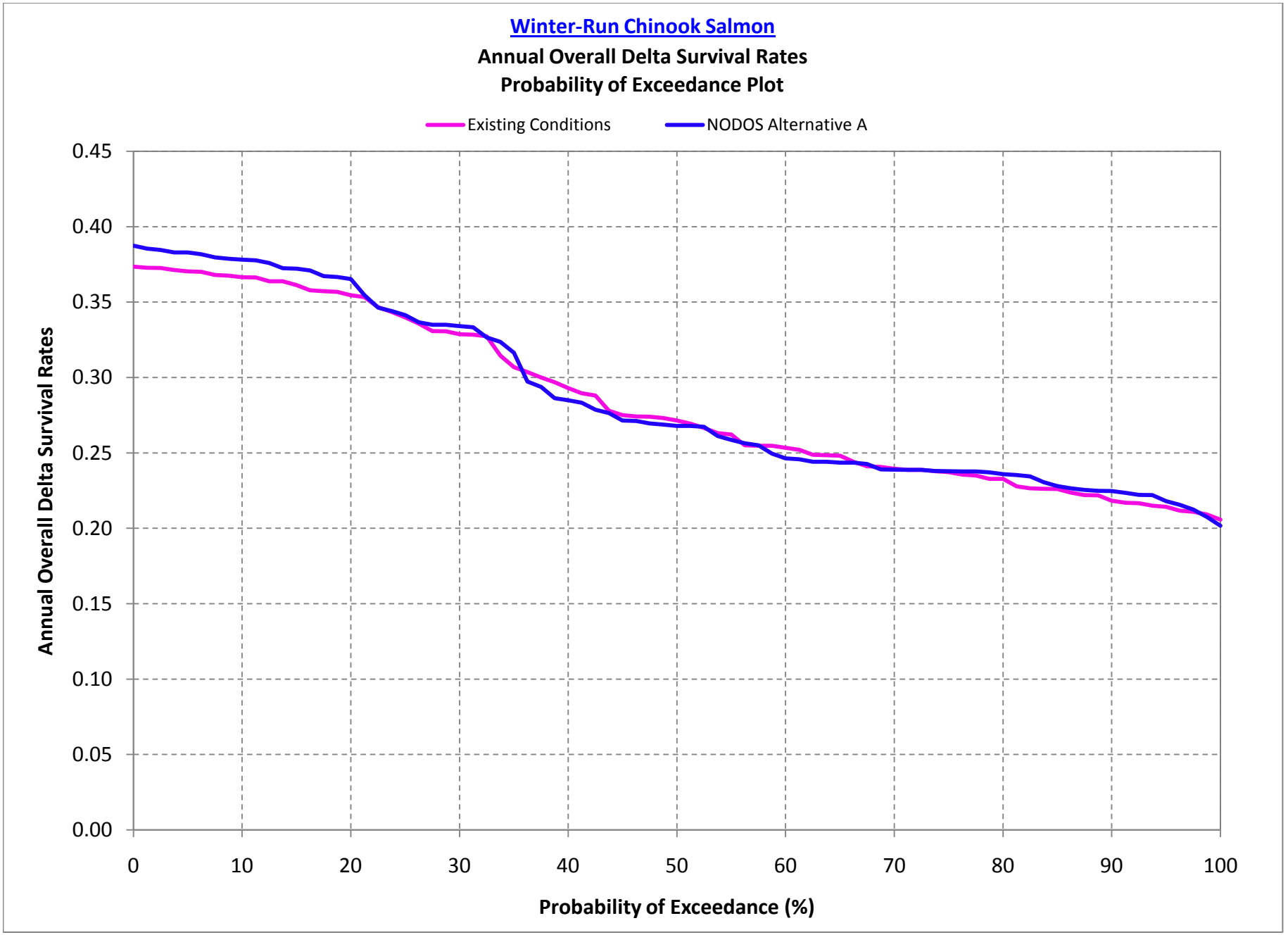
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative A (%)	Absolute Difference (%)	Relative Difference (%)
0.0	58,860	53,885	-4,975	-8.5
1.3	51,867	49,852	-2,015	-3.9
2.5	38,332	39,070	738	1.9
3.8	35,102	38,229	3,127	8.9
5.0	33,579	35,521	1,942	5.8
6.3	33,475	35,447	1,972	5.9
7.5	32,610	34,965	2,355	7.2
8.8	32,534	34,836	2,302	7.1
10.0	32,103	32,757	654	2.0
11.3	31,563	32,619	1,056	3.3
12.5	30,644	32,514	1,870	6.1
13.8	30,420	32,211	1,791	5.9
15.0	28,719	29,702	983	3.4
16.3	27,879	29,674	1,795	6.4
17.5	26,176	29,508	3,332	12.7
18.8	25,419	29,507	4,088	16.1
20.0	25,089	25,987	898	3.6
21.3	25,021	25,905	884	3.5
22.5	23,508	25,426	1,918	8.2
23.8	23,093	24,859	1,766	7.6
25.0	22,996	24,765	1,769	7.7
26.3	22,775	24,508	1,733	7.6
27.5	22,768	24,265	1,497	6.6
28.8	22,704	24,208	1,504	6.6
30.0	22,028	24,062	2,034	9.2
31.3	19,940	23,892	3,952	19.8
32.5	19,609	23,320	3,711	18.9
33.8	19,556	22,878	3,322	17.0
35.0	19,242	22,433	3,191	16.6
36.3	19,022	22,190	3,168	16.7
37.5	18,450	21,340	2,890	15.7
38.8	18,021	20,826	2,805	15.6
40.0	17,712	20,197	2,485	14.0
41.3	17,609	19,905	2,296	13.0
42.5	17,597	19,701	2,104	12.0
43.8	17,523	19,301	1,778	10.1
45.0	17,118	19,199	2,081	12.2
46.3	16,755	18,503	1,748	10.4
47.5	15,422	17,621	2,199	14.3
48.8	15,132	17,458	2,326	15.4
50.0	14,811	15,780	969	6.5
51.3	12,851	15,673	2,822	22.0
52.5	12,438	15,455	3,017	24.3
53.8	12,048	15,056	3,008	25.0
55.0	11,798	13,492	1,694	14.4
56.3	10,149	12,423	2,274	22.4
57.5	8,736	11,109	2,373	27.2
58.8	8,288	10,299	2,011	24.3
60.0	7,855	10,017	2,162	27.5
61.3	6,890	9,130	2,240	32.5

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative A (%)	Absolute Difference (%)	Relative Difference (%)
62.5	6,622	7,993	1,371	20.7
63.8	5,782	7,778	1,996	34.5
65.0	5,127	7,018	1,891	36.9
66.3	5,114	6,782	1,669	32.6
67.5	5,094	6,347	1,253	24.6
68.8	4,694	6,126	1,432	30.5
70.0	4,692	5,918	1,226	26.1
71.3	4,682	5,727	1,045	22.3
72.5	4,671	5,647	976	20.9
73.8	4,166	5,619	1,453	34.9
75.0	3,805	5,570	1,765	46.4
76.3	3,714	4,541	826	22.2
77.5	3,401	4,482	1,081	31.8
78.8	3,379	4,404	1,024	30.3
80.0	3,325	4,294	969	29.1
81.3	3,273	4,005	732	22.3
82.5	3,165	3,728	563	17.8
83.8	3,088	3,548	460	14.9
85.0	3,088	3,507	420	13.6
86.3	3,088	3,497	409	13.3
87.5	3,088	3,488	400	13.0
88.8	3,064	3,395	331	10.8
90.0	3,012	3,130	117	3.9
91.3	2,454	3,088	634	25.8
92.5	2,210	3,088	877	39.7
93.8	2,191	3,088	896	40.9
95.0	1,991	3,088	1,097	55.1
96.3	1,859	2,925	1,066	57.3
97.5	1,195	2,263	1,068	89.3
98.8	1,160	2,188	1,029	88.7
100.0	1,092	1,348	256	23.4
Min	1,092	1,348	-4,975	-8.5
Max	58,860	53,885	4,088	89.3
Mean	15,322	16,902	1,580	19.3
Median	14,811	15,780	1,733	15.6
P.I.	Percent of time -- (-1.1<X<1.1)			0.0
1.1<=X<10.0				28.8
X>=10.0				70.0
-10.0<X<=-1.1				2.5
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	0.1
1.3	1.00	1.00	0.00	0.2
2.5	0.99	0.99	0.00	0.0
3.8	0.99	0.99	0.00	-0.1
5.0	0.99	0.99	0.00	-0.1
6.3	0.99	0.99	0.00	-0.3
7.5	0.99	0.99	0.00	0.2
8.8	0.97	0.98	0.01	0.8
10.0	0.97	0.97	0.00	0.0
11.3	0.97	0.96	0.00	-0.5
12.5	0.97	0.96	-0.01	-0.9
13.8	0.96	0.96	-0.01	-0.9
15.0	0.96	0.95	-0.01	-1.5
16.3	0.96	0.95	-0.01	-1.3
17.5	0.96	0.95	-0.01	-0.9
18.8	0.96	0.94	-0.01	-1.2
20.0	0.96	0.94	-0.01	-1.3
21.3	0.96	0.94	-0.01	-1.3
22.5	0.95	0.94	-0.01	-1.2
23.8	0.95	0.94	-0.01	-0.8
25.0	0.95	0.94	-0.01	-0.5
26.3	0.94	0.94	-0.01	-0.7
27.5	0.94	0.94	0.00	-0.5
28.8	0.94	0.94	0.00	-0.4
30.0	0.94	0.93	0.00	-0.5
31.3	0.93	0.93	0.00	0.0
32.5	0.93	0.93	-0.01	-0.6
33.8	0.93	0.92	-0.01	-1.2
35.0	0.93	0.92	-0.01	-1.2
36.3	0.93	0.92	-0.02	-1.6
37.5	0.93	0.91	-0.02	-2.0
38.8	0.93	0.91	-0.02	-2.0
40.0	0.92	0.91	-0.01	-1.0
41.3	0.91	0.90	-0.01	-0.8
42.5	0.90	0.90	0.00	-0.3
43.8	0.90	0.90	0.00	0.4
45.0	0.90	0.89	0.00	-0.1
46.3	0.89	0.89	0.00	-0.5
47.5	0.89	0.89	0.00	-0.2
48.8	0.89	0.88	-0.01	-0.8
50.0	0.88	0.88	0.00	0.4
51.3	0.88	0.88	0.00	-0.1
52.5	0.87	0.88	0.00	0.5
53.8	0.87	0.88	0.01	1.2
55.0	0.87	0.88	0.01	1.2
56.3	0.86	0.87	0.01	1.3
57.5	0.86	0.87	0.01	1.0
58.8	0.85	0.87	0.02	2.4
60.0	0.84	0.86	0.02	2.2
61.3	0.84	0.86	0.02	2.2

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.84	0.86	0.02	2.5
63.8	0.84	0.85	0.01	1.6
65.0	0.82	0.85	0.03	3.8
66.3	0.82	0.85	0.03	3.9
67.5	0.82	0.84	0.02	2.8
68.8	0.81	0.83	0.02	2.0
70.0	0.80	0.80	0.00	-0.3
71.3	0.77	0.80	0.03	3.9
72.5	0.75	0.79	0.04	5.6
73.8	0.73	0.79	0.06	8.3
75.0	0.72	0.79	0.07	9.1
76.3	0.72	0.79	0.07	9.8
77.5	0.71	0.78	0.07	10.0
78.8	0.71	0.77	0.06	8.6
80.0	0.69	0.74	0.05	7.4
81.3	0.68	0.69	0.02	2.6
82.5	0.65	0.69	0.04	6.0
83.8	0.63	0.68	0.05	7.5
85.0	0.61	0.67	0.06	9.1
86.3	0.60	0.65	0.06	9.7
87.5	0.51	0.63	0.13	24.6
88.8	0.50	0.61	0.10	20.4
90.0	0.48	0.56	0.08	16.8
91.3	0.46	0.40	-0.06	-13.5
92.5	0.22	0.33	0.11	50.4
93.8	0.15	0.31	0.16	106.8
95.0	0.12	0.30	0.18	156.2
96.3	0.09	0.28	0.19	227.7
97.5	0.07	0.16	0.09	123.4
98.8	0.07	0.10	0.03	46.2
100.0	0.04	0.05	0.01	39.0
Min	0.04	0.05	-0.06	-13.5
Max	1.00	1.00	0.19	227.7
Mean	0.79	0.81	0.02	11.1
Median	0.88	0.88	0.00	0.2
P.I.	Percent of time -- (-1.1<X<1.1)			42.5
1.1<=X<10.0				30.0
X>=10.0				13.8
-10.0<X<=-1.1				13.8
X<=-10.0				1.3

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.61	0.60	-0.01	-1.1
1.3	0.58	0.59	0.01	0.9
2.5	0.55	0.56	0.01	2.1
3.8	0.55	0.56	0.01	1.2
5.0	0.53	0.54	0.01	2.4
6.3	0.53	0.52	-0.01	-1.7
7.5	0.51	0.51	0.00	0.1
8.8	0.51	0.51	0.00	-0.3
10.0	0.50	0.50	0.00	0.7
11.3	0.49	0.50	0.01	1.4
12.5	0.49	0.49	0.01	1.2
13.8	0.49	0.49	0.00	0.3
15.0	0.47	0.49	0.02	3.3
16.3	0.46	0.48	0.02	4.6
17.5	0.46	0.47	0.02	3.7
18.8	0.45	0.47	0.02	4.1
20.0	0.45	0.46	0.01	1.5
21.3	0.45	0.45	0.00	0.8
22.5	0.45	0.44	0.00	-0.6
23.8	0.44	0.44	0.00	-0.2
25.0	0.43	0.43	-0.01	-1.4
26.3	0.43	0.43	0.00	-0.7
27.5	0.43	0.42	-0.01	-1.3
28.8	0.42	0.42	0.00	-0.2
30.0	0.41	0.42	0.01	1.6
31.3	0.41	0.40	0.00	-0.8
32.5	0.40	0.40	-0.01	-1.7
33.8	0.40	0.38	-0.02	-5.1
35.0	0.39	0.38	-0.01	-3.8
36.3	0.39	0.37	-0.02	-4.5
37.5	0.39	0.37	-0.02	-5.1
38.8	0.38	0.37	-0.01	-3.1
40.0	0.37	0.37	-0.01	-2.4
41.3	0.37	0.36	-0.01	-2.6
42.5	0.37	0.36	-0.01	-2.8
43.8	0.36	0.36	-0.01	-1.8
45.0	0.36	0.36	0.00	0.0
46.3	0.36	0.36	0.00	0.3
47.5	0.35	0.36	0.00	0.8
48.8	0.35	0.36	0.00	0.8
50.0	0.35	0.35	0.00	1.4
51.3	0.35	0.35	0.01	2.2
52.5	0.34	0.35	0.01	2.3
53.8	0.34	0.35	0.00	1.3
55.0	0.34	0.35	0.01	2.7
56.3	0.34	0.35	0.01	2.7
57.5	0.34	0.34	0.01	2.2
58.8	0.34	0.34	0.01	2.2
60.0	0.33	0.34	0.01	1.7
61.3	0.33	0.33	0.00	0.2

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.32	0.33	0.00	1.4
63.8	0.32	0.32	0.00	-0.8
65.0	0.32	0.32	0.00	-1.0
66.3	0.32	0.32	0.00	-1.5
67.5	0.31	0.32	0.00	0.4
68.8	0.30	0.31	0.01	2.3
70.0	0.30	0.31	0.01	3.2
71.3	0.30	0.30	0.01	3.1
72.5	0.30	0.30	0.01	2.7
73.8	0.30	0.30	0.01	2.3
75.0	0.29	0.30	0.01	2.7
76.3	0.29	0.30	0.01	3.0
77.5	0.29	0.30	0.01	4.0
78.8	0.28	0.30	0.01	4.1
80.0	0.28	0.29	0.01	3.8
81.3	0.28	0.29	0.01	2.7
82.5	0.28	0.29	0.01	2.1
83.8	0.28	0.29	0.01	3.3
85.0	0.28	0.29	0.01	4.1
86.3	0.27	0.28	0.01	3.6
87.5	0.26	0.28	0.02	8.7
88.8	0.26	0.28	0.02	9.0
90.0	0.24	0.28	0.03	13.0
91.3	0.24	0.27	0.03	11.4
92.5	0.24	0.27	0.03	11.6
93.8	0.23	0.26	0.03	13.1
95.0	0.16	0.24	0.08	49.4
96.3	0.15	0.24	0.09	60.1
97.5	0.14	0.23	0.09	61.5
98.8	0.14	0.21	0.07	50.5
100.0	0.04	0.09	0.05	115.6
Min	0.04	0.09	-0.02	-5.1
Max	0.61	0.60	0.09	115.6
Mean	0.36	0.37	0.01	5.7
Median	0.35	0.35	0.01	1.5
P.I.	Percent of time -- (-1.1<X<1.1)			23.8
1.1<=X<10.0				47.5
X>=10.0				11.3
-10.0<X<=-1.1				18.8
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.37	0.39	0.01	3.7
1.3	0.37	0.39	0.01	3.4
2.5	0.37	0.38	0.01	3.2
3.8	0.37	0.38	0.01	3.1
5.0	0.37	0.38	0.01	3.4
6.3	0.37	0.38	0.01	3.2
7.5	0.37	0.38	0.01	3.2
8.8	0.37	0.38	0.01	3.1
10.0	0.37	0.38	0.01	3.2
11.3	0.37	0.38	0.01	3.1
12.5	0.36	0.38	0.01	3.3
13.8	0.36	0.37	0.01	2.4
15.0	0.36	0.37	0.01	3.0
16.3	0.36	0.37	0.01	3.7
17.5	0.36	0.37	0.01	2.8
18.8	0.36	0.37	0.01	2.8
20.0	0.35	0.37	0.01	3.0
21.3	0.35	0.35	0.00	0.4
22.5	0.35	0.35	0.00	-0.1
23.8	0.34	0.34	0.00	0.2
25.0	0.34	0.34	0.00	0.5
26.3	0.34	0.34	0.00	0.2
27.5	0.33	0.34	0.00	1.3
28.8	0.33	0.34	0.00	1.3
30.0	0.33	0.33	0.01	1.6
31.3	0.33	0.33	0.00	1.5
32.5	0.33	0.33	0.00	-0.2
33.8	0.31	0.32	0.01	2.9
35.0	0.31	0.32	0.01	3.1
36.3	0.30	0.30	-0.01	-2.1
37.5	0.30	0.29	-0.01	-2.1
38.8	0.30	0.29	-0.01	-3.6
40.0	0.29	0.28	-0.01	-2.7
41.3	0.29	0.28	-0.01	-2.2
42.5	0.29	0.28	-0.01	-3.3
43.8	0.28	0.28	0.00	-0.6
45.0	0.28	0.27	0.00	-1.3
46.3	0.27	0.27	0.00	-1.1
47.5	0.27	0.27	0.00	-1.7
48.8	0.27	0.27	0.00	-1.6
50.0	0.27	0.27	0.00	-1.3
51.3	0.27	0.27	0.00	-0.6
52.5	0.27	0.27	0.00	0.3
53.8	0.26	0.26	0.00	-0.8
55.0	0.26	0.26	0.00	-1.4
56.3	0.26	0.26	0.00	0.5
57.5	0.25	0.26	0.00	0.1
58.8	0.25	0.25	-0.01	-2.0
60.0	0.25	0.25	-0.01	-2.8
61.3	0.25	0.25	-0.01	-2.5

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.25	0.24	0.00	-1.9
63.8	0.25	0.24	0.00	-1.7
65.0	0.25	0.24	0.00	-1.9
66.3	0.24	0.24	0.00	-0.3
67.5	0.24	0.24	0.00	0.7
68.8	0.24	0.24	0.00	-0.7
70.0	0.24	0.24	0.00	-0.3
71.3	0.24	0.24	0.00	0.0
72.5	0.24	0.24	0.00	0.0
73.8	0.24	0.24	0.00	0.1
75.0	0.24	0.24	0.00	0.3
76.3	0.24	0.24	0.00	0.9
77.5	0.24	0.24	0.00	1.2
78.8	0.23	0.24	0.00	1.8
80.0	0.23	0.24	0.00	1.3
81.3	0.23	0.24	0.01	3.3
82.5	0.23	0.23	0.01	3.5
83.8	0.23	0.23	0.00	1.9
85.0	0.23	0.23	0.00	0.8
86.3	0.22	0.23	0.00	1.2
87.5	0.22	0.23	0.00	1.5
88.8	0.22	0.22	0.00	1.3
90.0	0.22	0.22	0.01	2.9
91.3	0.22	0.22	0.01	3.0
92.5	0.22	0.22	0.01	2.6
93.8	0.21	0.22	0.01	3.3
95.0	0.21	0.22	0.00	1.8
96.3	0.21	0.22	0.00	1.8
97.5	0.21	0.21	0.00	0.7
98.8	0.21	0.21	0.00	-0.8
100.0	0.21	0.20	0.00	-1.9
Min	0.21	0.20	-0.01	-3.6
Max	0.37	0.39	0.01	3.7
Mean	0.28	0.29	0.00	0.7
Median	0.27	0.27	0.00	0.7
P.I.	Percent of time -- (-1.1<X<1.1)			30.0
1.1<=X<10.0				47.5
X>=10.0				0.0
-10.0<X<=-1.1				23.8
X<=-10.0				0.0

Alternative A Compared to No Action Alternative Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
No Action Alternative	0.79	0.36	0.29
NODOS Alternative A	0.81	0.37	0.29
Difference	0.02	0.01	0.00
Percent Difference[3]	3	4	-1
Water Year Types[2]			
Wet (32.5%)			
BST NAA (070510)	0.91	0.36	0.30
NODOS ALT A (020811)	0.90	0.37	0.29
Difference	-0.01	0.01	0.00
Percent Difference	-1	3	-1
Above Normal (12.5%)			
BST NAA (070510)	0.90	0.34	0.30
NODOS ALT A (020811)	0.89	0.36	0.29
Difference	-0.01	0.01	0.00
Percent Difference	-1	4	-2
Below Normal (17.5%)			
BST NAA (070510)	0.86	0.36	0.31
NODOS ALT A (020811)	0.88	0.36	0.30
Difference	0.02	0.00	0.00
Percent Difference	3	0	-1
Dry (22.5%)			
BST NAA (070510)	0.76	0.38	0.29
NODOS ALT A (020811)	0.80	0.38	0.28
Difference	0.04	0.00	0.00
Percent Difference	5	0	-1
Critical (15%)			
BST NAA (070510)	0.38	0.32	0.26
NODOS ALT A (020811)	0.48	0.37	0.26
Difference	0.10	0.05	-0.01
Percent Difference	26	16	-3

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

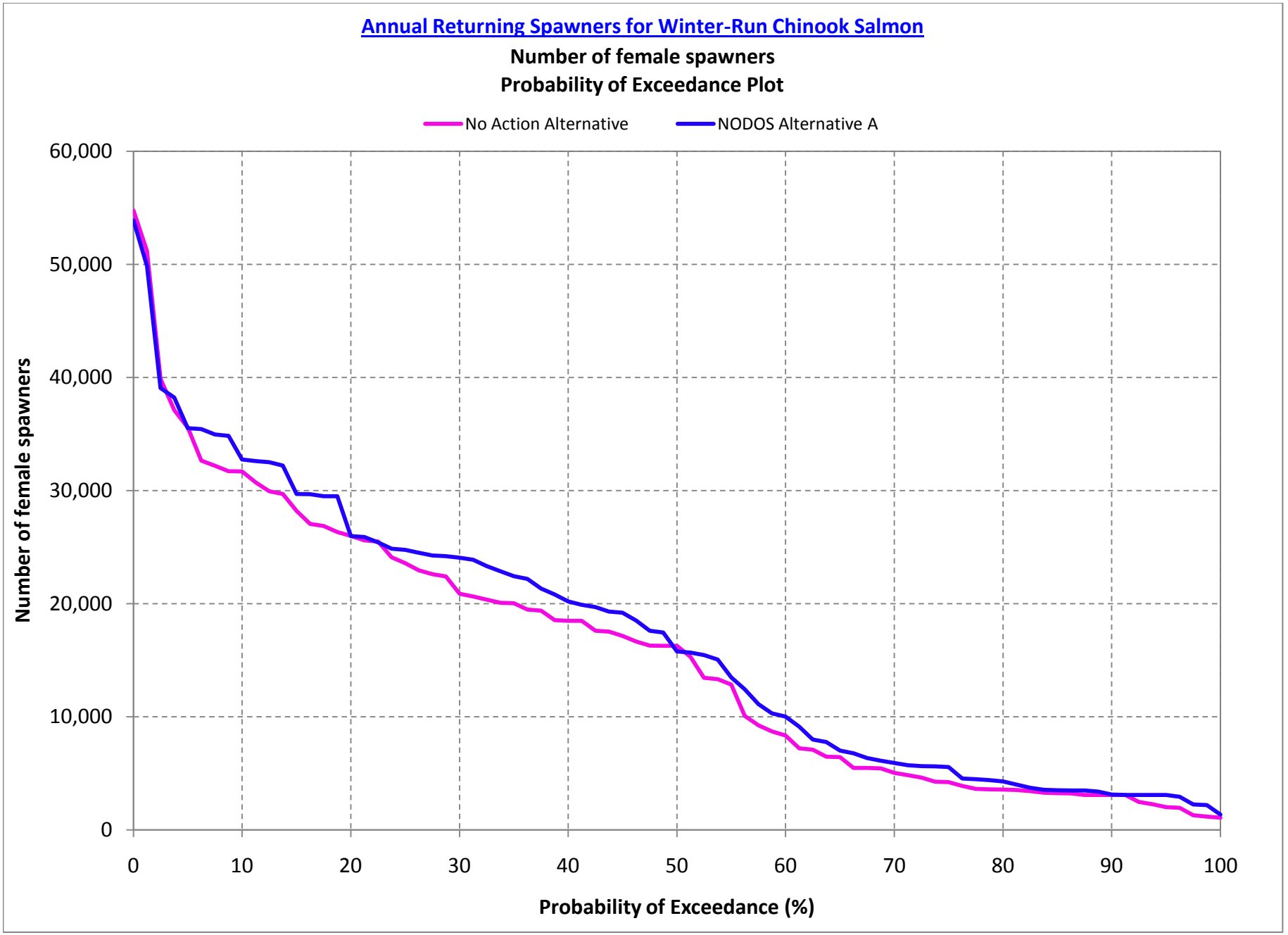
Long-term Average and Average by Water Year Type Annual Returning Spawners

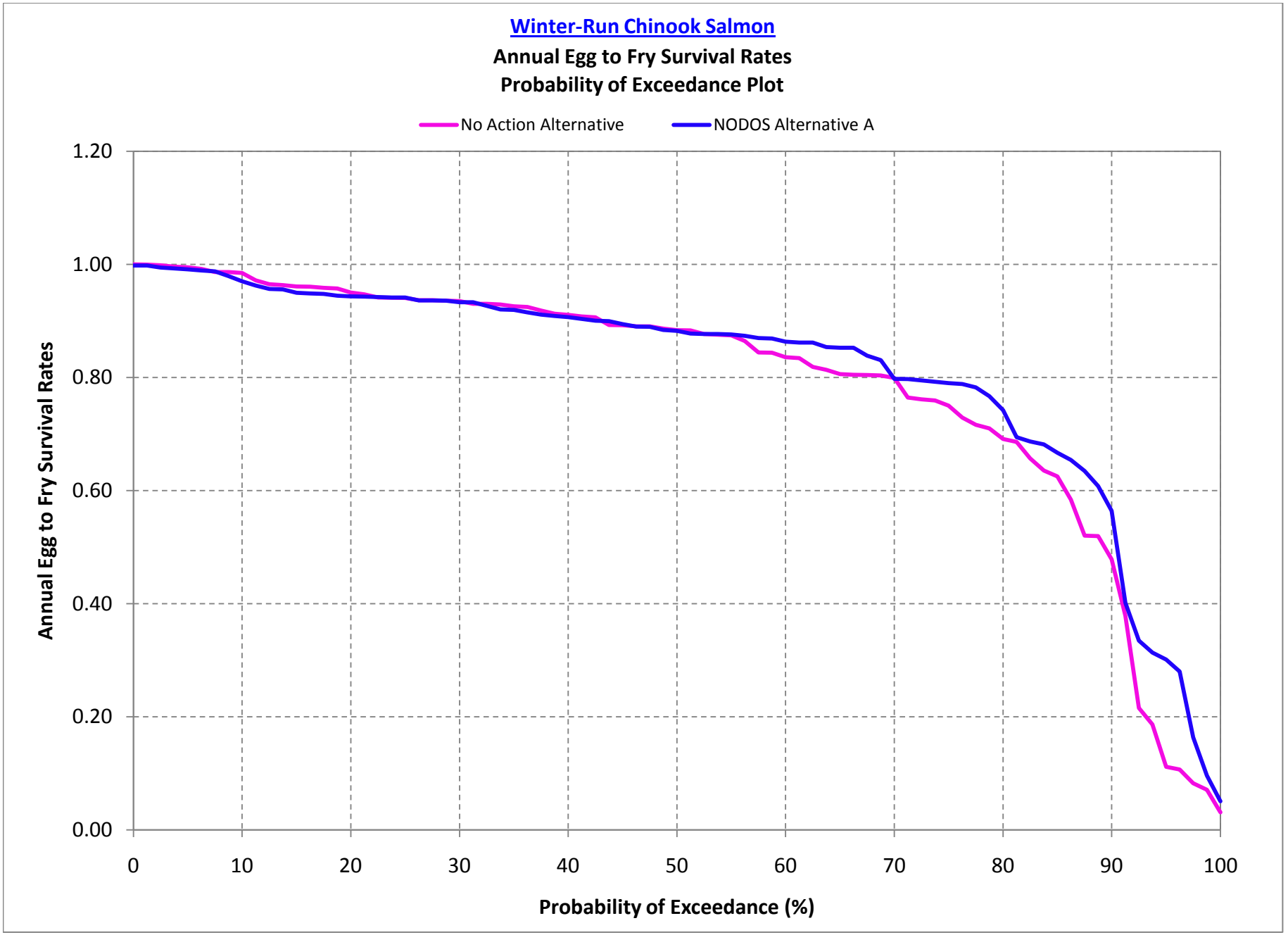
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
No Action Alternative	15,636
NODOS Alternative A	16,902
Difference	1,266
Percent Difference[3]	8
Water Year Types[2]	
Wet (32.5%)	
BST NAA (070510)	18,717
NODOS ALT A (020811)	20,433
Difference	1,716
Percent Difference	9
Above Normal (12.5%)	
BST NAA (070510)	13,331
NODOS ALT A (020811)	15,022
Difference	1,692
Percent Difference	13
Below Normal (17.5%)	
BST NAA (070510)	14,002
NODOS ALT A (020811)	14,244
Difference	242
Percent Difference	2
Dry (22.5%)	
BST NAA (070510)	15,604
NODOS ALT A (020811)	16,718
Difference	1,113
Percent Difference	7
Critical (15%)	
BST NAA (070510)	13,030
NODOS ALT A (020811)	14,355
Difference	1,325
Percent Difference	10

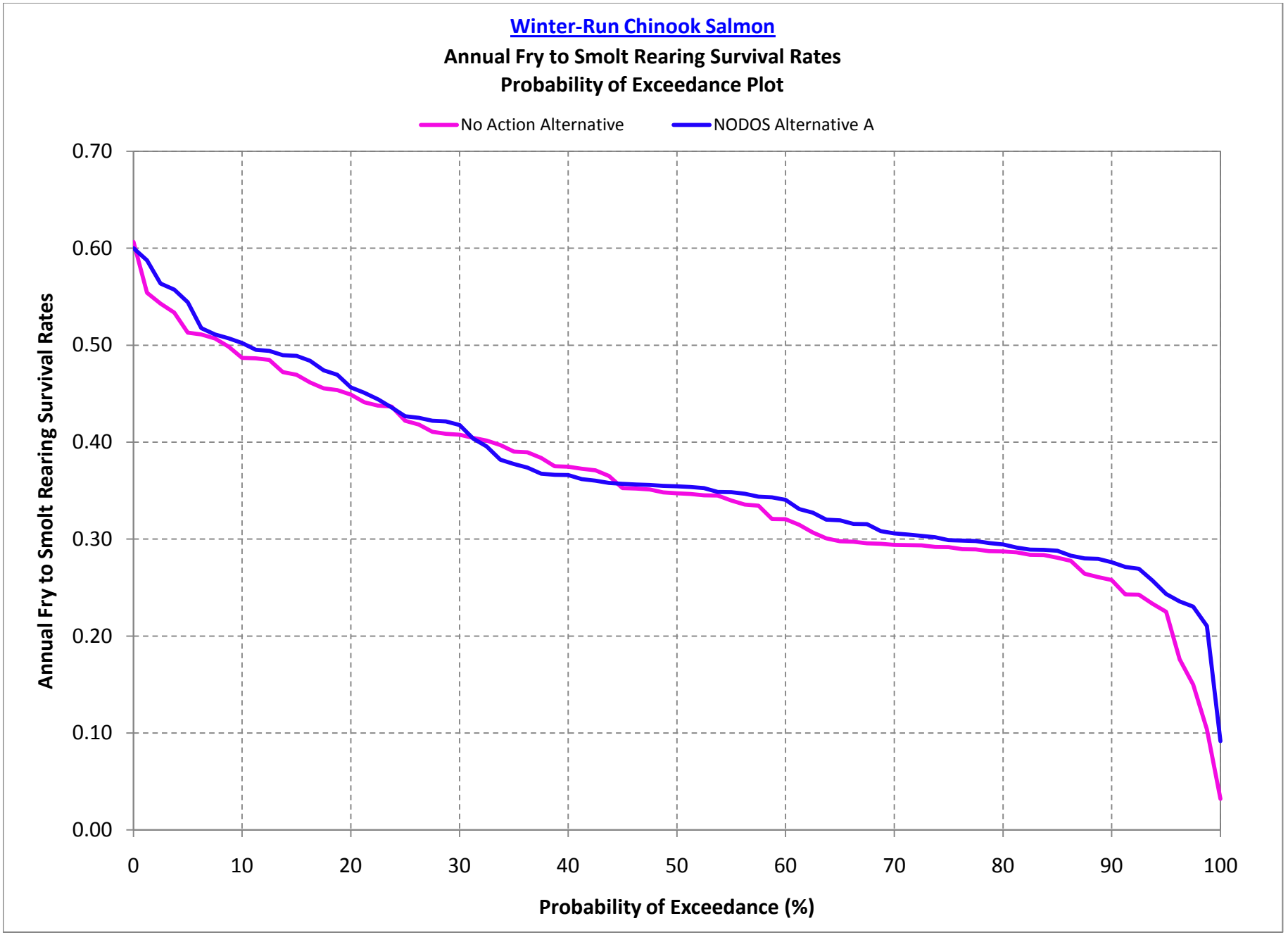
1 Based on the 80-year simulation period

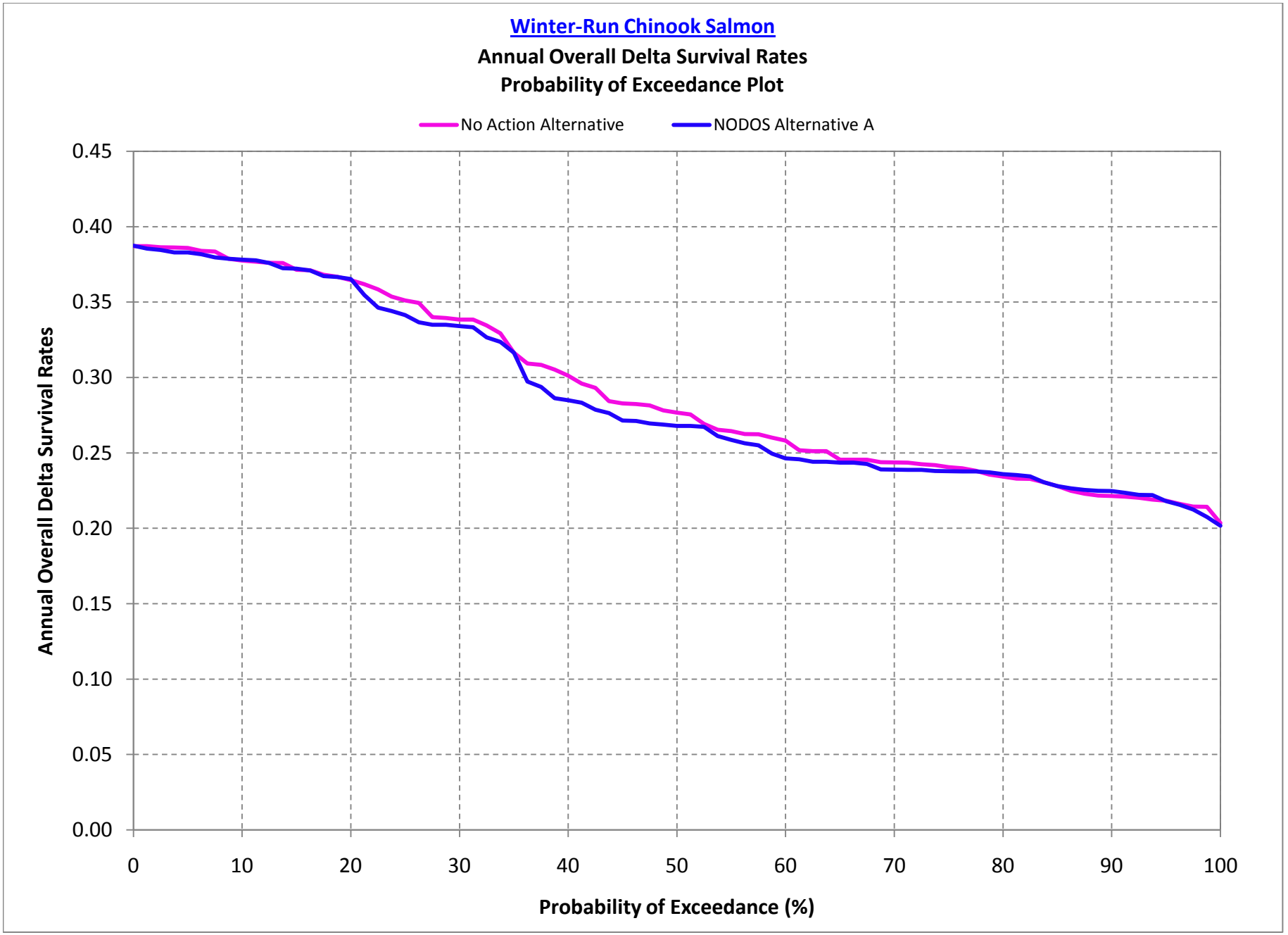
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative A (%)	Absolute Difference (%)	Relative Difference (%)
0.0	54,752	53,885	-867	-1.6
1.3	51,177	49,852	-1,325	-2.6
2.5	39,882	39,070	-812	-2.0
3.8	37,103	38,229	1,126	3.0
5.0	35,571	35,521	-50	-0.1
6.3	32,659	35,447	2,788	8.5
7.5	32,197	34,965	2,768	8.6
8.8	31,724	34,836	3,112	9.8
10.0	31,697	32,757	1,060	3.3
11.3	30,728	32,619	1,891	6.2
12.5	29,946	32,514	2,568	8.6
13.8	29,705	32,211	2,506	8.4
15.0	28,202	29,702	1,500	5.3
16.3	27,063	29,674	2,611	9.6
17.5	26,870	29,508	2,638	9.8
18.8	26,345	29,507	3,162	12.0
20.0	26,001	25,987	-14	-0.1
21.3	25,608	25,905	297	1.2
22.5	25,492	25,426	-66	-0.3
23.8	24,110	24,859	749	3.1
25.0	23,586	24,765	1,179	5.0
26.3	22,947	24,508	1,561	6.8
27.5	22,610	24,265	1,655	7.3
28.8	22,406	24,208	1,802	8.0
30.0	20,875	24,062	3,187	15.3
31.3	20,642	23,892	3,250	15.7
32.5	20,366	23,320	2,954	14.5
33.8	20,091	22,878	2,787	13.9
35.0	20,041	22,433	2,392	11.9
36.3	19,476	22,190	2,714	13.9
37.5	19,386	21,340	1,954	10.1
38.8	18,557	20,826	2,269	12.2
40.0	18,497	20,197	1,700	9.2
41.3	18,484	19,905	1,421	7.7
42.5	17,617	19,701	2,084	11.8
43.8	17,541	19,301	1,760	10.0
45.0	17,151	19,199	2,048	11.9
46.3	16,652	18,503	1,851	11.1
47.5	16,296	17,621	1,325	8.1
48.8	16,282	17,458	1,176	7.2
50.0	16,278	15,780	-498	-3.1
51.3	15,297	15,673	376	2.5
52.5	13,439	15,455	2,016	15.0
53.8	13,334	15,056	1,722	12.9
55.0	12,845	13,492	647	5.0
56.3	10,085	12,423	2,338	23.2
57.5	9,235	11,109	1,874	20.3
58.8	8,704	10,299	1,595	18.3
60.0	8,351	10,017	1,667	20.0
61.3	7,208	9,130	1,922	26.7

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative A (%)	Absolute Difference (%)	Relative Difference (%)
62.5	7,096	7,993	897	12.6
63.8	6,478	7,778	1,300	20.1
65.0	6,437	7,018	581	9.0
66.3	5,485	6,782	1,297	23.6
67.5	5,470	6,347	877	16.0
68.8	5,443	6,126	684	12.6
70.0	5,040	5,918	878	17.4
71.3	4,837	5,727	890	18.4
72.5	4,633	5,647	1,014	21.9
73.8	4,263	5,619	1,356	31.8
75.0	4,231	5,570	1,339	31.6
76.3	3,895	4,541	646	16.6
77.5	3,629	4,482	853	23.5
78.8	3,589	4,404	815	22.7
80.0	3,568	4,294	725	20.3
81.3	3,520	4,005	485	13.8
82.5	3,437	3,728	291	8.5
83.8	3,295	3,548	253	7.7
85.0	3,252	3,507	256	7.9
86.3	3,224	3,497	273	8.5
87.5	3,088	3,488	400	13.0
88.8	3,088	3,395	307	9.9
90.0	3,088	3,130	42	1.4
91.3	3,088	3,088	0	0.0
92.5	2,467	3,088	621	25.2
93.8	2,278	3,088	810	35.5
95.0	2,008	3,088	1,080	53.8
96.3	1,954	2,925	970	49.7
97.5	1,302	2,263	961	73.8
98.8	1,172	2,188	1,016	86.7
100.0	1,086	1,348	262	24.1
Min	1,086	1,348	-1,325	-3.1
Max	54,752	53,885	3,250	86.7
Mean	15,636	16,902	1,266	14.3
Median	16,278	15,780	1,176	11.1
P.I.	Percent of time -- (-1.1<X<1.1)			5.0
1.1<=X<10.0				37.5
X>=10.0				53.8
-10.0<X<=-1.1				5.0
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	-0.2
1.3	1.00	1.00	0.00	-0.2
2.5	1.00	0.99	0.00	-0.4
3.8	1.00	0.99	0.00	-0.3
5.0	0.99	0.99	0.00	-0.4
6.3	0.99	0.99	0.00	-0.3
7.5	0.99	0.99	0.00	0.1
8.8	0.99	0.98	-0.01	-0.7
10.0	0.98	0.97	-0.01	-1.5
11.3	0.97	0.96	-0.01	-0.9
12.5	0.97	0.96	-0.01	-0.9
13.8	0.96	0.96	-0.01	-0.8
15.0	0.96	0.95	-0.01	-1.2
16.3	0.96	0.95	-0.01	-1.3
17.5	0.96	0.95	-0.01	-1.1
18.8	0.96	0.94	-0.01	-1.3
20.0	0.95	0.94	-0.01	-0.7
21.3	0.95	0.94	0.00	-0.4
22.5	0.94	0.94	0.00	0.1
23.8	0.94	0.94	0.00	0.0
25.0	0.94	0.94	0.00	0.1
26.3	0.94	0.94	0.00	-0.1
27.5	0.94	0.94	0.00	-0.1
28.8	0.94	0.94	0.00	0.0
30.0	0.94	0.93	0.00	-0.2
31.3	0.93	0.93	0.00	0.3
32.5	0.93	0.93	0.00	-0.4
33.8	0.93	0.92	-0.01	-1.0
35.0	0.93	0.92	-0.01	-0.7
36.3	0.92	0.92	-0.01	-1.0
37.5	0.92	0.91	-0.01	-0.8
38.8	0.91	0.91	0.00	-0.4
40.0	0.91	0.91	0.00	-0.4
41.3	0.91	0.90	0.00	-0.5
42.5	0.91	0.90	-0.01	-0.7
43.8	0.89	0.90	0.01	0.7
45.0	0.89	0.89	0.00	0.2
46.3	0.89	0.89	0.00	-0.1
47.5	0.89	0.89	0.00	-0.1
48.8	0.89	0.88	0.00	-0.2
50.0	0.88	0.88	0.00	-0.1
51.3	0.88	0.88	-0.01	-0.6
52.5	0.88	0.88	0.00	0.0
53.8	0.88	0.88	0.00	0.1
55.0	0.87	0.88	0.00	0.2
56.3	0.86	0.87	0.01	1.1
57.5	0.84	0.87	0.03	3.0
58.8	0.84	0.87	0.03	3.0
60.0	0.84	0.86	0.03	3.3
61.3	0.83	0.86	0.03	3.3

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.82	0.86	0.04	5.3
63.8	0.81	0.85	0.04	5.0
65.0	0.81	0.85	0.05	5.8
66.3	0.80	0.85	0.05	6.0
67.5	0.80	0.84	0.03	4.3
68.8	0.80	0.83	0.03	3.4
70.0	0.80	0.80	0.00	-0.2
71.3	0.76	0.80	0.03	4.3
72.5	0.76	0.79	0.03	4.4
73.8	0.76	0.79	0.03	4.4
75.0	0.75	0.79	0.04	5.3
76.3	0.73	0.79	0.06	8.1
77.5	0.72	0.78	0.07	9.2
78.8	0.71	0.77	0.06	8.0
80.0	0.69	0.74	0.05	7.4
81.3	0.69	0.69	0.01	1.2
82.5	0.66	0.69	0.03	4.5
83.8	0.64	0.68	0.05	7.3
85.0	0.63	0.67	0.04	6.6
86.3	0.58	0.65	0.07	12.0
87.5	0.52	0.63	0.11	22.0
88.8	0.52	0.61	0.09	17.0
90.0	0.48	0.56	0.09	17.9
91.3	0.38	0.40	0.02	6.1
92.5	0.22	0.33	0.12	55.3
93.8	0.19	0.31	0.13	68.3
95.0	0.11	0.30	0.19	170.1
96.3	0.11	0.28	0.17	162.4
97.5	0.08	0.16	0.08	98.0
98.8	0.07	0.10	0.03	35.8
100.0	0.03	0.05	0.02	62.4
Min	0.03	0.05	-0.01	-1.5
Max	1.00	1.00	0.19	170.1
Mean	0.79	0.81	0.02	10.2
Median	0.88	0.88	0.00	0.1
P.I.	Percent of time -- (-1.1<X<1.1)			51.3
1.1<=X<10.0				30.0
X>=10.0				13.8
-10.0<X<=-1.1				6.3
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.61	0.60	-0.01	-1.1
1.3	0.55	0.59	0.03	6.0
2.5	0.54	0.56	0.02	3.8
3.8	0.53	0.56	0.02	4.4
5.0	0.51	0.54	0.03	6.2
6.3	0.51	0.52	0.01	1.3
7.5	0.51	0.51	0.00	0.8
8.8	0.50	0.51	0.01	1.7
10.0	0.49	0.50	0.02	3.1
11.3	0.49	0.50	0.01	1.8
12.5	0.48	0.49	0.01	1.9
13.8	0.47	0.49	0.02	3.7
15.0	0.47	0.49	0.02	4.2
16.3	0.46	0.48	0.02	4.8
17.5	0.46	0.47	0.02	4.1
18.8	0.45	0.47	0.02	3.5
20.0	0.45	0.46	0.01	1.7
21.3	0.44	0.45	0.01	2.2
22.5	0.44	0.44	0.01	1.5
23.8	0.44	0.44	0.00	-0.2
25.0	0.42	0.43	0.00	1.1
26.3	0.42	0.43	0.01	1.7
27.5	0.41	0.42	0.01	2.8
28.8	0.41	0.42	0.01	3.1
30.0	0.41	0.42	0.01	2.4
31.3	0.40	0.40	0.00	-0.1
32.5	0.40	0.40	-0.01	-1.5
33.8	0.40	0.38	-0.02	-3.8
35.0	0.39	0.38	-0.01	-3.3
36.3	0.39	0.37	-0.02	-4.1
37.5	0.38	0.37	-0.02	-4.3
38.8	0.38	0.37	-0.01	-2.4
40.0	0.37	0.37	-0.01	-2.3
41.3	0.37	0.36	-0.01	-2.9
42.5	0.37	0.36	-0.01	-2.9
43.8	0.37	0.36	-0.01	-2.0
45.0	0.35	0.36	0.00	1.2
46.3	0.35	0.36	0.00	1.2
47.5	0.35	0.36	0.00	1.3
48.8	0.35	0.36	0.01	1.9
50.0	0.35	0.35	0.01	2.1
51.3	0.35	0.35	0.01	2.0
52.5	0.35	0.35	0.01	2.2
53.8	0.34	0.35	0.00	1.1
55.0	0.34	0.35	0.01	2.5
56.3	0.34	0.35	0.01	3.3
57.5	0.33	0.34	0.01	2.8
58.8	0.32	0.34	0.02	6.9
60.0	0.32	0.34	0.02	6.3
61.3	0.31	0.33	0.02	5.2

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.31	0.33	0.02	6.7
63.8	0.30	0.32	0.02	6.4
65.0	0.30	0.32	0.02	7.2
66.3	0.30	0.32	0.02	6.2
67.5	0.30	0.32	0.02	6.8
68.8	0.30	0.31	0.01	4.4
70.0	0.29	0.31	0.01	4.1
71.3	0.29	0.30	0.01	3.7
72.5	0.29	0.30	0.01	3.3
73.8	0.29	0.30	0.01	3.4
75.0	0.29	0.30	0.01	2.5
76.3	0.29	0.30	0.01	3.1
77.5	0.29	0.30	0.01	3.0
78.8	0.29	0.30	0.01	2.9
80.0	0.29	0.29	0.01	2.5
81.3	0.29	0.29	0.00	1.7
82.5	0.28	0.29	0.01	1.9
83.8	0.28	0.29	0.01	1.9
85.0	0.28	0.29	0.01	2.6
86.3	0.28	0.28	0.01	1.9
87.5	0.26	0.28	0.02	6.0
88.8	0.26	0.28	0.02	7.2
90.0	0.26	0.28	0.02	7.1
91.3	0.24	0.27	0.03	11.6
92.5	0.24	0.27	0.03	11.0
93.8	0.23	0.26	0.02	10.3
95.0	0.22	0.24	0.02	8.2
96.3	0.18	0.24	0.06	34.0
97.5	0.15	0.23	0.08	53.5
98.8	0.10	0.21	0.11	102.7
100.0	0.03	0.09	0.06	185.2
Min	0.03	0.09	-0.02	-4.3
Max	0.61	0.60	0.11	185.2
Mean	0.36	0.37	0.01	7.3
Median	0.35	0.35	0.01	2.8
P.I.	Percent of time -- (-1.1<X<1.1)			3.8
1.1<=X<10.0				75.0
X>=10.0				8.8
-10.0<X<=-1.1				13.8
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.39	0.39	0.00	0.1
1.3	0.39	0.39	0.00	-0.4
2.5	0.39	0.38	0.00	-0.5
3.8	0.39	0.38	0.00	-0.8
5.0	0.39	0.38	0.00	-0.8
6.3	0.38	0.38	0.00	-0.6
7.5	0.38	0.38	0.00	-1.0
8.8	0.38	0.38	0.00	0.0
10.0	0.38	0.38	0.00	0.2
11.3	0.38	0.38	0.00	0.2
12.5	0.38	0.38	0.00	0.0
13.8	0.38	0.37	0.00	-0.9
15.0	0.37	0.37	0.00	0.2
16.3	0.37	0.37	0.00	0.0
17.5	0.37	0.37	0.00	-0.2
18.8	0.37	0.37	0.00	0.0
20.0	0.36	0.37	0.00	0.2
21.3	0.36	0.35	-0.01	-2.0
22.5	0.36	0.35	-0.01	-3.3
23.8	0.35	0.34	-0.01	-2.7
25.0	0.35	0.34	-0.01	-2.8
26.3	0.35	0.34	-0.01	-3.7
27.5	0.34	0.34	0.00	-1.5
28.8	0.34	0.34	0.00	-1.3
30.0	0.34	0.33	0.00	-1.3
31.3	0.34	0.33	-0.01	-1.5
32.5	0.33	0.33	-0.01	-2.4
33.8	0.33	0.32	-0.01	-1.8
35.0	0.32	0.32	0.00	0.0
36.3	0.31	0.30	-0.01	-3.8
37.5	0.31	0.29	-0.01	-4.8
38.8	0.31	0.29	-0.02	-6.2
40.0	0.30	0.28	-0.02	-5.4
41.3	0.30	0.28	-0.01	-4.3
42.5	0.29	0.28	-0.01	-5.0
43.8	0.28	0.28	-0.01	-2.8
45.0	0.28	0.27	-0.01	-4.0
46.3	0.28	0.27	-0.01	-4.0
47.5	0.28	0.27	-0.01	-4.3
48.8	0.28	0.27	-0.01	-3.4
50.0	0.28	0.27	-0.01	-3.2
51.3	0.28	0.27	-0.01	-2.8
52.5	0.27	0.27	0.00	-0.7
53.8	0.27	0.26	0.00	-1.6
55.0	0.26	0.26	-0.01	-2.2
56.3	0.26	0.26	-0.01	-2.3
57.5	0.26	0.26	-0.01	-2.8
58.8	0.26	0.25	-0.01	-4.1
60.0	0.26	0.25	-0.01	-4.6
61.3	0.25	0.25	-0.01	-2.4

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.25	0.24	-0.01	-2.8
63.8	0.25	0.24	-0.01	-2.8
65.0	0.25	0.24	0.00	-0.8
66.3	0.25	0.24	0.00	-0.8
67.5	0.25	0.24	0.00	-1.1
68.8	0.24	0.24	0.00	-2.0
70.0	0.24	0.24	0.00	-2.0
71.3	0.24	0.24	0.00	-2.0
72.5	0.24	0.24	0.00	-1.5
73.8	0.24	0.24	0.00	-1.6
75.0	0.24	0.24	0.00	-1.1
76.3	0.24	0.24	0.00	-0.8
77.5	0.24	0.24	0.00	-0.1
78.8	0.24	0.24	0.00	0.7
80.0	0.23	0.24	0.00	0.7
81.3	0.23	0.24	0.00	1.0
82.5	0.23	0.23	0.00	0.7
83.8	0.23	0.23	0.00	0.0
85.0	0.23	0.23	0.00	0.0
86.3	0.22	0.23	0.00	0.7
87.5	0.22	0.23	0.00	1.2
88.8	0.22	0.22	0.00	1.4
90.0	0.22	0.22	0.00	1.5
91.3	0.22	0.22	0.00	1.1
92.5	0.22	0.22	0.00	0.9
93.8	0.22	0.22	0.00	1.3
95.0	0.22	0.22	0.00	-0.2
96.3	0.22	0.22	0.00	-0.3
97.5	0.21	0.21	0.00	-0.9
98.8	0.21	0.21	-0.01	-3.1
100.0	0.20	0.20	0.00	-0.9
Min	0.20	0.20	-0.02	-6.2
Max	0.39	0.39	0.00	1.5
Mean	0.29	0.29	0.00	-1.4
Median	0.28	0.27	0.00	-1.1
P.I.	Percent of time -- (-1.1<X<1.1)			43.8
1.1<=X<10.0				6.3
X>=10.0				0.0
-10.0<X<=-1.1				51.3
X<=-10.0				0.0

Alternative B Compared to Existing Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
Existing Conditions	0.79	0.36	0.28
NODOS Alternative B	0.81	0.37	0.29
Difference	0.02	0.01	0.00
Percent Difference[3]	3	2	1
Water Year Types[2]			
Wet (32.5%)			
Existing Conditions	0.91	0.37	0.29
NODOS Alternative B	0.90	0.37	0.29
Difference	-0.01	0.00	0.00
Percent Difference	-1	0	1
Above Normal (12.5%)			
Existing Conditions	0.90	0.35	0.29
NODOS Alternative B	0.89	0.35	0.29
Difference	0.00	0.00	0.01
Percent Difference	0	0	2
Below Normal (17.5%)			
Existing Conditions	0.86	0.37	0.30
NODOS Alternative B	0.89	0.35	0.31
Difference	0.03	-0.01	0.01
Percent Difference	4	-3	2
Dry (22.5%)			
Existing Conditions	0.78	0.38	0.28
NODOS Alternative B	0.81	0.37	0.29
Difference	0.03	-0.01	0.00
Percent Difference	4	-2	2
Critical (15%)			
Existing Conditions	0.36	0.31	0.26
NODOS Alternative B	0.46	0.38	0.26
Difference	0.10	0.07	0.00
Percent Difference	26	21	-1

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

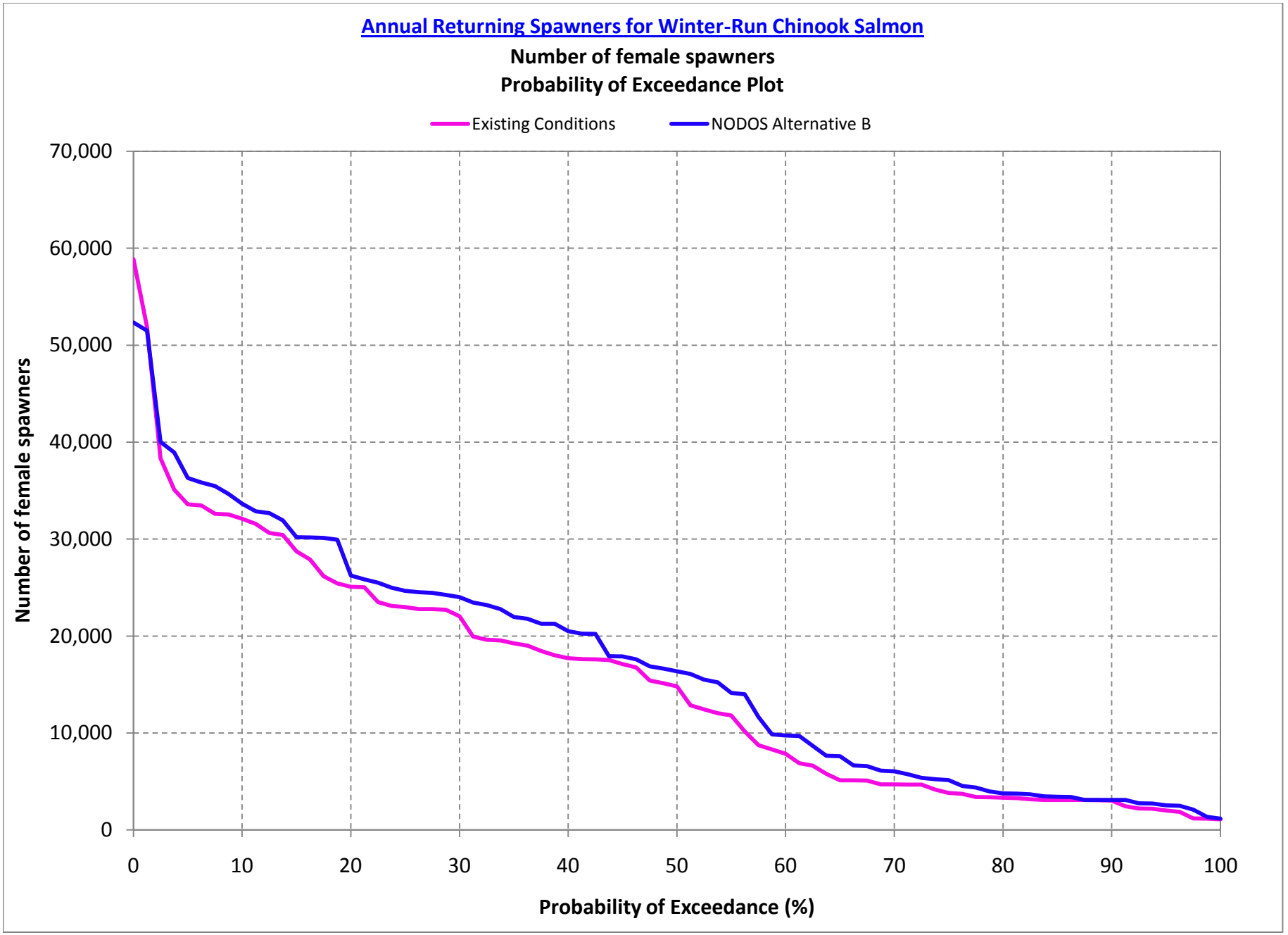
Long-term Average and Average by Water Year Type Annual Returning Spawners

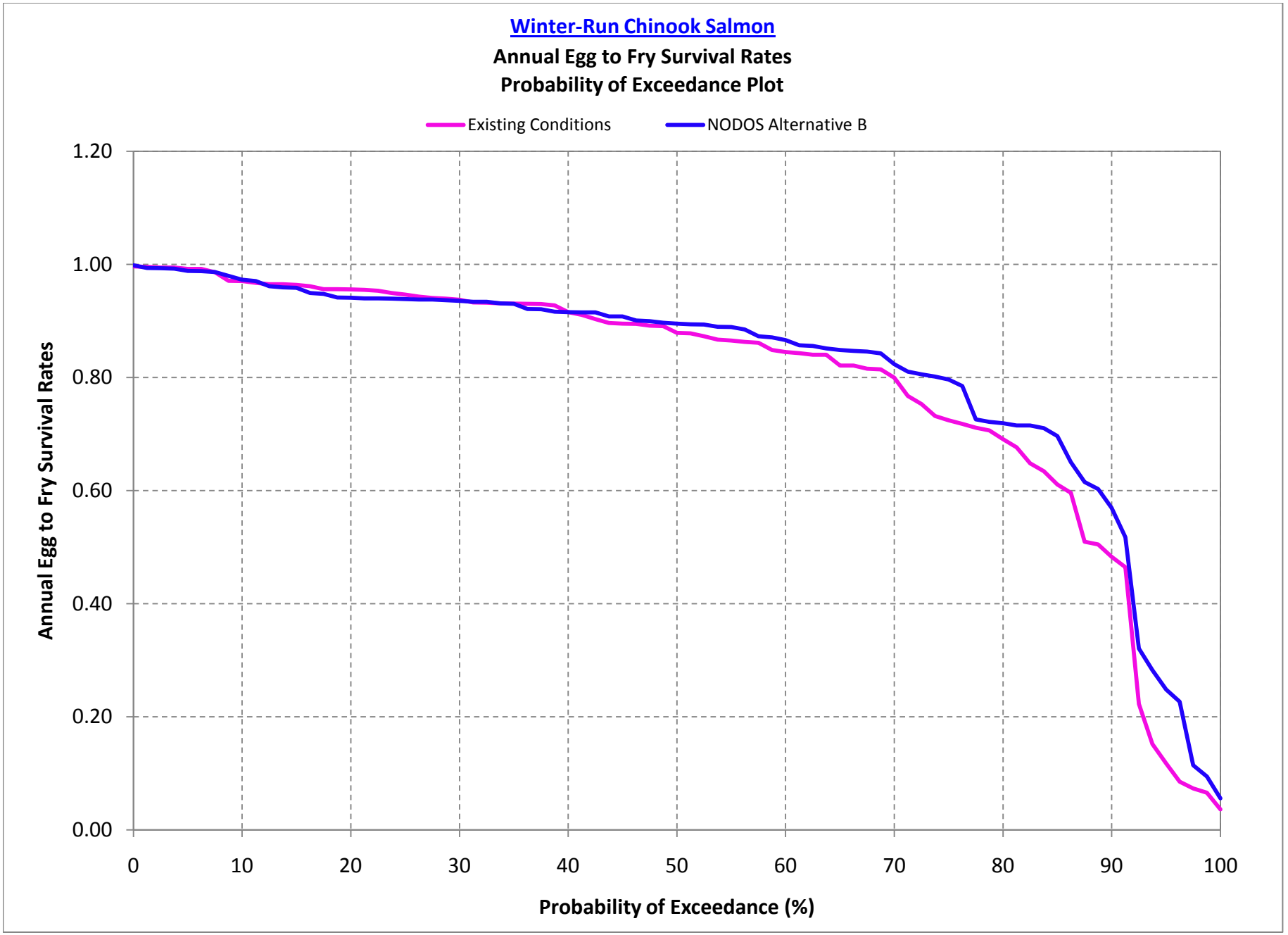
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
Existing Conditions	15,322
NODOS Alternative B	16,906
Difference	1,584
Percent Difference[3]	10
Water Year Types[2]	
Wet (32.5%)	
Existing Conditions	18,586
NODOS Alternative B	20,579
Difference	1,993
Percent Difference	11
Above Normal (12.5%)	
Existing Conditions	12,829
NODOS Alternative B	15,097
Difference	2,267
Percent Difference	18
Below Normal (17.5%)	
Existing Conditions	13,506
NODOS Alternative B	13,979
Difference	473
Percent Difference	4
Dry (22.5%)	
Existing Conditions	15,369
NODOS Alternative B	16,598
Difference	1,229
Percent Difference	8
Critical (15%)	
Existing Conditions	12,586
NODOS Alternative B	14,487
Difference	1,901
Percent Difference	15

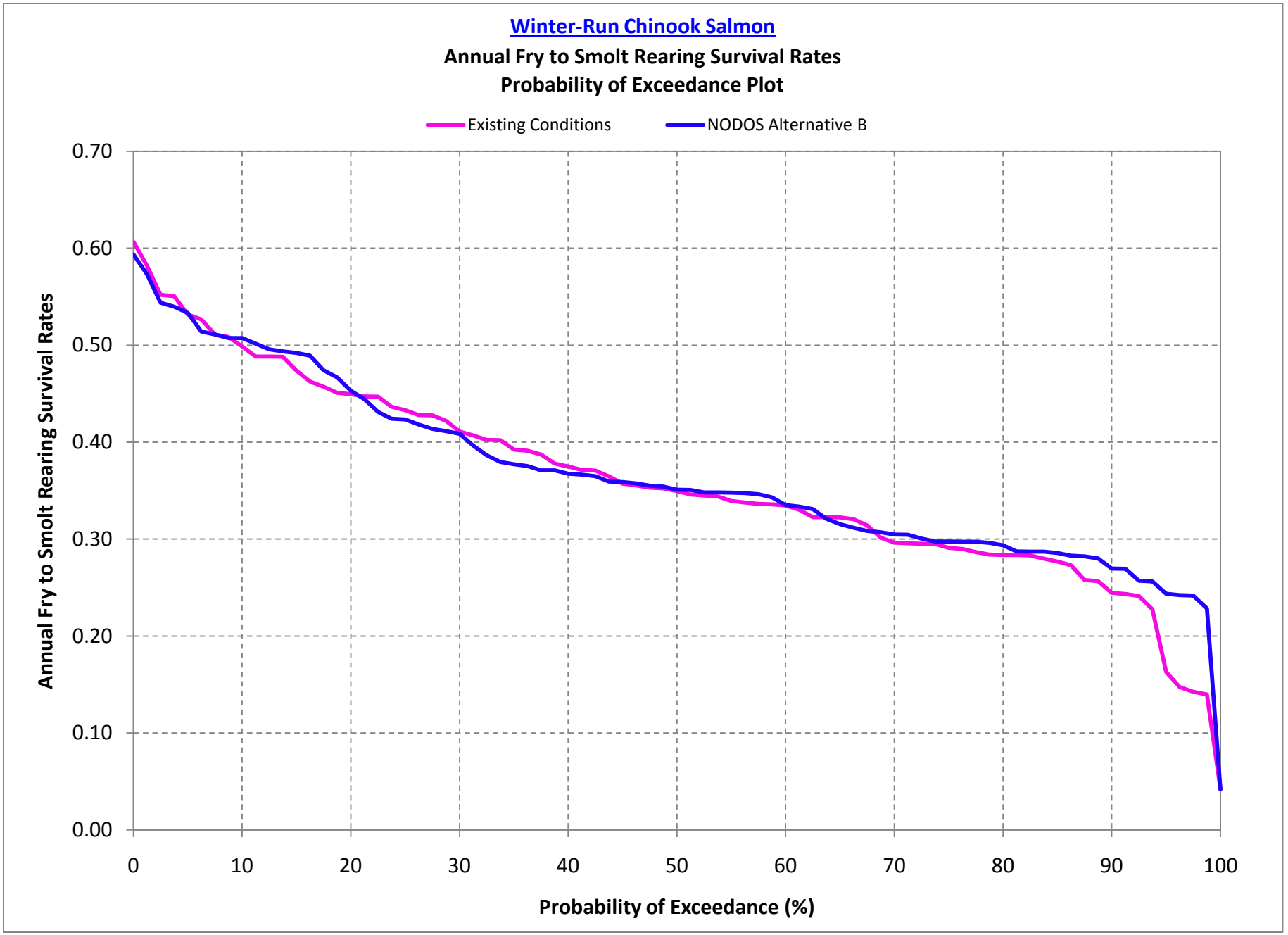
1 Based on the 80-year simulation period

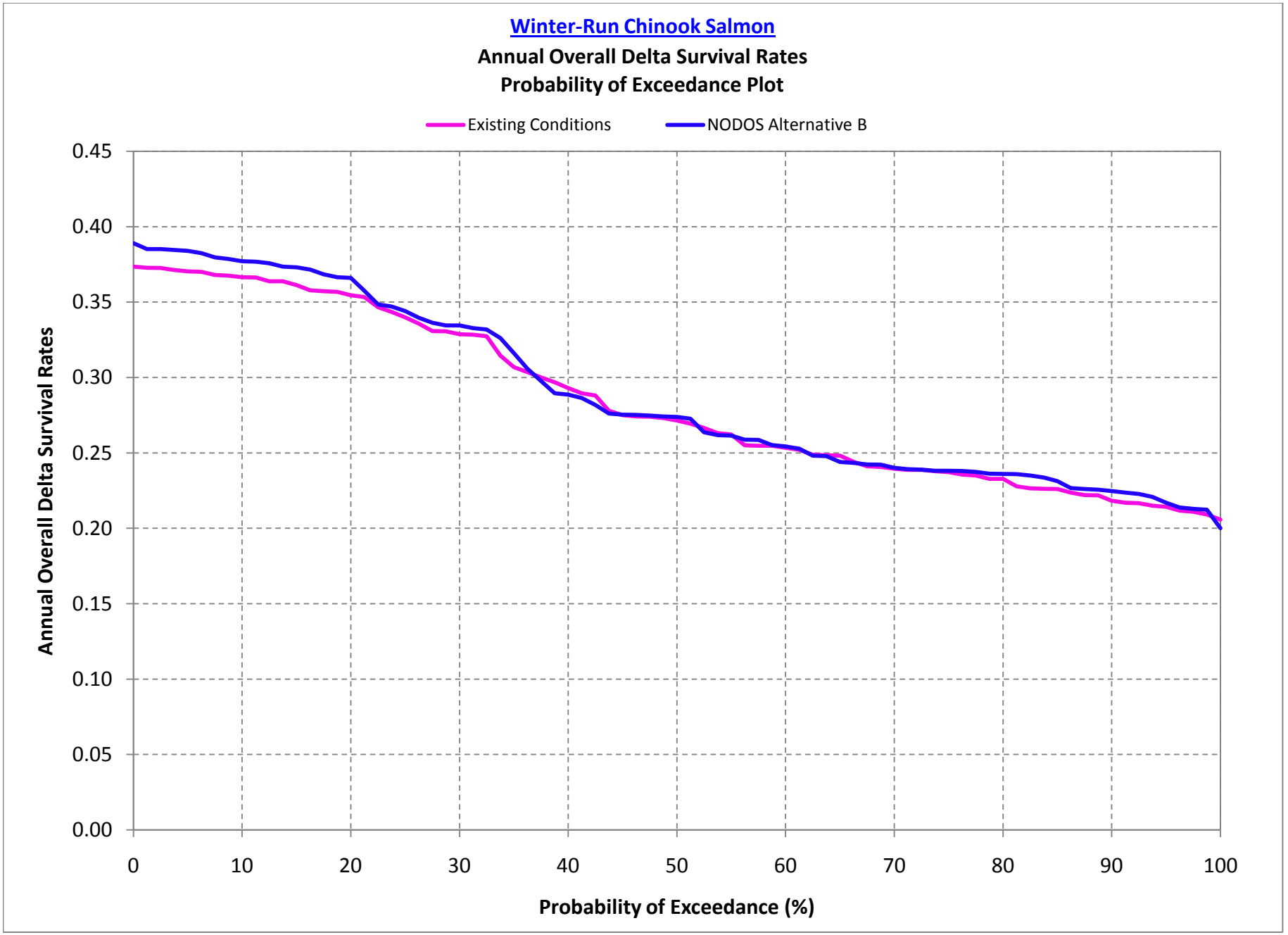
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative B (%)	Absolute Difference (%)	Relative Difference (%)
0.0	58,860	52,347	-6,513	-11.1
1.3	51,867	51,502	-365	-0.7
2.5	38,332	40,031	1,699	4.4
3.8	35,102	38,922	3,820	10.9
5.0	33,579	36,292	2,713	8.1
6.3	33,475	35,837	2,362	7.1
7.5	32,610	35,468	2,858	8.8
8.8	32,534	34,654	2,120	6.5
10.0	32,103	33,661	1,558	4.9
11.3	31,563	32,853	1,290	4.1
12.5	30,644	32,667	2,023	6.6
13.8	30,420	31,928	1,508	5.0
15.0	28,719	30,194	1,475	5.1
16.3	27,879	30,165	2,286	8.2
17.5	26,176	30,131	3,955	15.1
18.8	25,419	29,932	4,513	17.8
20.0	25,089	26,240	1,151	4.6
21.3	25,021	25,849	828	3.3
22.5	23,508	25,499	1,991	8.5
23.8	23,093	24,982	1,889	8.2
25.0	22,996	24,652	1,656	7.2
26.3	22,775	24,518	1,743	7.7
27.5	22,768	24,447	1,679	7.4
28.8	22,704	24,238	1,534	6.8
30.0	22,028	24,014	1,986	9.0
31.3	19,940	23,454	3,514	17.6
32.5	19,609	23,185	3,576	18.2
33.8	19,556	22,785	3,229	16.5
35.0	19,242	21,974	2,732	14.2
36.3	19,022	21,778	2,756	14.5
37.5	18,450	21,266	2,816	15.3
38.8	18,021	21,261	3,240	18.0
40.0	17,712	20,511	2,799	15.8
41.3	17,609	20,253	2,644	15.0
42.5	17,597	20,213	2,616	14.9
43.8	17,523	17,932	409	2.3
45.0	17,118	17,895	777	4.5
46.3	16,755	17,589	834	5.0
47.5	15,422	16,876	1,454	9.4
48.8	15,132	16,636	1,504	9.9
50.0	14,811	16,361	1,550	10.5
51.3	12,851	16,080	3,229	25.1
52.5	12,438	15,514	3,076	24.7
53.8	12,048	15,227	3,179	26.4
55.0	11,798	14,133	2,335	19.8
56.3	10,149	13,996	3,847	37.9
57.5	8,736	11,637	2,901	33.2
58.8	8,288	9,852	1,564	18.9
60.0	7,855	9,752	1,897	24.1
61.3	6,890	9,692	2,802	40.7

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative B (%)	Absolute Difference (%)	Relative Difference (%)
62.5	6,622	8,666	2,044	30.9
63.8	5,782	7,651	1,869	32.3
65.0	5,127	7,593	2,467	48.1
66.3	5,114	6,657	1,543	30.2
67.5	5,094	6,576	1,482	29.1
68.8	4,694	6,115	1,421	30.3
70.0	4,692	6,046	1,354	28.9
71.3	4,682	5,744	1,062	22.7
72.5	4,671	5,361	689	14.8
73.8	4,166	5,222	1,056	25.3
75.0	3,805	5,132	1,327	34.9
76.3	3,714	4,524	809	21.8
77.5	3,401	4,380	979	28.8
78.8	3,379	3,978	598	17.7
80.0	3,325	3,771	446	13.4
81.3	3,273	3,743	470	14.3
82.5	3,165	3,668	503	15.9
83.8	3,088	3,467	379	12.3
85.0	3,088	3,411	323	10.5
86.3	3,088	3,389	301	9.8
87.5	3,088	3,088	0	0.0
88.8	3,064	3,088	24	0.8
90.0	3,012	3,088	75	2.5
91.3	2,454	3,088	634	25.8
92.5	2,210	2,750	540	24.4
93.8	2,191	2,727	536	24.5
95.0	1,991	2,529	539	27.1
96.3	1,859	2,497	638	34.3
97.5	1,195	2,088	893	74.7
98.8	1,160	1,343	183	15.8
100.0	1,092	1,176	84	7.7
Min	1,092	1,176	-6,513	-11.1
Max	58,860	52,347	4,513	74.7
Mean	15,322	16,906	1,584	16.4
Median	14,811	16,361	1,543	14.8
P.I.	Percent of time -- (-1.1<X<1.1)			3.8
1.1<=X<10.0				35.0
X>=10.0				61.3
-10.0<X<=-1.1				0.0
X<=-10.0				1.3

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	0.2
1.3	1.00	0.99	0.00	-0.2
2.5	0.99	0.99	0.00	-0.1
3.8	0.99	0.99	0.00	-0.2
5.0	0.99	0.99	0.00	-0.4
6.3	0.99	0.99	0.00	-0.4
7.5	0.99	0.99	0.00	0.1
8.8	0.97	0.98	0.01	0.9
10.0	0.97	0.97	0.00	0.2
11.3	0.97	0.97	0.00	0.3
12.5	0.97	0.96	0.00	-0.4
13.8	0.96	0.96	-0.01	-0.6
15.0	0.96	0.96	0.00	-0.5
16.3	0.96	0.95	-0.01	-1.2
17.5	0.96	0.95	-0.01	-0.9
18.8	0.96	0.94	-0.01	-1.6
20.0	0.96	0.94	-0.01	-1.5
21.3	0.96	0.94	-0.02	-1.6
22.5	0.95	0.94	-0.01	-1.4
23.8	0.95	0.94	-0.01	-1.1
25.0	0.95	0.94	-0.01	-0.8
26.3	0.94	0.94	0.00	-0.5
27.5	0.94	0.94	0.00	-0.3
28.8	0.94	0.94	0.00	-0.3
30.0	0.94	0.94	0.00	-0.2
31.3	0.93	0.93	0.00	0.1
32.5	0.93	0.93	0.00	0.2
33.8	0.93	0.93	0.00	0.0
35.0	0.93	0.93	0.00	0.0
36.3	0.93	0.92	-0.01	-1.0
37.5	0.93	0.92	-0.01	-1.0
38.8	0.93	0.92	-0.01	-1.2
40.0	0.92	0.92	0.00	0.0
41.3	0.91	0.92	0.00	0.5
42.5	0.90	0.92	0.01	1.3
43.8	0.90	0.91	0.01	1.3
45.0	0.90	0.91	0.01	1.4
46.3	0.89	0.90	0.01	0.7
47.5	0.89	0.90	0.01	0.9
48.8	0.89	0.90	0.01	0.6
50.0	0.88	0.90	0.02	1.9
51.3	0.88	0.89	0.02	1.8
52.5	0.87	0.89	0.02	2.4
53.8	0.87	0.89	0.02	2.6
55.0	0.87	0.89	0.02	2.7
56.3	0.86	0.88	0.02	2.6
57.5	0.86	0.87	0.01	1.3
58.8	0.85	0.87	0.02	2.7
60.0	0.84	0.87	0.02	2.5
61.3	0.84	0.86	0.01	1.7

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.84	0.86	0.02	1.8
63.8	0.84	0.85	0.01	1.3
65.0	0.82	0.85	0.03	3.4
66.3	0.82	0.85	0.03	3.2
67.5	0.82	0.85	0.03	3.7
68.8	0.81	0.84	0.03	3.5
70.0	0.80	0.82	0.02	3.0
71.3	0.77	0.81	0.04	5.6
72.5	0.75	0.81	0.05	7.0
73.8	0.73	0.80	0.07	9.5
75.0	0.72	0.80	0.07	9.9
76.3	0.72	0.78	0.07	9.4
77.5	0.71	0.73	0.01	2.0
78.8	0.71	0.72	0.01	2.1
80.0	0.69	0.72	0.03	4.1
81.3	0.68	0.72	0.04	5.7
82.5	0.65	0.72	0.07	10.3
83.8	0.63	0.71	0.08	12.0
85.0	0.61	0.70	0.09	14.0
86.3	0.60	0.65	0.05	9.0
87.5	0.51	0.62	0.11	20.7
88.8	0.50	0.60	0.10	19.4
90.0	0.48	0.57	0.09	17.9
91.3	0.46	0.52	0.05	11.4
92.5	0.22	0.32	0.10	44.0
93.8	0.15	0.28	0.13	86.2
95.0	0.12	0.25	0.13	111.2
96.3	0.09	0.23	0.14	165.1
97.5	0.07	0.11	0.04	56.3
98.8	0.07	0.09	0.03	43.5
100.0	0.04	0.06	0.02	53.1
Min	0.04	0.06	-0.02	-1.6
Max	1.00	1.00	0.14	165.1
Mean	0.79	0.81	0.02	9.4
Median	0.88	0.90	0.01	1.3
P.I.	Percent of time -- (-1.1<X<1.1)			37.5
1.1<=X<10.0				37.5
X>=10.0				17.5
-10.0<X<=-1.1				8.8
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.61	0.59	-0.01	-2.2
1.3	0.58	0.57	-0.01	-1.5
2.5	0.55	0.54	-0.01	-1.5
3.8	0.55	0.54	-0.01	-2.0
5.0	0.53	0.53	0.00	0.3
6.3	0.53	0.51	-0.01	-2.4
7.5	0.51	0.51	0.00	0.1
8.8	0.51	0.51	0.00	-0.3
10.0	0.50	0.51	0.01	1.7
11.3	0.49	0.50	0.01	2.7
12.5	0.49	0.50	0.01	1.6
13.8	0.49	0.49	0.01	1.1
15.0	0.47	0.49	0.02	3.9
16.3	0.46	0.49	0.03	5.8
17.5	0.46	0.47	0.02	3.7
18.8	0.45	0.47	0.02	3.5
20.0	0.45	0.45	0.00	0.8
21.3	0.45	0.44	0.00	-0.6
22.5	0.45	0.43	-0.02	-3.5
23.8	0.44	0.42	-0.01	-2.8
25.0	0.43	0.42	-0.01	-2.2
26.3	0.43	0.42	-0.01	-2.3
27.5	0.43	0.41	-0.01	-3.3
28.8	0.42	0.41	-0.01	-2.6
30.0	0.41	0.41	0.00	-0.6
31.3	0.41	0.40	-0.01	-2.6
32.5	0.40	0.39	-0.02	-3.9
33.8	0.40	0.38	-0.02	-5.6
35.0	0.39	0.38	-0.02	-3.8
36.3	0.39	0.38	-0.02	-4.1
37.5	0.39	0.37	-0.02	-4.2
38.8	0.38	0.37	-0.01	-1.8
40.0	0.37	0.37	-0.01	-2.0
41.3	0.37	0.37	0.00	-1.3
42.5	0.37	0.36	-0.01	-1.6
43.8	0.36	0.36	-0.01	-1.4
45.0	0.36	0.36	0.00	0.5
46.3	0.36	0.36	0.00	0.6
47.5	0.35	0.36	0.00	0.5
48.8	0.35	0.35	0.00	0.6
50.0	0.35	0.35	0.00	0.4
51.3	0.35	0.35	0.00	1.4
52.5	0.34	0.35	0.00	1.0
53.8	0.34	0.35	0.00	1.2
55.0	0.34	0.35	0.01	2.5
56.3	0.34	0.35	0.01	2.9
57.5	0.34	0.35	0.01	3.0
58.8	0.34	0.34	0.01	2.2
60.0	0.33	0.34	0.00	0.1
61.3	0.33	0.33	0.00	1.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.32	0.33	0.01	2.5
63.8	0.32	0.32	0.00	-0.5
65.0	0.32	0.32	-0.01	-2.2
66.3	0.32	0.31	-0.01	-2.7
67.5	0.31	0.31	-0.01	-1.9
68.8	0.30	0.31	0.01	1.9
70.0	0.30	0.30	0.01	2.8
71.3	0.30	0.30	0.01	3.0
72.5	0.30	0.30	0.01	1.8
73.8	0.30	0.30	0.00	0.9
75.0	0.29	0.30	0.01	2.3
76.3	0.29	0.30	0.01	2.6
77.5	0.29	0.30	0.01	3.7
78.8	0.28	0.30	0.01	4.2
80.0	0.28	0.29	0.01	3.5
81.3	0.28	0.29	0.00	1.3
82.5	0.28	0.29	0.00	1.4
83.8	0.28	0.29	0.01	2.6
85.0	0.28	0.29	0.01	3.2
86.3	0.27	0.28	0.01	3.5
87.5	0.26	0.28	0.02	9.5
88.8	0.26	0.28	0.02	9.1
90.0	0.24	0.27	0.03	10.3
91.3	0.24	0.27	0.03	10.7
92.5	0.24	0.26	0.02	6.6
93.8	0.23	0.26	0.03	12.7
95.0	0.16	0.24	0.08	49.6
96.3	0.15	0.24	0.09	64.5
97.5	0.14	0.24	0.10	69.5
98.8	0.14	0.23	0.09	63.5
100.0	0.04	0.04	0.00	-2.3
Min	0.04	0.04	-0.02	-5.6
Max	0.61	0.59	0.10	69.5
Mean	0.36	0.37	0.01	4.0
Median	0.35	0.35	0.00	1.0
P.I.	Percent of time -- (-1.1<X<1.1)			20.0
1.1<=X<10.0				40.0
X>=10.0				8.8
-10.0<X<=-1.1				32.5
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.37	0.39	0.02	4.1
1.3	0.37	0.39	0.01	3.3
2.5	0.37	0.39	0.01	3.4
3.8	0.37	0.38	0.01	3.6
5.0	0.37	0.38	0.01	3.7
6.3	0.37	0.38	0.01	3.3
7.5	0.37	0.38	0.01	3.2
8.8	0.37	0.38	0.01	3.0
10.0	0.37	0.38	0.01	2.9
11.3	0.37	0.38	0.01	2.9
12.5	0.36	0.38	0.01	3.3
13.8	0.36	0.37	0.01	2.7
15.0	0.36	0.37	0.01	3.2
16.3	0.36	0.37	0.01	3.8
17.5	0.36	0.37	0.01	3.1
18.8	0.36	0.37	0.01	2.7
20.0	0.35	0.37	0.01	3.3
21.3	0.35	0.36	0.00	1.2
22.5	0.35	0.35	0.00	0.5
23.8	0.34	0.35	0.00	1.1
25.0	0.34	0.34	0.00	1.3
26.3	0.34	0.34	0.00	1.1
27.5	0.33	0.34	0.01	1.7
28.8	0.33	0.33	0.00	1.2
30.0	0.33	0.33	0.01	1.8
31.3	0.33	0.33	0.00	1.3
32.5	0.33	0.33	0.00	1.4
33.8	0.31	0.33	0.01	3.7
35.0	0.31	0.32	0.01	3.0
36.3	0.30	0.31	0.00	0.7
37.5	0.30	0.30	0.00	-0.8
38.8	0.30	0.29	-0.01	-2.5
40.0	0.29	0.29	0.00	-1.5
41.3	0.29	0.29	0.00	-1.1
42.5	0.29	0.28	-0.01	-2.2
43.8	0.28	0.28	0.00	-0.6
45.0	0.28	0.28	0.00	0.1
46.3	0.27	0.28	0.00	0.4
47.5	0.27	0.27	0.00	0.3
48.8	0.27	0.27	0.00	0.3
50.0	0.27	0.27	0.00	0.9
51.3	0.27	0.27	0.00	1.3
52.5	0.27	0.26	0.00	-1.0
53.8	0.26	0.26	0.00	-0.5
55.0	0.26	0.26	0.00	-0.3
56.3	0.26	0.26	0.00	1.5
57.5	0.25	0.26	0.00	1.5
58.8	0.25	0.26	0.00	0.2
60.0	0.25	0.25	0.00	0.3
61.3	0.25	0.25	0.00	0.3

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.25	0.25	0.00	-0.3
63.8	0.25	0.25	0.00	-0.2
65.0	0.25	0.24	0.00	-1.7
66.3	0.24	0.24	0.00	-0.3
67.5	0.24	0.24	0.00	0.5
68.8	0.24	0.24	0.00	0.6
70.0	0.24	0.24	0.00	0.2
71.3	0.24	0.24	0.00	0.2
72.5	0.24	0.24	0.00	0.1
73.8	0.24	0.24	0.00	0.2
75.0	0.24	0.24	0.00	0.4
76.3	0.24	0.24	0.00	1.0
77.5	0.24	0.24	0.00	1.0
78.8	0.23	0.24	0.00	1.4
80.0	0.23	0.24	0.00	1.4
81.3	0.23	0.24	0.01	3.6
82.5	0.23	0.24	0.01	3.8
83.8	0.23	0.23	0.01	3.3
85.0	0.23	0.23	0.01	2.3
86.3	0.22	0.23	0.00	1.3
87.5	0.22	0.23	0.00	1.8
88.8	0.22	0.23	0.00	1.7
90.0	0.22	0.22	0.01	2.9
91.3	0.22	0.22	0.01	3.1
92.5	0.22	0.22	0.01	2.8
93.8	0.21	0.22	0.01	2.7
95.0	0.21	0.22	0.00	1.3
96.3	0.21	0.21	0.00	1.0
97.5	0.21	0.21	0.00	0.9
98.8	0.21	0.21	0.00	1.5
100.0	0.21	0.20	-0.01	-2.7
Min	0.21	0.20	-0.01	-2.7
Max	0.37	0.39	0.02	4.1
Mean	0.28	0.29	0.00	1.3
Median	0.27	0.27	0.00	1.3
P.I.	Percent of time -- (-1.1<X<1.1)			36.3
1.1<=X<10.0				57.5
X>=10.0				0.0
-10.0<X<=-1.1				7.5
X<=-10.0				0.0

Alternative B Compared to No Action Alternative Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
No Action Alternative	0.79	0.36	0.29
NODOS Alternative B	0.81	0.37	0.29
Difference	0.02	0.01	0.00
Percent Difference[3]	3	3	-1
Water Year Types[2]			
Wet (32.5%)			
BST NAA (070510)	0.91	0.36	0.30
NODOS ALT B (020811)	0.90	0.37	0.29
Difference	-0.01	0.01	0.00
Percent Difference	-1	1	-1
Above Normal (12.5%)			
BST NAA (070510)	0.90	0.34	0.30
NODOS ALT B (020811)	0.89	0.35	0.29
Difference	-0.01	0.00	0.00
Percent Difference	-1	1	-1
Below Normal (17.5%)			
BST NAA (070510)	0.86	0.36	0.31
NODOS ALT B (020811)	0.89	0.35	0.31
Difference	0.03	0.00	0.00
Percent Difference	4	-1	0
Dry (22.5%)			
BST NAA (070510)	0.76	0.38	0.29
NODOS ALT B (020811)	0.81	0.37	0.29
Difference	0.05	0.00	0.00
Percent Difference	6	-1	0
Critical (15%)			
BST NAA (070510)	0.38	0.32	0.26
NODOS ALT B (020811)	0.46	0.38	0.26
Difference	0.08	0.06	-0.01
Percent Difference	21	20	-3

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

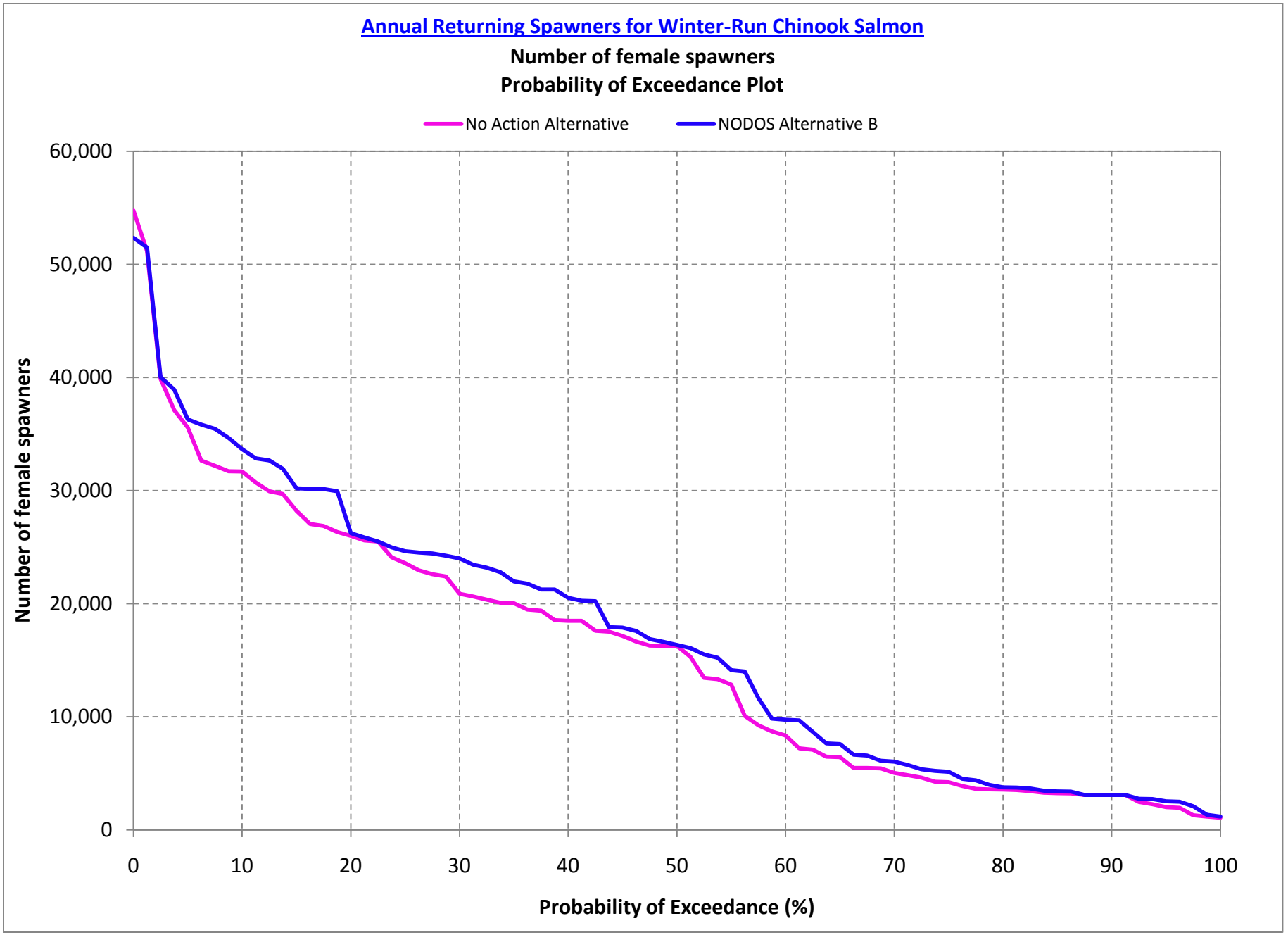
Long-term Average and Average by Water Year Type Annual Returning Spawners

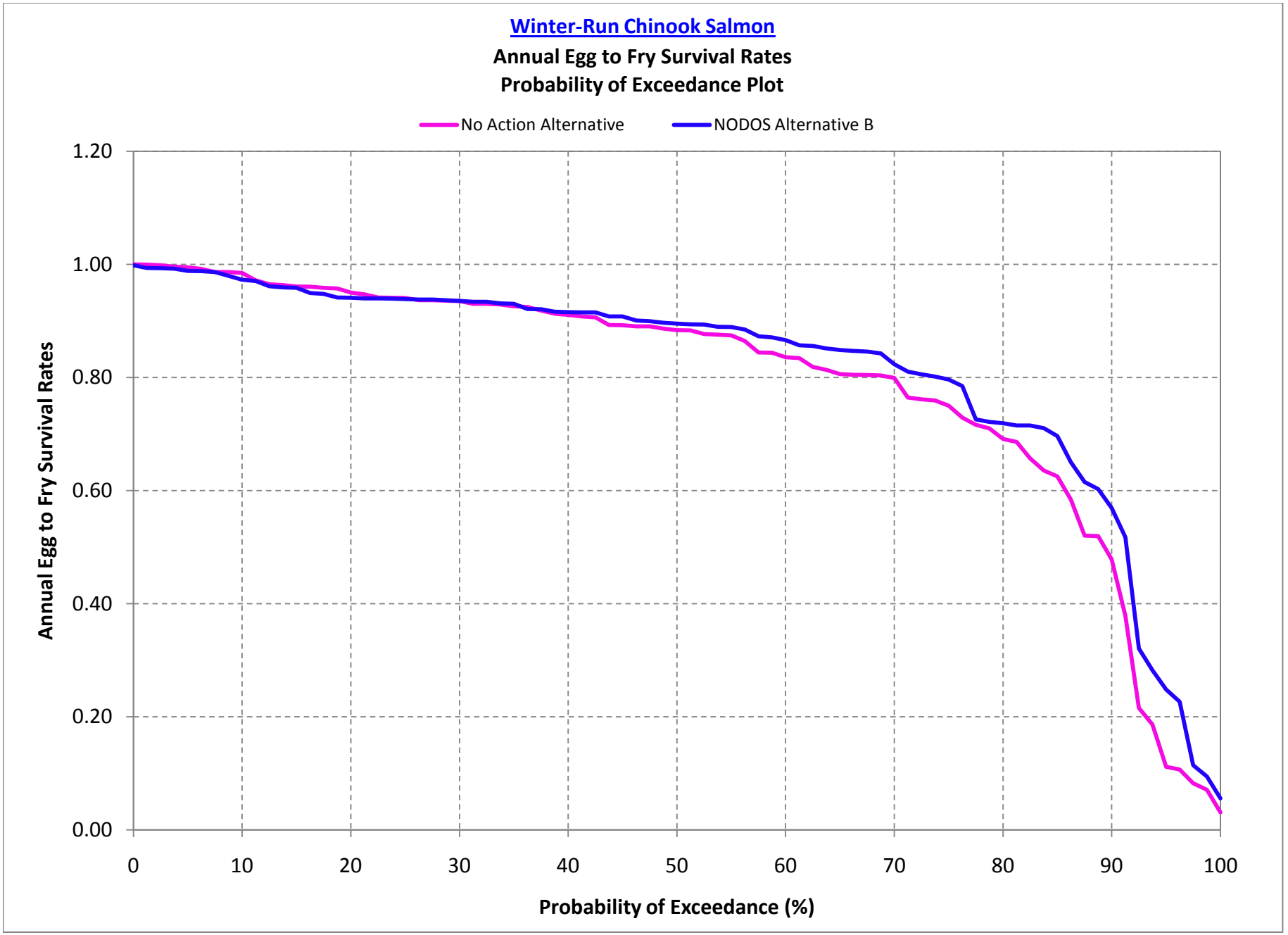
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
No Action Alternative	15,636
NODOS Alternative B	16,906
Difference	1,270
Percent Difference[3]	8
Water Year Types[2]	
Wet (32.5%)	
BST NAA (070510)	18,717
NODOS ALT B (020811)	20,579
Difference	1,862
Percent Difference	10
Above Normal (12.5%)	
BST NAA (070510)	13,331
NODOS ALT B (020811)	15,097
Difference	1,766
Percent Difference	13
Below Normal (17.5%)	
BST NAA (070510)	14,002
NODOS ALT B (020811)	13,979
Difference	-23
Percent Difference	0
Dry (22.5%)	
BST NAA (070510)	15,604
NODOS ALT B (020811)	16,598
Difference	994
Percent Difference	6
Critical (15%)	
BST NAA (070510)	13,030
NODOS ALT B (020811)	14,487
Difference	1,458
Percent Difference	11

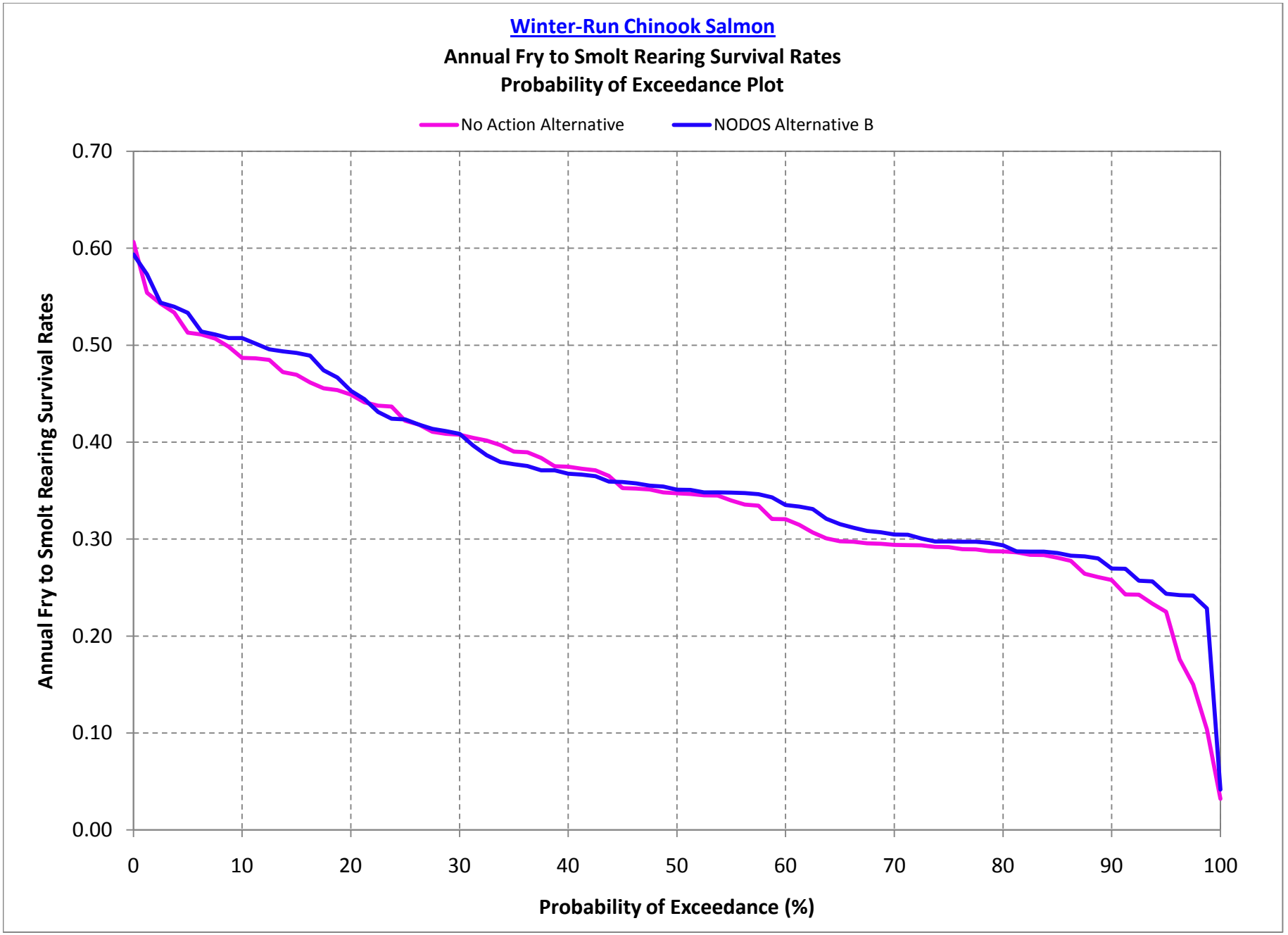
1 Based on the 80-year simulation period

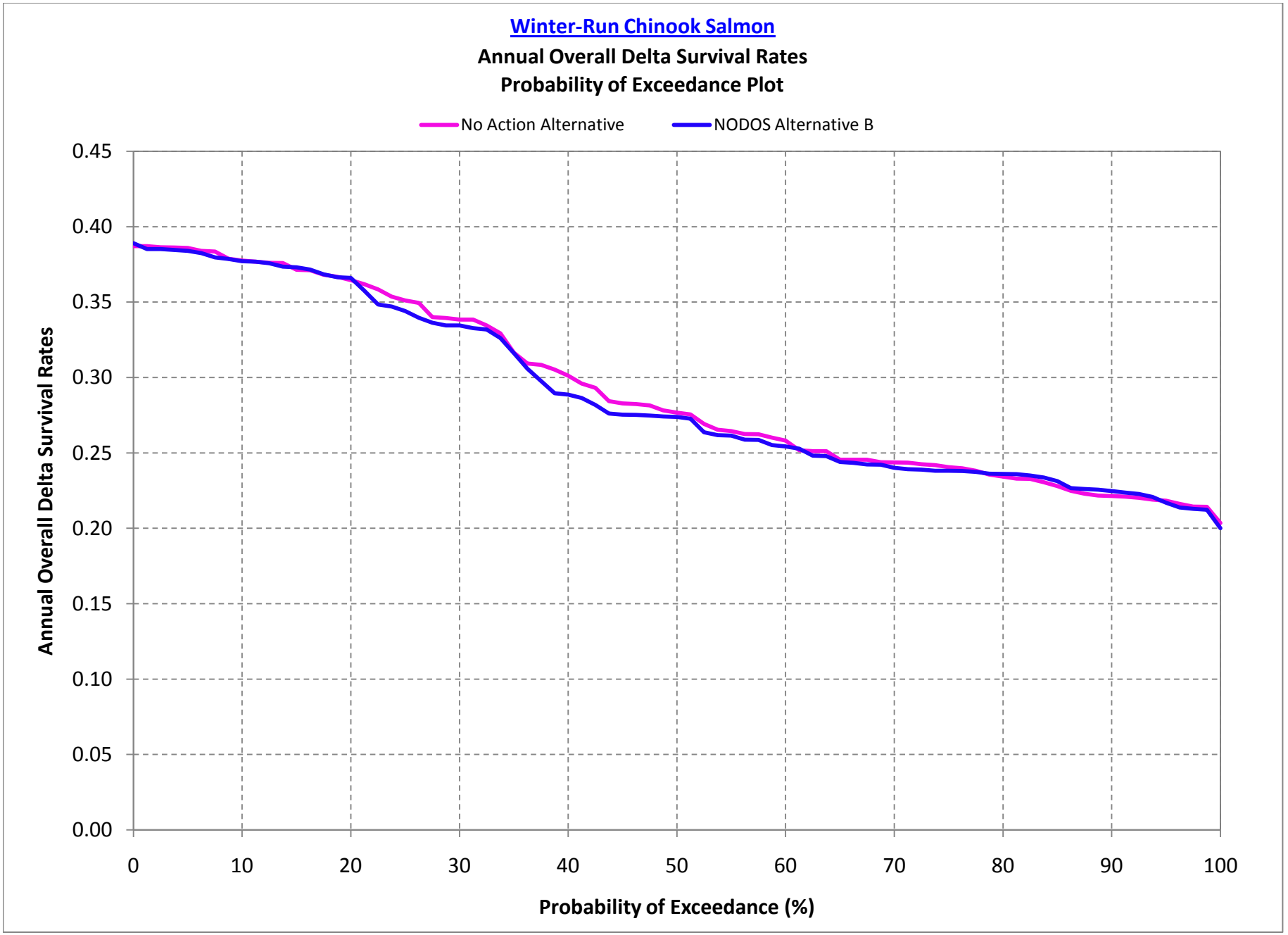
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative B (%)	Absolute Difference (%)	Relative Difference (%)
0.0	54,752	52,347	-2,405	-4.4
1.3	51,177	51,502	325	0.6
2.5	39,882	40,031	149	0.4
3.8	37,103	38,922	1,819	4.9
5.0	35,571	36,292	721	2.0
6.3	32,659	35,837	3,178	9.7
7.5	32,197	35,468	3,271	10.2
8.8	31,724	34,654	2,930	9.2
10.0	31,697	33,661	1,964	6.2
11.3	30,728	32,853	2,125	6.9
12.5	29,946	32,667	2,721	9.1
13.8	29,705	31,928	2,223	7.5
15.0	28,202	30,194	1,992	7.1
16.3	27,063	30,165	3,102	11.5
17.5	26,870	30,131	3,261	12.1
18.8	26,345	29,932	3,587	13.6
20.0	26,001	26,240	239	0.9
21.3	25,608	25,849	241	0.9
22.5	25,492	25,499	7	0.0
23.8	24,110	24,982	872	3.6
25.0	23,586	24,652	1,066	4.5
26.3	22,947	24,518	1,571	6.8
27.5	22,610	24,447	1,837	8.1
28.8	22,406	24,238	1,832	8.2
30.0	20,875	24,014	3,139	15.0
31.3	20,642	23,454	2,812	13.6
32.5	20,366	23,185	2,819	13.8
33.8	20,091	22,785	2,694	13.4
35.0	20,041	21,974	1,933	9.6
36.3	19,476	21,778	2,302	11.8
37.5	19,386	21,266	1,880	9.7
38.8	18,557	21,261	2,704	14.6
40.0	18,497	20,511	2,014	10.9
41.3	18,484	20,253	1,769	9.6
42.5	17,617	20,213	2,596	14.7
43.8	17,541	17,932	391	2.2
45.0	17,151	17,895	744	4.3
46.3	16,652	17,589	937	5.6
47.5	16,296	16,876	580	3.6
48.8	16,282	16,636	354	2.2
50.0	16,278	16,361	83	0.5
51.3	15,297	16,080	783	5.1
52.5	13,439	15,514	2,075	15.4
53.8	13,334	15,227	1,893	14.2
55.0	12,845	14,133	1,288	10.0
56.3	10,085	13,996	3,911	38.8
57.5	9,235	11,637	2,402	26.0
58.8	8,704	9,852	1,148	13.2
60.0	8,351	9,752	1,401	16.8
61.3	7,208	9,692	2,484	34.5

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative B (%)	Absolute Difference (%)	Relative Difference (%)
62.5	7,096	8,666	1,570	22.1
63.8	6,478	7,651	1,173	18.1
65.0	6,437	7,593	1,157	18.0
66.3	5,485	6,657	1,171	21.4
67.5	5,470	6,576	1,105	20.2
68.8	5,443	6,115	672	12.3
70.0	5,040	6,046	1,006	20.0
71.3	4,837	5,744	907	18.8
72.5	4,633	5,361	727	15.7
73.8	4,263	5,222	959	22.5
75.0	4,231	5,132	900	21.3
76.3	3,895	4,524	628	16.1
77.5	3,629	4,380	751	20.7
78.8	3,589	3,978	389	10.8
80.0	3,568	3,771	202	5.7
81.3	3,520	3,743	223	6.3
82.5	3,437	3,668	231	6.7
83.8	3,295	3,467	172	5.2
85.0	3,252	3,411	159	4.9
86.3	3,224	3,389	165	5.1
87.5	3,088	3,088	0	0.0
88.8	3,088	3,088	0	0.0
90.0	3,088	3,088	0	0.0
91.3	3,088	3,088	0	0.0
92.5	2,467	2,750	284	11.5
93.8	2,278	2,727	449	19.7
95.0	2,008	2,529	522	26.0
96.3	1,954	2,497	542	27.8
97.5	1,302	2,088	786	60.3
98.8	1,172	1,343	171	14.5
100.0	1,086	1,176	90	8.3
Min	1,086	1,176	-2,405	-4.4
Max	54,752	52,347	3,911	60.3
Mean	15,636	16,906	1,270	11.5
Median	16,278	16,361	1,006	9.7
P.I.	Percent of time -- (-1.1<X<1.1)			12.5
1.1<=X<10.0				37.5
X>=10.0				50.0
-10.0<X<=-1.1				1.3
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	-0.1
1.3	1.00	0.99	-0.01	-0.6
2.5	1.00	0.99	-0.01	-0.5
3.8	1.00	0.99	0.00	-0.4
5.0	0.99	0.99	-0.01	-0.7
6.3	0.99	0.99	0.00	-0.4
7.5	0.99	0.99	0.00	0.0
8.8	0.99	0.98	-0.01	-0.7
10.0	0.98	0.97	-0.01	-1.2
11.3	0.97	0.97	0.00	-0.1
12.5	0.97	0.96	0.00	-0.4
13.8	0.96	0.96	0.00	-0.4
15.0	0.96	0.96	0.00	-0.2
16.3	0.96	0.95	-0.01	-1.2
17.5	0.96	0.95	-0.01	-1.1
18.8	0.96	0.94	-0.02	-1.7
20.0	0.95	0.94	-0.01	-1.0
21.3	0.95	0.94	-0.01	-0.8
22.5	0.94	0.94	0.00	-0.2
23.8	0.94	0.94	0.00	-0.2
25.0	0.94	0.94	0.00	-0.2
26.3	0.94	0.94	0.00	0.1
27.5	0.94	0.94	0.00	0.1
28.8	0.94	0.94	0.00	0.1
30.0	0.94	0.94	0.00	0.0
31.3	0.93	0.93	0.00	0.4
32.5	0.93	0.93	0.00	0.4
33.8	0.93	0.93	0.00	0.2
35.0	0.93	0.93	0.00	0.5
36.3	0.92	0.92	0.00	-0.4
37.5	0.92	0.92	0.00	0.2
38.8	0.91	0.92	0.00	0.4
40.0	0.91	0.92	0.00	0.5
41.3	0.91	0.92	0.01	0.8
42.5	0.91	0.92	0.01	1.0
43.8	0.89	0.91	0.01	1.7
45.0	0.89	0.91	0.02	1.7
46.3	0.89	0.90	0.01	1.2
47.5	0.89	0.90	0.01	1.0
48.8	0.89	0.90	0.01	1.2
50.0	0.88	0.90	0.01	1.3
51.3	0.88	0.89	0.01	1.2
52.5	0.88	0.89	0.02	1.9
53.8	0.88	0.89	0.01	1.6
55.0	0.87	0.89	0.01	1.7
56.3	0.86	0.88	0.02	2.4
57.5	0.84	0.87	0.03	3.4
58.8	0.84	0.87	0.03	3.2
60.0	0.84	0.87	0.03	3.6
61.3	0.83	0.86	0.02	2.7

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.82	0.86	0.04	4.5
63.8	0.81	0.85	0.04	4.7
65.0	0.81	0.85	0.04	5.3
66.3	0.80	0.85	0.04	5.3
67.5	0.80	0.85	0.04	5.2
68.8	0.80	0.84	0.04	4.9
70.0	0.80	0.82	0.02	3.0
71.3	0.76	0.81	0.05	6.0
72.5	0.76	0.81	0.04	5.8
73.8	0.76	0.80	0.04	5.6
75.0	0.75	0.80	0.05	6.2
76.3	0.73	0.78	0.06	7.6
77.5	0.72	0.73	0.01	1.3
78.8	0.71	0.72	0.01	1.6
80.0	0.69	0.72	0.03	4.0
81.3	0.69	0.72	0.03	4.3
82.5	0.66	0.72	0.06	8.8
83.8	0.64	0.71	0.08	11.8
85.0	0.63	0.70	0.07	11.4
86.3	0.58	0.65	0.07	11.3
87.5	0.52	0.62	0.10	18.3
88.8	0.52	0.60	0.08	16.0
90.0	0.48	0.57	0.09	18.9
91.3	0.38	0.52	0.14	36.7
92.5	0.22	0.32	0.11	48.7
93.8	0.19	0.28	0.10	51.6
95.0	0.11	0.25	0.14	122.6
96.3	0.11	0.23	0.12	112.3
97.5	0.08	0.11	0.03	38.5
98.8	0.07	0.09	0.02	33.2
100.0	0.03	0.06	0.02	78.9
Min	0.03	0.06	-0.02	-1.7
Max	1.00	1.00	0.14	122.6
Mean	0.79	0.81	0.02	8.8
Median	0.88	0.90	0.01	1.3
P.I.	Percent of time -- (-1.1<X<1.1)			40.0
1.1<=X<10.0				38.8
X>=10.0				17.5
-10.0<X<=-1.1				5.0
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.61	0.59	-0.01	-2.1
1.3	0.55	0.57	0.02	3.4
2.5	0.54	0.54	0.00	0.2
3.8	0.53	0.54	0.01	1.1
5.0	0.51	0.53	0.02	4.0
6.3	0.51	0.51	0.00	0.6
7.5	0.51	0.51	0.00	0.8
8.8	0.50	0.51	0.01	1.7
10.0	0.49	0.51	0.02	4.2
11.3	0.49	0.50	0.02	3.1
12.5	0.48	0.50	0.01	2.2
13.8	0.47	0.49	0.02	4.5
15.0	0.47	0.49	0.02	4.8
16.3	0.46	0.49	0.03	6.0
17.5	0.46	0.47	0.02	4.1
18.8	0.45	0.47	0.01	2.8
20.0	0.45	0.45	0.00	0.9
21.3	0.44	0.44	0.00	0.7
22.5	0.44	0.43	-0.01	-1.5
23.8	0.44	0.42	-0.01	-2.9
25.0	0.42	0.42	0.00	0.3
26.3	0.42	0.42	0.00	0.0
27.5	0.41	0.41	0.00	0.7
28.8	0.41	0.41	0.00	0.7
30.0	0.41	0.41	0.00	0.2
31.3	0.40	0.40	-0.01	-2.0
32.5	0.40	0.39	-0.02	-3.7
33.8	0.40	0.38	-0.02	-4.4
35.0	0.39	0.38	-0.01	-3.3
36.3	0.39	0.38	-0.01	-3.7
37.5	0.38	0.37	-0.01	-3.3
38.8	0.38	0.37	0.00	-1.1
40.0	0.37	0.37	-0.01	-1.9
41.3	0.37	0.37	-0.01	-1.6
42.5	0.37	0.36	-0.01	-1.6
43.8	0.37	0.36	-0.01	-1.6
45.0	0.35	0.36	0.01	1.7
46.3	0.35	0.36	0.01	1.5
47.5	0.35	0.36	0.00	1.1
48.8	0.35	0.35	0.01	1.7
50.0	0.35	0.35	0.00	1.1
51.3	0.35	0.35	0.00	1.2
52.5	0.35	0.35	0.00	0.9
53.8	0.34	0.35	0.00	1.0
55.0	0.34	0.35	0.01	2.4
56.3	0.34	0.35	0.01	3.6
57.5	0.33	0.35	0.01	3.6
58.8	0.32	0.34	0.02	6.9
60.0	0.32	0.34	0.01	4.6
61.3	0.31	0.33	0.02	5.9

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.31	0.33	0.02	7.9
63.8	0.30	0.32	0.02	6.7
65.0	0.30	0.32	0.02	5.9
66.3	0.30	0.31	0.01	4.9
67.5	0.30	0.31	0.01	4.3
68.8	0.30	0.31	0.01	4.0
70.0	0.29	0.30	0.01	3.7
71.3	0.29	0.30	0.01	3.6
72.5	0.29	0.30	0.01	2.4
73.8	0.29	0.30	0.01	1.9
75.0	0.29	0.30	0.01	2.0
76.3	0.29	0.30	0.01	2.7
77.5	0.29	0.30	0.01	2.7
78.8	0.29	0.30	0.01	2.9
80.0	0.29	0.29	0.01	2.2
81.3	0.29	0.29	0.00	0.3
82.5	0.28	0.29	0.00	1.1
83.8	0.28	0.29	0.00	1.2
85.0	0.28	0.29	0.00	1.7
86.3	0.28	0.28	0.01	1.9
87.5	0.26	0.28	0.02	6.7
88.8	0.26	0.28	0.02	7.3
90.0	0.26	0.27	0.01	4.6
91.3	0.24	0.27	0.03	10.9
92.5	0.24	0.26	0.01	6.0
93.8	0.23	0.26	0.02	9.8
95.0	0.22	0.24	0.02	8.3
96.3	0.18	0.24	0.07	37.7
97.5	0.15	0.24	0.09	61.1
98.8	0.10	0.23	0.12	120.2
100.0	0.03	0.04	0.01	29.2
Min	0.03	0.04	-0.02	-4.4
Max	0.61	0.59	0.12	120.2
Mean	0.36	0.37	0.01	5.1
Median	0.35	0.35	0.01	2.0
P.I.	Percent of time -- (-1.1<X<1.1)			16.3
1.1<=X<10.0				61.3
X>=10.0				6.3
-10.0<X<=-1.1				17.5
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.39	0.39	0.00	0.5
1.3	0.39	0.39	0.00	-0.5
2.5	0.39	0.39	0.00	-0.3
3.8	0.39	0.38	0.00	-0.4
5.0	0.39	0.38	0.00	-0.5
6.3	0.38	0.38	0.00	-0.4
7.5	0.38	0.38	0.00	-1.0
8.8	0.38	0.38	0.00	0.0
10.0	0.38	0.38	0.00	-0.1
11.3	0.38	0.38	0.00	0.0
12.5	0.38	0.38	0.00	0.0
13.8	0.38	0.37	0.00	-0.6
15.0	0.37	0.37	0.00	0.4
16.3	0.37	0.37	0.00	0.1
17.5	0.37	0.37	0.00	0.1
18.8	0.37	0.37	0.00	-0.1
20.0	0.36	0.37	0.00	0.4
21.3	0.36	0.36	0.00	-1.2
22.5	0.36	0.35	-0.01	-2.8
23.8	0.35	0.35	-0.01	-1.8
25.0	0.35	0.34	-0.01	-2.0
26.3	0.35	0.34	-0.01	-2.8
27.5	0.34	0.34	0.00	-1.1
28.8	0.34	0.33	0.00	-1.5
30.0	0.34	0.33	0.00	-1.2
31.3	0.34	0.33	-0.01	-1.7
32.5	0.33	0.33	0.00	-0.8
33.8	0.33	0.33	0.00	-1.0
35.0	0.32	0.32	0.00	-0.1
36.3	0.31	0.31	0.00	-1.1
37.5	0.31	0.30	-0.01	-3.5
38.8	0.31	0.29	-0.02	-5.2
40.0	0.30	0.29	-0.01	-4.2
41.3	0.30	0.29	-0.01	-3.2
42.5	0.29	0.28	-0.01	-3.9
43.8	0.28	0.28	-0.01	-2.9
45.0	0.28	0.28	-0.01	-2.7
46.3	0.28	0.28	-0.01	-2.6
47.5	0.28	0.27	-0.01	-2.4
48.8	0.28	0.27	0.00	-1.5
50.0	0.28	0.27	0.00	-1.1
51.3	0.28	0.27	0.00	-1.0
52.5	0.27	0.26	-0.01	-2.0
53.8	0.27	0.26	0.00	-1.3
55.0	0.26	0.26	0.00	-1.1
56.3	0.26	0.26	0.00	-1.4
57.5	0.26	0.26	0.00	-1.4
58.8	0.26	0.26	0.00	-1.9
60.0	0.26	0.25	0.00	-1.5
61.3	0.25	0.25	0.00	0.4

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.25	0.25	0.00	-1.2
63.8	0.25	0.25	0.00	-1.3
65.0	0.25	0.24	0.00	-0.6
66.3	0.25	0.24	0.00	-0.8
67.5	0.25	0.24	0.00	-1.3
68.8	0.24	0.24	0.00	-0.7
70.0	0.24	0.24	0.00	-1.5
71.3	0.24	0.24	0.00	-1.8
72.5	0.24	0.24	0.00	-1.5
73.8	0.24	0.24	0.00	-1.5
75.0	0.24	0.24	0.00	-1.0
76.3	0.24	0.24	0.00	-0.7
77.5	0.24	0.24	0.00	-0.3
78.8	0.24	0.24	0.00	0.3
80.0	0.23	0.24	0.00	0.7
81.3	0.23	0.24	0.00	1.3
82.5	0.23	0.24	0.00	0.9
83.8	0.23	0.23	0.00	1.4
85.0	0.23	0.23	0.00	1.4
86.3	0.22	0.23	0.00	0.8
87.5	0.22	0.23	0.00	1.4
88.8	0.22	0.23	0.00	1.7
90.0	0.22	0.22	0.00	1.5
91.3	0.22	0.22	0.00	1.2
92.5	0.22	0.22	0.00	1.2
93.8	0.22	0.22	0.00	0.8
95.0	0.22	0.22	0.00	-0.6
96.3	0.22	0.21	0.00	-1.1
97.5	0.21	0.21	0.00	-0.7
98.8	0.21	0.21	0.00	-0.9
100.0	0.20	0.20	0.00	-1.7
Min	0.20	0.20	-0.02	-5.2
Max	0.39	0.39	0.00	1.7
Mean	0.29	0.29	0.00	-0.9
Median	0.28	0.27	0.00	-1.0
P.I.	Percent of time -- (-1.1<X<1.1)			45.0
1.1<=X<10.0				10.0
X>=10.0				0.0
-10.0<X<=-1.1				46.3
X<=-10.0				0.0

Alternative C Compared to Existing Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
Existing Conditions	0.79	0.36	0.28
NODOS Alternative C	0.82	0.36	0.29
Difference	0.03	0.00	0.00
Percent Difference[3]	4	1	1
Water Year Types[2]			
Wet (32.5%)			
Existing Conditions	0.91	0.37	0.29
NODOS Alternative C	0.90	0.37	0.29
Difference	-0.01	0.00	0.00
Percent Difference	-1	1	1
Above Normal (12.5%)			
Existing Conditions	0.90	0.35	0.29
NODOS Alternative C	0.89	0.34	0.29
Difference	0.00	0.00	0.00
Percent Difference	0	-1	1
Below Normal (17.5%)			
Existing Conditions	0.86	0.37	0.30
NODOS Alternative C	0.88	0.35	0.30
Difference	0.02	-0.01	0.00
Percent Difference	2	-3	2
Dry (22.5%)			
Existing Conditions	0.78	0.38	0.28
NODOS Alternative C	0.81	0.37	0.28
Difference	0.04	-0.01	0.00
Percent Difference	5	-2	1
Critical (15%)			
Existing Conditions	0.36	0.31	0.26
NODOS Alternative C	0.50	0.36	0.26
Difference	0.14	0.04	0.00
Percent Difference	39	14	0

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

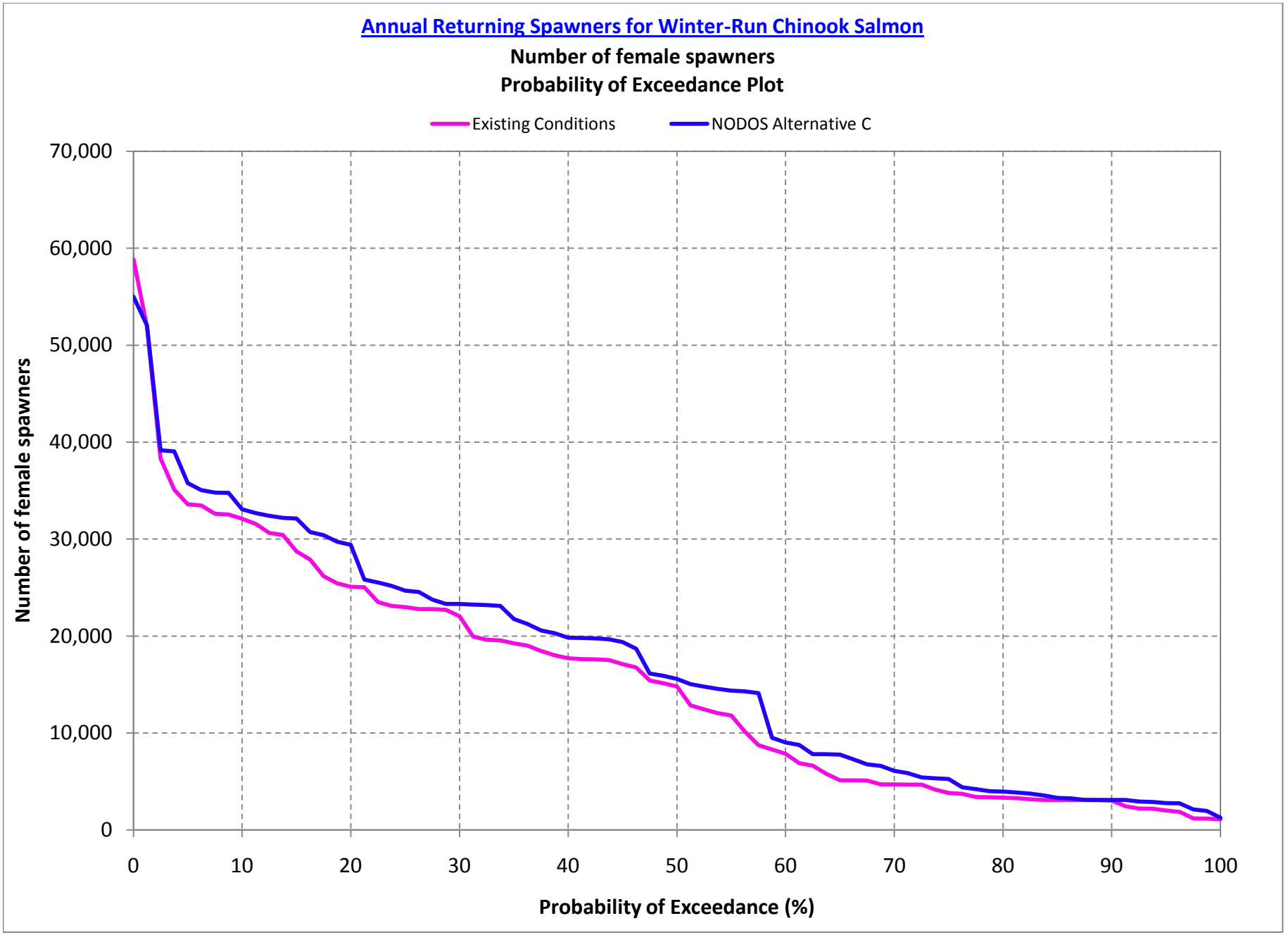
Long-term Average and Average by Water Year Type Annual Returning Spawners

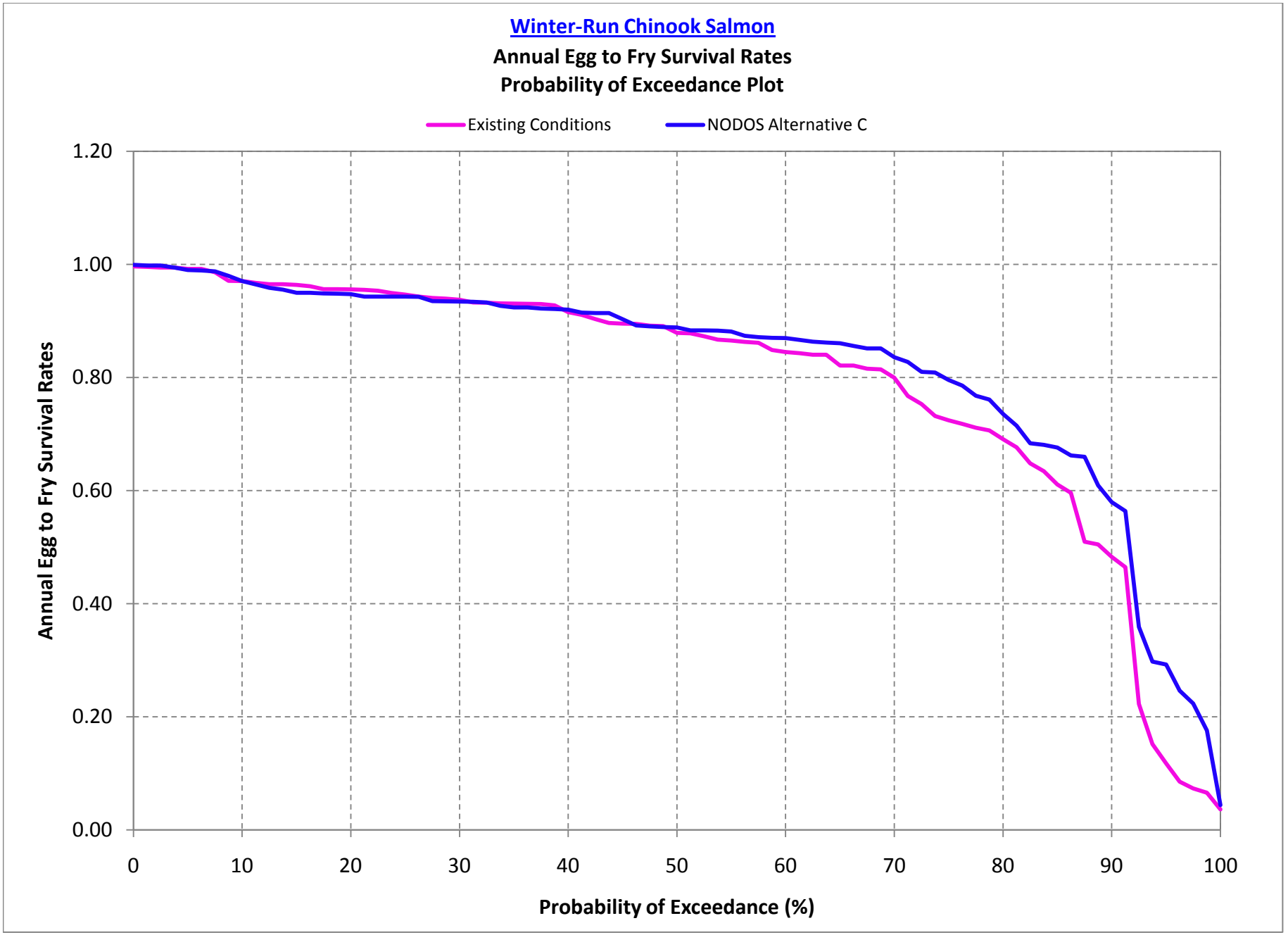
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
Existing Conditions	15,322
NODOS Alternative C	16,941
Difference	1,619
Percent Difference[3]	11
Water Year Types[2]	
Wet (32.5%)	
Existing Conditions	18,586
NODOS Alternative C	20,644
Difference	2,058
Percent Difference	11
Above Normal (12.5%)	
Existing Conditions	12,829
NODOS Alternative C	15,413
Difference	2,583
Percent Difference	20
Below Normal (17.5%)	
Existing Conditions	13,506
NODOS Alternative C	14,232
Difference	727
Percent Difference	5
Dry (22.5%)	
Existing Conditions	15,369
NODOS Alternative C	16,501
Difference	1,132
Percent Difference	7
Critical (15%)	
Existing Conditions	12,586
NODOS Alternative C	14,139
Difference	1,552
Percent Difference	12

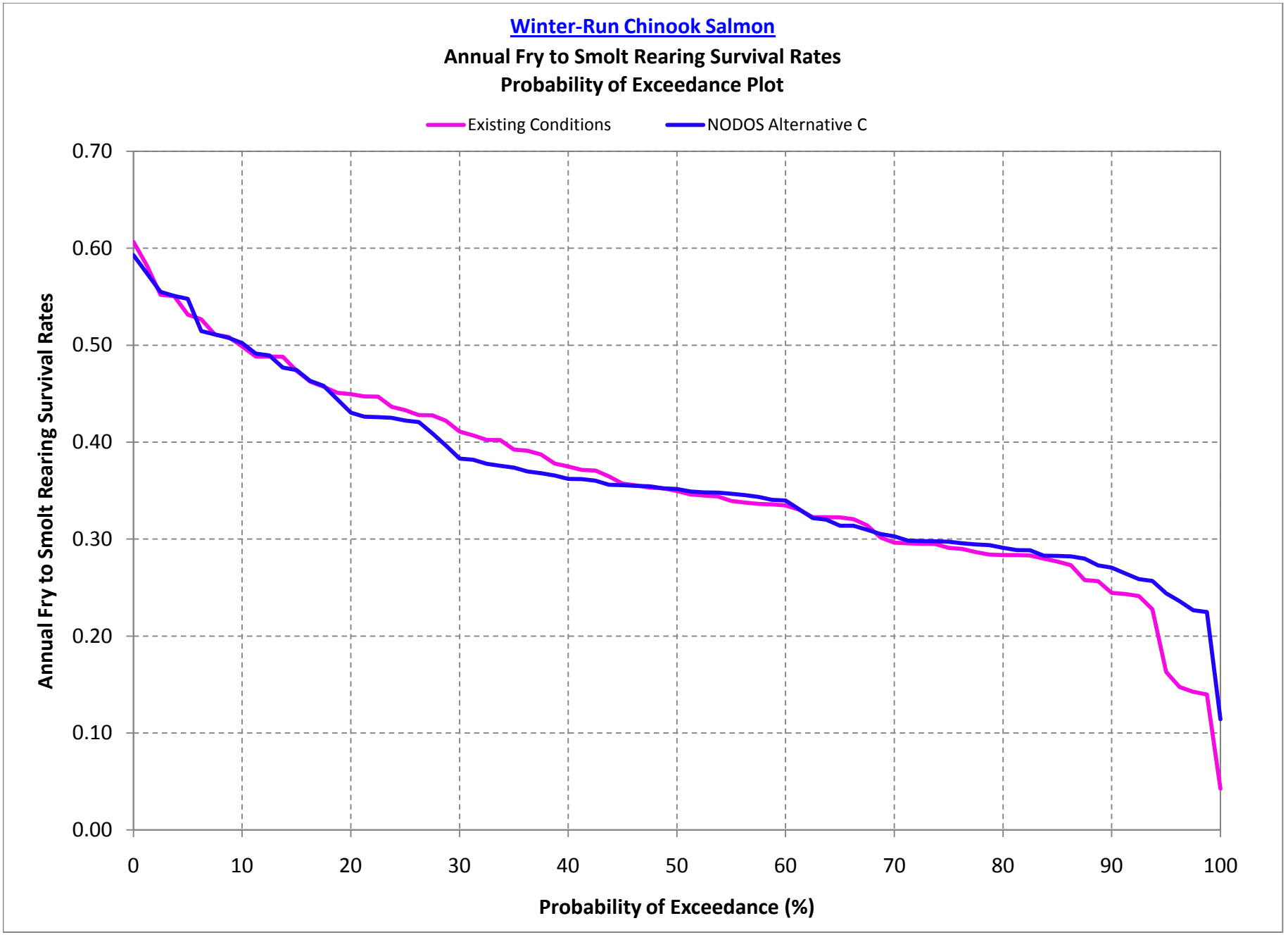
1 Based on the 80-year simulation period

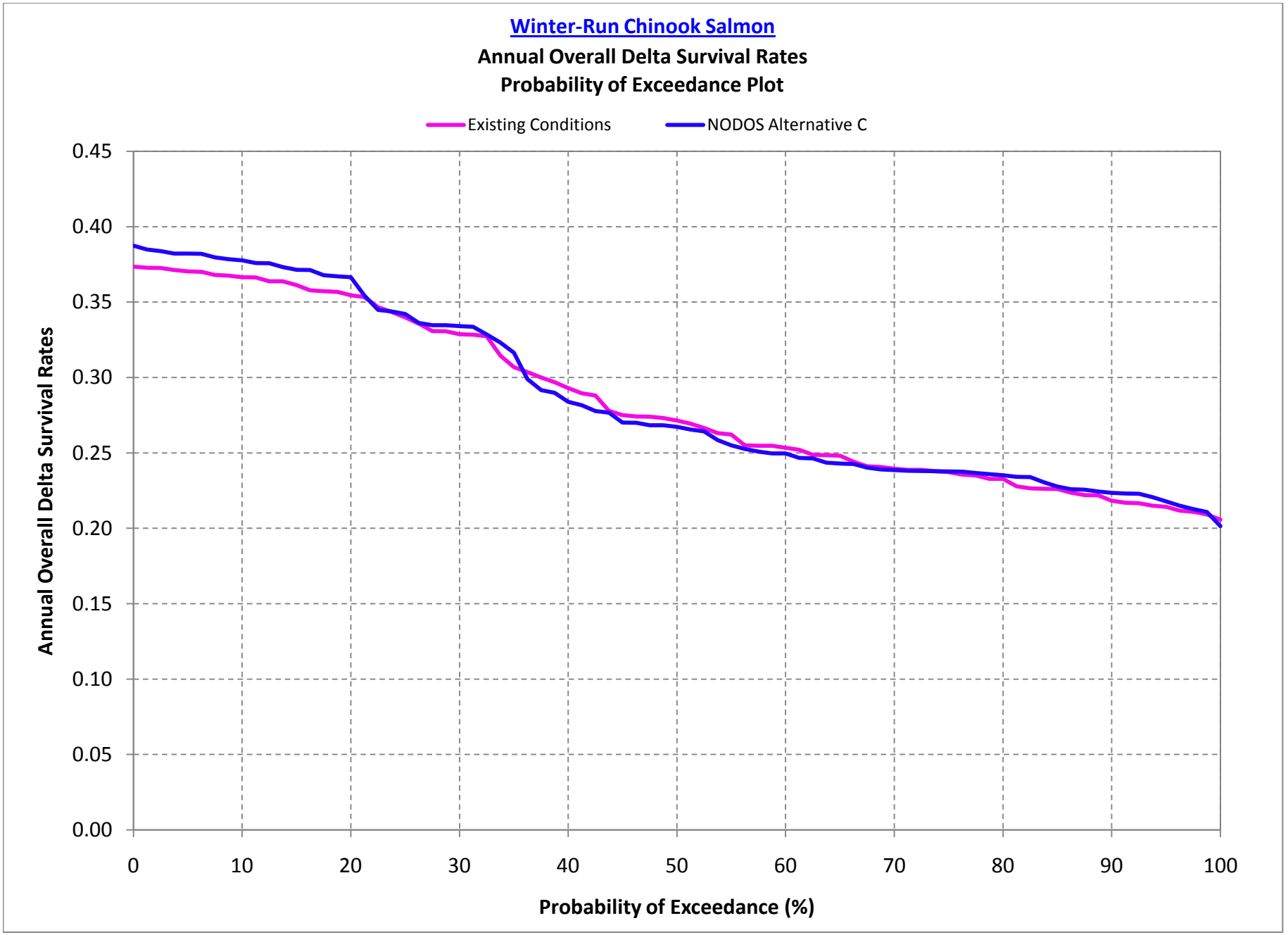
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative C (%)	Absolute Difference (%)	Relative Difference (%)
0.0	58,860	55,016	-3,844	-6.5
1.3	51,867	52,042	175	0.3
2.5	38,332	39,153	821	2.1
3.8	35,102	39,049	3,947	11.2
5.0	33,579	35,765	2,186	6.5
6.3	33,475	35,043	1,568	4.7
7.5	32,610	34,781	2,171	6.7
8.8	32,534	34,773	2,239	6.9
10.0	32,103	33,071	968	3.0
11.3	31,563	32,671	1,108	3.5
12.5	30,644	32,407	1,763	5.8
13.8	30,420	32,178	1,758	5.8
15.0	28,719	32,115	3,396	11.8
16.3	27,879	30,723	2,844	10.2
17.5	26,176	30,409	4,233	16.2
18.8	25,419	29,737	4,318	17.0
20.0	25,089	29,390	4,301	17.1
21.3	25,021	25,826	805	3.2
22.5	23,508	25,513	2,005	8.5
23.8	23,093	25,160	2,067	9.0
25.0	22,996	24,691	1,695	7.4
26.3	22,775	24,552	1,777	7.8
27.5	22,768	23,748	980	4.3
28.8	22,704	23,315	611	2.7
30.0	22,028	23,313	1,285	5.8
31.3	19,940	23,237	3,297	16.5
32.5	19,609	23,207	3,598	18.3
33.8	19,556	23,114	3,558	18.2
35.0	19,242	21,755	2,513	13.1
36.3	19,022	21,237	2,215	11.6
37.5	18,450	20,564	2,114	11.5
38.8	18,021	20,281	2,260	12.5
40.0	17,712	19,815	2,103	11.9
41.3	17,609	19,801	2,192	12.4
42.5	17,597	19,761	2,164	12.3
43.8	17,523	19,669	2,146	12.2
45.0	17,118	19,393	2,275	13.3
46.3	16,755	18,683	1,928	11.5
47.5	15,422	16,126	704	4.6
48.8	15,132	15,901	769	5.1
50.0	14,811	15,575	764	5.2
51.3	12,851	15,047	2,196	17.1
52.5	12,438	14,785	2,347	18.9
53.8	12,048	14,544	2,496	20.7
55.0	11,798	14,373	2,575	21.8
56.3	10,149	14,285	4,136	40.8
57.5	8,736	14,105	5,369	61.5
58.8	8,288	9,510	1,222	14.7
60.0	7,855	9,027	1,172	14.9
61.3	6,890	8,760	1,871	27.2

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions (%)	NODOS Alternative C (%)	Absolute Difference (%)	Relative Difference (%)
62.5	6,622	7,806	1,184	17.9
63.8	5,782	7,801	2,019	34.9
65.0	5,127	7,760	2,634	51.4
66.3	5,114	7,278	2,165	42.3
67.5	5,094	6,771	1,678	32.9
68.8	4,694	6,610	1,916	40.8
70.0	4,692	6,080	1,388	29.6
71.3	4,682	5,868	1,186	25.3
72.5	4,671	5,413	742	15.9
73.8	4,166	5,323	1,156	27.8
75.0	3,805	5,245	1,440	37.8
76.3	3,714	4,393	678	18.3
77.5	3,401	4,220	818	24.1
78.8	3,379	4,007	628	18.6
80.0	3,325	3,962	637	19.2
81.3	3,273	3,852	579	17.7
82.5	3,165	3,738	574	18.1
83.8	3,088	3,567	479	15.5
85.0	3,088	3,293	206	6.7
86.3	3,088	3,246	158	5.1
87.5	3,088	3,088	0	0.0
88.8	3,064	3,088	24	0.8
90.0	3,012	3,088	75	2.5
91.3	2,454	3,088	634	25.8
92.5	2,210	2,928	718	32.5
93.8	2,191	2,883	692	31.6
95.0	1,991	2,772	781	39.2
96.3	1,859	2,746	887	47.7
97.5	1,195	2,114	919	76.8
98.8	1,160	1,949	790	68.1
100.0	1,092	1,252	160	14.7
Min	1,092	1,252	-3,844	-6.5
Max	58,860	55,016	5,369	76.8
Mean	15,322	16,941	1,619	17.8
Median	14,811	15,575	1,568	14.7
P.I.	Percent of time -- (-1.1<X<1.1)			3.8
1.1<=X<10.0				28.8
X>=10.0				67.5
-10.0<X<=-1.1				1.3
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	0.3
1.3	1.00	1.00	0.00	0.2
2.5	0.99	1.00	0.00	0.3
3.8	0.99	0.99	0.00	0.0
5.0	0.99	0.99	0.00	-0.2
6.3	0.99	0.99	0.00	-0.3
7.5	0.99	0.99	0.00	0.2
8.8	0.97	0.98	0.01	0.9
10.0	0.97	0.97	0.00	0.0
11.3	0.97	0.96	0.00	-0.3
12.5	0.97	0.96	-0.01	-0.7
13.8	0.96	0.96	-0.01	-1.0
15.0	0.96	0.95	-0.01	-1.5
16.3	0.96	0.95	-0.01	-1.2
17.5	0.96	0.95	-0.01	-0.8
18.8	0.96	0.95	-0.01	-0.8
20.0	0.96	0.95	-0.01	-0.9
21.3	0.96	0.94	-0.01	-1.2
22.5	0.95	0.94	-0.01	-1.1
23.8	0.95	0.94	-0.01	-0.7
25.0	0.95	0.94	0.00	-0.4
26.3	0.94	0.94	0.00	0.0
27.5	0.94	0.94	-0.01	-0.6
28.8	0.94	0.93	0.00	-0.5
30.0	0.94	0.93	0.00	-0.3
31.3	0.93	0.93	0.00	0.1
32.5	0.93	0.93	0.00	0.1
33.8	0.93	0.93	0.00	-0.5
35.0	0.93	0.92	-0.01	-0.8
36.3	0.93	0.92	-0.01	-0.7
37.5	0.93	0.92	-0.01	-0.8
38.8	0.93	0.92	-0.01	-0.7
40.0	0.92	0.92	0.00	0.5
41.3	0.91	0.91	0.00	0.4
42.5	0.90	0.91	0.01	1.2
43.8	0.90	0.91	0.02	2.0
45.0	0.90	0.90	0.01	0.9
46.3	0.89	0.89	0.00	-0.3
47.5	0.89	0.89	0.00	-0.1
48.8	0.89	0.89	0.00	-0.2
50.0	0.88	0.89	0.01	1.1
51.3	0.88	0.88	0.01	0.6
52.5	0.87	0.88	0.01	1.2
53.8	0.87	0.88	0.02	1.9
55.0	0.87	0.88	0.02	1.8
56.3	0.86	0.87	0.01	1.2
57.5	0.86	0.87	0.01	1.1
58.8	0.85	0.87	0.02	2.5
60.0	0.84	0.87	0.02	3.0
61.3	0.84	0.87	0.02	2.8

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.84	0.86	0.02	2.7
63.8	0.84	0.86	0.02	2.5
65.0	0.82	0.86	0.04	4.8
66.3	0.82	0.86	0.03	4.3
67.5	0.82	0.85	0.04	4.4
68.8	0.81	0.85	0.04	4.5
70.0	0.80	0.84	0.04	4.5
71.3	0.77	0.83	0.06	7.8
72.5	0.75	0.81	0.06	7.6
73.8	0.73	0.81	0.08	10.5
75.0	0.72	0.80	0.07	9.8
76.3	0.72	0.79	0.07	9.5
77.5	0.71	0.77	0.06	7.9
78.8	0.71	0.76	0.05	7.7
80.0	0.69	0.74	0.04	6.5
81.3	0.68	0.71	0.04	5.6
82.5	0.65	0.68	0.04	5.5
83.8	0.63	0.68	0.05	7.4
85.0	0.61	0.68	0.07	10.7
86.3	0.60	0.66	0.07	11.1
87.5	0.51	0.66	0.15	29.5
88.8	0.50	0.61	0.10	20.6
90.0	0.48	0.58	0.10	20.1
91.3	0.46	0.56	0.10	21.4
92.5	0.22	0.36	0.14	61.2
93.8	0.15	0.30	0.15	96.3
95.0	0.12	0.29	0.17	148.6
96.3	0.09	0.25	0.16	188.3
97.5	0.07	0.22	0.15	205.0
98.8	0.07	0.18	0.11	167.6
100.0	0.04	0.04	0.01	20.2
Min	0.04	0.04	-0.01	-1.5
Max	1.00	1.00	0.17	205.0
Mean	0.79	0.82	0.03	13.8
Median	0.88	0.89	0.01	1.1
P.I.	Percent of time -- (-1.1<X<1.1)			43.8
1.1<=X<10.0				35.0
X>=10.0				17.5
-10.0<X<=-1.1				5.0
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.61	0.59	-0.01	-2.3
1.3	0.58	0.57	-0.01	-1.4
2.5	0.55	0.55	0.00	0.5
3.8	0.55	0.55	0.00	0.0
5.0	0.53	0.55	0.02	3.0
6.3	0.53	0.51	-0.01	-2.3
7.5	0.51	0.51	0.00	0.0
8.8	0.51	0.51	0.00	-0.2
10.0	0.50	0.50	0.00	0.7
11.3	0.49	0.49	0.00	0.6
12.5	0.49	0.49	0.00	0.3
13.8	0.49	0.48	-0.01	-2.3
15.0	0.47	0.47	0.00	0.1
16.3	0.46	0.46	0.00	0.1
17.5	0.46	0.46	0.00	0.2
18.8	0.45	0.44	-0.01	-1.5
20.0	0.45	0.43	-0.02	-4.2
21.3	0.45	0.43	-0.02	-4.7
22.5	0.45	0.43	-0.02	-4.8
23.8	0.44	0.42	-0.01	-2.6
25.0	0.43	0.42	-0.01	-2.5
26.3	0.43	0.42	-0.01	-1.7
27.5	0.43	0.41	-0.02	-4.4
28.8	0.42	0.40	-0.03	-6.0
30.0	0.41	0.38	-0.03	-6.8
31.3	0.41	0.38	-0.03	-6.2
32.5	0.40	0.38	-0.02	-6.1
33.8	0.40	0.38	-0.03	-6.6
35.0	0.39	0.37	-0.02	-4.8
36.3	0.39	0.37	-0.02	-5.5
37.5	0.39	0.37	-0.02	-5.0
38.8	0.38	0.37	-0.01	-3.3
40.0	0.37	0.36	-0.01	-3.4
41.3	0.37	0.36	-0.01	-2.6
42.5	0.37	0.36	-0.01	-2.8
43.8	0.36	0.36	-0.01	-2.3
45.0	0.36	0.36	0.00	-0.4
46.3	0.36	0.35	0.00	-0.1
47.5	0.35	0.35	0.00	0.4
48.8	0.35	0.35	0.00	0.0
50.0	0.35	0.35	0.00	0.7
51.3	0.35	0.35	0.00	0.9
52.5	0.34	0.35	0.00	1.0
53.8	0.34	0.35	0.00	1.1
55.0	0.34	0.35	0.01	2.2
56.3	0.34	0.35	0.01	2.3
57.5	0.34	0.34	0.01	2.2
58.8	0.34	0.34	0.00	1.4
60.0	0.33	0.34	0.01	1.6
61.3	0.33	0.33	0.00	0.2

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.32	0.32	0.00	-0.3
63.8	0.32	0.32	0.00	-0.8
65.0	0.32	0.31	-0.01	-2.6
66.3	0.32	0.31	-0.01	-2.1
67.5	0.31	0.31	0.00	-1.5
68.8	0.30	0.31	0.00	1.2
70.0	0.30	0.30	0.01	2.2
71.3	0.30	0.30	0.00	0.9
72.5	0.30	0.30	0.00	0.9
73.8	0.30	0.30	0.00	0.9
75.0	0.29	0.30	0.01	2.2
76.3	0.29	0.30	0.01	2.0
77.5	0.29	0.29	0.01	2.7
78.8	0.28	0.29	0.01	3.4
80.0	0.28	0.29	0.01	2.6
81.3	0.28	0.29	0.01	1.8
82.5	0.28	0.29	0.01	1.9
83.8	0.28	0.28	0.00	1.1
85.0	0.28	0.28	0.01	2.1
86.3	0.27	0.28	0.01	3.4
87.5	0.26	0.28	0.02	8.5
88.8	0.26	0.27	0.02	6.4
90.0	0.24	0.27	0.03	10.7
91.3	0.24	0.26	0.02	8.7
92.5	0.24	0.26	0.02	7.2
93.8	0.23	0.26	0.03	13.0
95.0	0.16	0.24	0.08	49.9
96.3	0.15	0.24	0.09	60.2
97.5	0.14	0.23	0.08	58.9
98.8	0.14	0.22	0.09	61.0
100.0	0.04	0.11	0.07	168.7
Min	0.04	0.11	-0.03	-6.8
Max	0.61	0.59	0.09	168.7
Mean	0.36	0.36	0.00	4.9
Median	0.35	0.35	0.00	0.3
P.I.	Percent of time -- (-1.1<X<1.1)			28.8
1.1<=X<10.0				28.8
X>=10.0				8.8
-10.0<X<=-1.1				35.0
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.37	0.39	0.01	3.7
1.3	0.37	0.38	0.01	3.2
2.5	0.37	0.38	0.01	3.0
3.8	0.37	0.38	0.01	2.9
5.0	0.37	0.38	0.01	3.2
6.3	0.37	0.38	0.01	3.2
7.5	0.37	0.38	0.01	3.1
8.8	0.37	0.38	0.01	2.9
10.0	0.37	0.38	0.01	3.1
11.3	0.37	0.38	0.01	2.6
12.5	0.36	0.38	0.01	3.3
13.8	0.36	0.37	0.01	2.6
15.0	0.36	0.37	0.01	2.8
16.3	0.36	0.37	0.01	3.8
17.5	0.36	0.37	0.01	3.0
18.8	0.36	0.37	0.01	2.9
20.0	0.35	0.37	0.01	3.4
21.3	0.35	0.35	0.00	0.3
22.5	0.35	0.34	0.00	-0.5
23.8	0.34	0.34	0.00	0.1
25.0	0.34	0.34	0.00	0.7
26.3	0.34	0.34	0.00	0.1
27.5	0.33	0.33	0.00	1.2
28.8	0.33	0.33	0.00	1.2
30.0	0.33	0.33	0.01	1.6
31.3	0.33	0.33	0.01	1.6
32.5	0.33	0.33	0.00	0.4
33.8	0.31	0.32	0.01	2.8
35.0	0.31	0.32	0.01	3.1
36.3	0.30	0.30	0.00	-1.6
37.5	0.30	0.29	-0.01	-2.8
38.8	0.30	0.29	-0.01	-2.4
40.0	0.29	0.28	-0.01	-3.1
41.3	0.29	0.28	-0.01	-2.8
42.5	0.29	0.28	-0.01	-3.6
43.8	0.28	0.28	0.00	-0.5
45.0	0.28	0.27	0.00	-1.8
46.3	0.27	0.27	0.00	-1.5
47.5	0.27	0.27	-0.01	-2.0
48.8	0.27	0.27	0.00	-1.8
50.0	0.27	0.27	0.00	-1.5
51.3	0.27	0.27	0.00	-1.4
52.5	0.27	0.26	0.00	-0.8
53.8	0.26	0.26	0.00	-1.8
55.0	0.26	0.26	-0.01	-2.7
56.3	0.26	0.25	0.00	-1.0
57.5	0.25	0.25	0.00	-1.6
58.8	0.25	0.25	-0.01	-2.0
60.0	0.25	0.25	0.00	-1.5
61.3	0.25	0.25	-0.01	-2.2

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.25	0.25	0.00	-1.0
63.8	0.25	0.24	0.00	-1.9
65.0	0.25	0.24	-0.01	-2.1
66.3	0.24	0.24	0.00	-0.6
67.5	0.24	0.24	0.00	-0.3
68.8	0.24	0.24	0.00	-0.7
70.0	0.24	0.24	0.00	-0.4
71.3	0.24	0.24	0.00	-0.3
72.5	0.24	0.24	0.00	-0.3
73.8	0.24	0.24	0.00	0.0
75.0	0.24	0.24	0.00	0.2
76.3	0.24	0.24	0.00	0.8
77.5	0.24	0.24	0.00	0.7
78.8	0.23	0.24	0.00	1.3
80.0	0.23	0.24	0.00	1.0
81.3	0.23	0.23	0.01	2.8
82.5	0.23	0.23	0.01	3.3
83.8	0.23	0.23	0.00	2.0
85.0	0.23	0.23	0.00	0.7
86.3	0.22	0.23	0.00	1.0
87.5	0.22	0.23	0.00	1.6
88.8	0.22	0.22	0.00	1.1
90.0	0.22	0.22	0.01	2.4
91.3	0.22	0.22	0.01	2.9
92.5	0.22	0.22	0.01	2.9
93.8	0.21	0.22	0.01	2.7
95.0	0.21	0.22	0.00	1.7
96.3	0.21	0.21	0.00	1.5
97.5	0.21	0.21	0.00	0.8
98.8	0.21	0.21	0.00	0.8
100.0	0.21	0.20	0.00	-2.1
Min	0.21	0.20	-0.01	-3.6
Max	0.37	0.39	0.01	3.8
Mean	0.28	0.29	0.00	0.6
Median	0.27	0.27	0.00	0.7
P.I.	Percent of time -- (-1.1<X<1.1)			31.3
1.1<=X<10.0				43.8
X>=10.0				0.0
-10.0<X<=-1.1				26.3
X<=-10.0				0.0

Alternative C Compared to No Action Alternative Condition

Winter-Run Chinook Salmon

Long-term Average and Average by Water Year Type Annual Survival

Analysis Period	Annual Survival Rates		
	Egg to Fry	Fry to Smolt	Overall Delta
Long-term			
Full Simulation Period[1]			
No Action Alternative	0.79	0.36	0.29
NODOS Alternative C	0.82	0.36	0.29
Difference	0.03	0.01	0.00
Percent Difference[3]	4	2	-2
Water Year Types[2]			
Wet (32.5%)			
BST NAA (070510)	0.91	0.36	0.30
NODOS ALT C (020811)	0.90	0.37	0.29
Difference	-0.01	0.01	0.00
Percent Difference	-1	2	-2
Above Normal (12.5%)			
BST NAA (070510)	0.90	0.34	0.30
NODOS ALT C (020811)	0.89	0.34	0.29
Difference	-0.01	0.00	-0.01
Percent Difference	-1	0	-2
Below Normal (17.5%)			
BST NAA (070510)	0.86	0.36	0.31
NODOS ALT C (020811)	0.88	0.35	0.30
Difference	0.02	0.00	0.00
Percent Difference	2	-1	-1
Dry (22.5%)			
BST NAA (070510)	0.76	0.38	0.29
NODOS ALT C (020811)	0.81	0.37	0.28
Difference	0.05	0.00	0.00
Percent Difference	7	-1	-1
Critical (15%)			
BST NAA (070510)	0.38	0.32	0.26
NODOS ALT C (020811)	0.50	0.36	0.26
Difference	0.12	0.04	-0.01
Percent Difference	33	13	-3

1 Based on the 80-year simulation period

2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average

Winter-Run Chinook Salmon

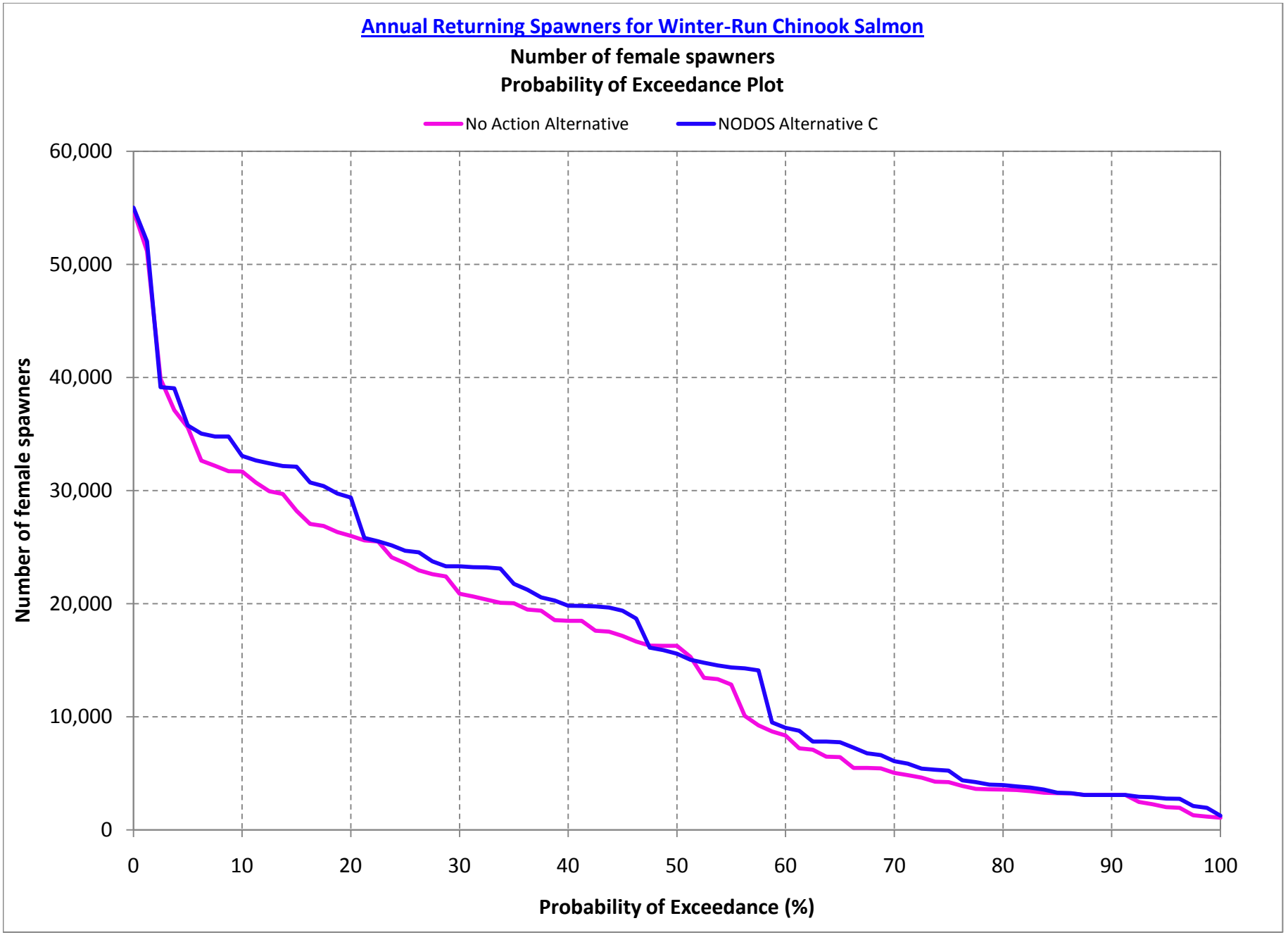
Long-term Average and Average by Water Year Type Annual Returning Spawners

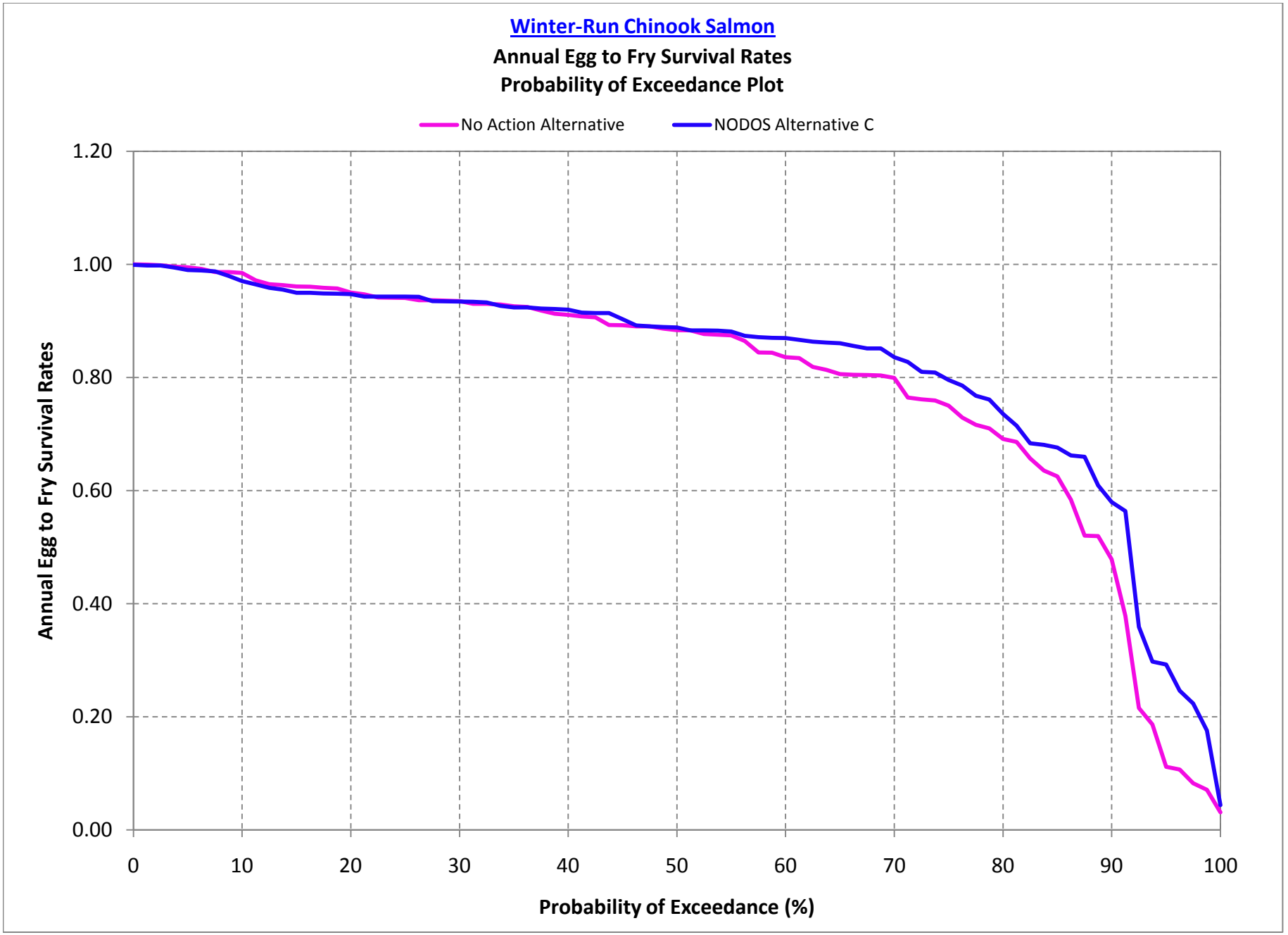
Analysis Period	Number of Female Spawners
Long-term	
Full Simulation Period[1]	
No Action Alternative	15,636
NODOS Alternative C	16,941
Difference	1,305
Percent Difference[3]	8
Water Year Types[2]	
Wet (32.5%)	
BST NAA (070510)	18,717
NODOS ALT C (020811)	20,644
Difference	1,927
Percent Difference	10
Above Normal (12.5%)	
BST NAA (070510)	13,331
NODOS ALT C (020811)	15,413
Difference	2,082
Percent Difference	16
Below Normal (17.5%)	
BST NAA (070510)	14,002
NODOS ALT C (020811)	14,232
Difference	230
Percent Difference	2
Dry (22.5%)	
BST NAA (070510)	15,604
NODOS ALT C (020811)	16,501
Difference	896
Percent Difference	6
Critical (15%)	
BST NAA (070510)	13,030
NODOS ALT C (020811)	14,139
Difference	1,109
Percent Difference	9

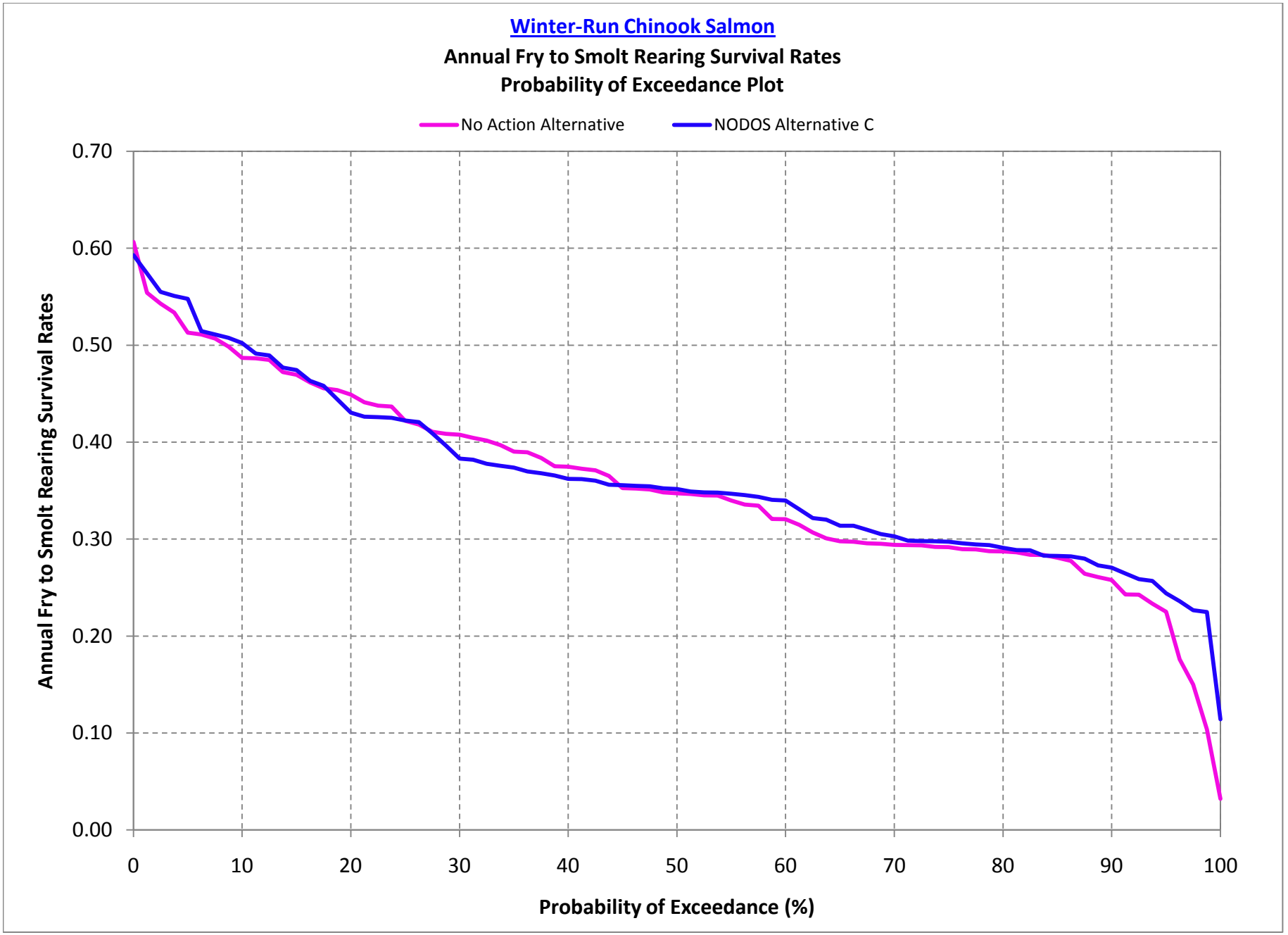
1 Based on the 80-year simulation period

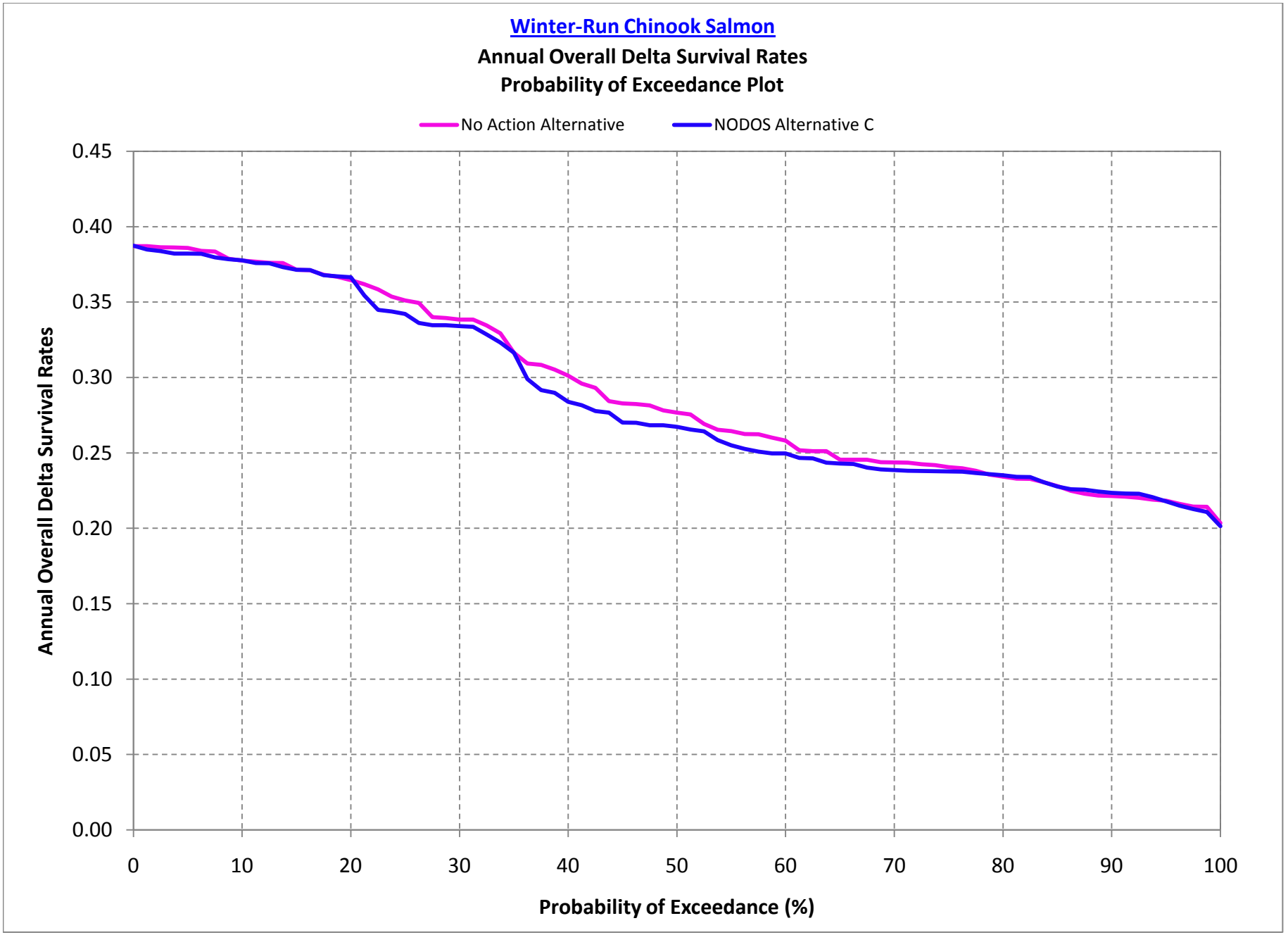
2 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995). Water years may not correspond to the biological years in IOS.

3 Relative difference of the Annual average









Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative C (%)	Absolute Difference (%)	Relative Difference (%)
0.0	54,752	55,016	264	0.5
1.3	51,177	52,042	865	1.7
2.5	39,882	39,153	-729	-1.8
3.8	37,103	39,049	1,946	5.2
5.0	35,571	35,765	194	0.5
6.3	32,659	35,043	2,384	7.3
7.5	32,197	34,781	2,584	8.0
8.8	31,724	34,773	3,049	9.6
10.0	31,697	33,071	1,374	4.3
11.3	30,728	32,671	1,943	6.3
12.5	29,946	32,407	2,461	8.2
13.8	29,705	32,178	2,473	8.3
15.0	28,202	32,115	3,913	13.9
16.3	27,063	30,723	3,660	13.5
17.5	26,870	30,409	3,539	13.2
18.8	26,345	29,737	3,392	12.9
20.0	26,001	29,390	3,389	13.0
21.3	25,608	25,826	218	0.9
22.5	25,492	25,513	21	0.1
23.8	24,110	25,160	1,050	4.4
25.0	23,586	24,691	1,105	4.7
26.3	22,947	24,552	1,605	7.0
27.5	22,610	23,748	1,138	5.0
28.8	22,406	23,315	909	4.1
30.0	20,875	23,313	2,438	11.7
31.3	20,642	23,237	2,595	12.6
32.5	20,366	23,207	2,841	13.9
33.8	20,091	23,114	3,023	15.0
35.0	20,041	21,755	1,714	8.6
36.3	19,476	21,237	1,761	9.0
37.5	19,386	20,564	1,178	6.1
38.8	18,557	20,281	1,724	9.3
40.0	18,497	19,815	1,318	7.1
41.3	18,484	19,801	1,317	7.1
42.5	17,617	19,761	2,144	12.2
43.8	17,541	19,669	2,128	12.1
45.0	17,151	19,393	2,242	13.1
46.3	16,652	18,683	2,031	12.2
47.5	16,296	16,126	-170	-1.0
48.8	16,282	15,901	-381	-2.3
50.0	16,278	15,575	-703	-4.3
51.3	15,297	15,047	-250	-1.6
52.5	13,439	14,785	1,346	10.0
53.8	13,334	14,544	1,210	9.1
55.0	12,845	14,373	1,528	11.9
56.3	10,085	14,285	4,200	41.6
57.5	9,235	14,105	4,870	52.7
58.8	8,704	9,510	806	9.3
60.0	8,351	9,027	677	8.1
61.3	7,208	8,760	1,553	21.5

Annual Returning Spawners for Winter-Run Chinook Salmon				
Number of female spawners				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative (%)	NODOS Alternative C (%)	Absolute Difference (%)	Relative Difference (%)
62.5	7,096	7,806	710	10.0
63.8	6,478	7,801	1,323	20.4
65.0	6,437	7,760	1,324	20.6
66.3	5,485	7,278	1,793	32.7
67.5	5,470	6,771	1,301	23.8
68.8	5,443	6,610	1,167	21.4
70.0	5,040	6,080	1,040	20.6
71.3	4,837	5,868	1,031	21.3
72.5	4,633	5,413	780	16.8
73.8	4,263	5,323	1,060	24.9
75.0	4,231	5,245	1,014	24.0
76.3	3,895	4,393	498	12.8
77.5	3,629	4,220	590	16.3
78.8	3,589	4,007	418	11.7
80.0	3,568	3,962	393	11.0
81.3	3,520	3,852	332	9.4
82.5	3,437	3,738	302	8.8
83.8	3,295	3,567	272	8.2
85.0	3,252	3,293	42	1.3
86.3	3,224	3,246	22	0.7
87.5	3,088	3,088	0	0.0
88.8	3,088	3,088	0	0.0
90.0	3,088	3,088	0	0.0
91.3	3,088	3,088	0	0.0
92.5	2,467	2,928	462	18.7
93.8	2,278	2,883	605	26.6
95.0	2,008	2,772	764	38.1
96.3	1,954	2,746	792	40.5
97.5	1,302	2,114	811	62.3
98.8	1,172	1,949	777	66.3
100.0	1,086	1,252	166	15.3
Min	1,086	1,252	-729	-4.3
Max	54,752	55,016	4,870	66.3
Mean	15,636	16,941	1,305	12.8
Median	16,278	15,575	1,105	9.6
P.I.	Percent of time -- (-1.1<X<1.1)			12.5
1.1<=X<10.0				33.8
X>=10.0				50.0
-10.0<X<=-1.1				5.0
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	1.00	1.00	0.00	-0.1
1.3	1.00	1.00	0.00	-0.2
2.5	1.00	1.00	0.00	-0.1
3.8	1.00	0.99	0.00	-0.2
5.0	0.99	0.99	0.00	-0.5
6.3	0.99	0.99	0.00	-0.3
7.5	0.99	0.99	0.00	0.1
8.8	0.99	0.98	-0.01	-0.7
10.0	0.98	0.97	-0.01	-1.4
11.3	0.97	0.96	-0.01	-0.7
12.5	0.97	0.96	-0.01	-0.6
13.8	0.96	0.96	-0.01	-0.8
15.0	0.96	0.95	-0.01	-1.2
16.3	0.96	0.95	-0.01	-1.1
17.5	0.96	0.95	-0.01	-1.0
18.8	0.96	0.95	-0.01	-1.0
20.0	0.95	0.95	0.00	-0.3
21.3	0.95	0.94	0.00	-0.4
22.5	0.94	0.94	0.00	0.2
23.8	0.94	0.94	0.00	0.2
25.0	0.94	0.94	0.00	0.2
26.3	0.94	0.94	0.01	0.6
27.5	0.94	0.94	0.00	-0.2
28.8	0.94	0.93	0.00	-0.1
30.0	0.94	0.93	0.00	-0.1
31.3	0.93	0.93	0.00	0.4
32.5	0.93	0.93	0.00	0.3
33.8	0.93	0.93	0.00	-0.3
35.0	0.93	0.92	0.00	-0.2
36.3	0.92	0.92	0.00	-0.1
37.5	0.92	0.92	0.00	0.4
38.8	0.91	0.92	0.01	0.9
40.0	0.91	0.92	0.01	1.0
41.3	0.91	0.91	0.01	0.8
42.5	0.91	0.91	0.01	0.9
43.8	0.89	0.91	0.02	2.3
45.0	0.89	0.90	0.01	1.2
46.3	0.89	0.89	0.00	0.2
47.5	0.89	0.89	0.00	0.0
48.8	0.89	0.89	0.00	0.3
50.0	0.88	0.89	0.00	0.5
51.3	0.88	0.88	0.00	0.0
52.5	0.88	0.88	0.01	0.7
53.8	0.88	0.88	0.01	0.8
55.0	0.87	0.88	0.01	0.8
56.3	0.86	0.87	0.01	1.1
57.5	0.84	0.87	0.03	3.2
58.8	0.84	0.87	0.03	3.1
60.0	0.84	0.87	0.03	4.0
61.3	0.83	0.87	0.03	3.9

Winter-Run Chinook Salmon				
Annual Egg to Fry Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.82	0.86	0.04	5.5
63.8	0.81	0.86	0.05	5.9
65.0	0.81	0.86	0.05	6.8
66.3	0.80	0.86	0.05	6.4
67.5	0.80	0.85	0.05	5.9
68.8	0.80	0.85	0.05	5.9
70.0	0.80	0.84	0.04	4.6
71.3	0.76	0.83	0.06	8.3
72.5	0.76	0.81	0.05	6.4
73.8	0.76	0.81	0.05	6.5
75.0	0.75	0.80	0.05	6.1
76.3	0.73	0.79	0.06	7.8
77.5	0.72	0.77	0.05	7.2
78.8	0.71	0.76	0.05	7.2
80.0	0.69	0.74	0.04	6.4
81.3	0.69	0.71	0.03	4.2
82.5	0.66	0.68	0.03	4.1
83.8	0.64	0.68	0.05	7.2
85.0	0.63	0.68	0.05	8.1
86.3	0.58	0.66	0.08	13.4
87.5	0.52	0.66	0.14	26.8
88.8	0.52	0.61	0.09	17.2
90.0	0.48	0.58	0.10	21.1
91.3	0.38	0.56	0.19	48.9
92.5	0.22	0.36	0.14	66.5
93.8	0.19	0.30	0.11	59.8
95.0	0.11	0.29	0.18	162.0
96.3	0.11	0.25	0.14	130.9
97.5	0.08	0.22	0.14	170.3
98.8	0.07	0.18	0.11	148.5
100.0	0.03	0.04	0.01	40.5
Min	0.03	0.04	-0.01	-1.4
Max	1.00	1.00	0.19	170.3
Mean	0.79	0.82	0.03	12.9
Median	0.88	0.89	0.01	0.9
P.I.	Percent of time -- (-1.1<X<1.1)			50.0
1.1<=X<10.0				32.5
X>=10.0				15.0
-10.0<X<=-1.1				3.8
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.61	0.59	-0.01	-2.2
1.3	0.55	0.57	0.02	3.6
2.5	0.54	0.55	0.01	2.2
3.8	0.53	0.55	0.02	3.2
5.0	0.51	0.55	0.04	6.8
6.3	0.51	0.51	0.00	0.7
7.5	0.51	0.51	0.00	0.8
8.8	0.50	0.51	0.01	1.8
10.0	0.49	0.50	0.02	3.1
11.3	0.49	0.49	0.00	1.0
12.5	0.48	0.49	0.00	1.0
13.8	0.47	0.48	0.00	1.0
15.0	0.47	0.47	0.00	1.0
16.3	0.46	0.46	0.00	0.4
17.5	0.46	0.46	0.00	0.5
18.8	0.45	0.44	-0.01	-2.1
20.0	0.45	0.43	-0.02	-4.1
21.3	0.44	0.43	-0.01	-3.4
22.5	0.44	0.43	-0.01	-2.7
23.8	0.44	0.42	-0.01	-2.7
25.0	0.42	0.42	0.00	0.1
26.3	0.42	0.42	0.00	0.6
27.5	0.41	0.41	0.00	-0.4
28.8	0.41	0.40	-0.01	-2.9
30.0	0.41	0.38	-0.02	-6.1
31.3	0.40	0.38	-0.02	-5.5
32.5	0.40	0.38	-0.02	-5.9
33.8	0.40	0.38	-0.02	-5.4
35.0	0.39	0.37	-0.02	-4.3
36.3	0.39	0.37	-0.02	-5.1
37.5	0.38	0.37	-0.02	-4.1
38.8	0.38	0.37	-0.01	-2.5
40.0	0.37	0.36	-0.01	-3.4
41.3	0.37	0.36	-0.01	-2.9
42.5	0.37	0.36	-0.01	-2.9
43.8	0.37	0.36	-0.01	-2.5
45.0	0.35	0.36	0.00	0.8
46.3	0.35	0.35	0.00	0.8
47.5	0.35	0.35	0.00	0.9
48.8	0.35	0.35	0.00	1.1
50.0	0.35	0.35	0.00	1.3
51.3	0.35	0.35	0.00	0.7
52.5	0.35	0.35	0.00	0.9
53.8	0.34	0.35	0.00	0.9
55.0	0.34	0.35	0.01	2.0
56.3	0.34	0.35	0.01	2.9
57.5	0.33	0.34	0.01	2.7
58.8	0.32	0.34	0.02	6.1
60.0	0.32	0.34	0.02	6.1
61.3	0.31	0.33	0.02	5.1

Winter-Run Chinook Salmon				
Annual Fry to Smolt Rearing Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.31	0.32	0.01	4.9
63.8	0.30	0.32	0.02	6.4
65.0	0.30	0.31	0.02	5.4
66.3	0.30	0.31	0.02	5.5
67.5	0.30	0.31	0.01	4.7
68.8	0.30	0.31	0.01	3.4
70.0	0.29	0.30	0.01	3.0
71.3	0.29	0.30	0.00	1.5
72.5	0.29	0.30	0.00	1.5
73.8	0.29	0.30	0.01	2.0
75.0	0.29	0.30	0.01	2.0
76.3	0.29	0.30	0.01	2.1
77.5	0.29	0.29	0.01	1.7
78.8	0.29	0.29	0.01	2.2
80.0	0.29	0.29	0.00	1.3
81.3	0.29	0.29	0.00	0.8
82.5	0.28	0.29	0.00	1.6
83.8	0.28	0.28	0.00	-0.3
85.0	0.28	0.28	0.00	0.6
86.3	0.28	0.28	0.00	1.7
87.5	0.26	0.28	0.02	5.8
88.8	0.26	0.27	0.01	4.6
90.0	0.26	0.27	0.01	5.0
91.3	0.24	0.26	0.02	8.9
92.5	0.24	0.26	0.02	6.7
93.8	0.23	0.26	0.02	10.1
95.0	0.22	0.24	0.02	8.6
96.3	0.18	0.24	0.06	34.1
97.5	0.15	0.23	0.08	51.0
98.8	0.10	0.22	0.12	116.8
100.0	0.03	0.11	0.08	255.5
Min	0.03	0.11	-0.02	-6.1
Max	0.61	0.59	0.12	255.5
Mean	0.36	0.36	0.01	6.8
Median	0.35	0.35	0.00	1.3
P.I.	Percent of time -- (-1.1<X<1.1)			25.0
1.1<=X<10.0				46.3
X>=10.0				6.3
-10.0<X<=-1.1				23.8
X<=-10.0				0.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.39	0.39	0.00	0.1
1.3	0.39	0.38	0.00	-0.6
2.5	0.39	0.38	0.00	-0.6
3.8	0.39	0.38	0.00	-1.0
5.0	0.39	0.38	0.00	-1.0
6.3	0.38	0.38	0.00	-0.5
7.5	0.38	0.38	0.00	-1.0
8.8	0.38	0.38	0.00	-0.1
10.0	0.38	0.38	0.00	0.1
11.3	0.38	0.38	0.00	-0.2
12.5	0.38	0.38	0.00	-0.1
13.8	0.38	0.37	0.00	-0.7
15.0	0.37	0.37	0.00	0.0
16.3	0.37	0.37	0.00	0.0
17.5	0.37	0.37	0.00	-0.1
18.8	0.37	0.37	0.00	0.1
20.0	0.36	0.37	0.00	0.5
21.3	0.36	0.35	-0.01	-2.1
22.5	0.36	0.34	-0.01	-3.8
23.8	0.35	0.34	-0.01	-2.8
25.0	0.35	0.34	-0.01	-2.6
26.3	0.35	0.34	-0.01	-3.8
27.5	0.34	0.33	-0.01	-1.6
28.8	0.34	0.33	0.00	-1.4
30.0	0.34	0.33	0.00	-1.3
31.3	0.34	0.33	0.00	-1.4
32.5	0.33	0.33	-0.01	-1.8
33.8	0.33	0.32	-0.01	-1.9
35.0	0.32	0.32	0.00	0.0
36.3	0.31	0.30	-0.01	-3.3
37.5	0.31	0.29	-0.02	-5.4
38.8	0.31	0.29	-0.02	-5.1
40.0	0.30	0.28	-0.02	-5.7
41.3	0.30	0.28	-0.01	-4.8
42.5	0.29	0.28	-0.02	-5.3
43.8	0.28	0.28	-0.01	-2.7
45.0	0.28	0.27	-0.01	-4.5
46.3	0.28	0.27	-0.01	-4.4
47.5	0.28	0.27	-0.01	-4.6
48.8	0.28	0.27	-0.01	-3.5
50.0	0.28	0.27	-0.01	-3.4
51.3	0.28	0.27	-0.01	-3.6
52.5	0.27	0.26	0.00	-1.8
53.8	0.27	0.26	-0.01	-2.6
55.0	0.26	0.26	-0.01	-3.6
56.3	0.26	0.25	-0.01	-3.8
57.5	0.26	0.25	-0.01	-4.4
58.8	0.26	0.25	-0.01	-4.0
60.0	0.26	0.25	-0.01	-3.3
61.3	0.25	0.25	-0.01	-2.0

Winter-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.25	0.25	0.00	-1.9
63.8	0.25	0.24	-0.01	-3.0
65.0	0.25	0.24	0.00	-1.0
66.3	0.25	0.24	0.00	-1.2
67.5	0.25	0.24	-0.01	-2.1
68.8	0.24	0.24	0.00	-2.0
70.0	0.24	0.24	-0.01	-2.1
71.3	0.24	0.24	-0.01	-2.3
72.5	0.24	0.24	0.00	-1.8
73.8	0.24	0.24	0.00	-1.7
75.0	0.24	0.24	0.00	-1.2
76.3	0.24	0.24	0.00	-0.9
77.5	0.24	0.24	0.00	-0.6
78.8	0.24	0.24	0.00	0.2
80.0	0.23	0.24	0.00	0.4
81.3	0.23	0.23	0.00	0.5
82.5	0.23	0.23	0.00	0.5
83.8	0.23	0.23	0.00	0.0
85.0	0.23	0.23	0.00	-0.1
86.3	0.22	0.23	0.00	0.5
87.5	0.22	0.23	0.00	1.2
88.8	0.22	0.22	0.00	1.2
90.0	0.22	0.22	0.00	0.9
91.3	0.22	0.22	0.00	0.9
92.5	0.22	0.22	0.00	1.3
93.8	0.22	0.22	0.00	0.7
95.0	0.22	0.22	0.00	-0.3
96.3	0.22	0.21	0.00	-0.6
97.5	0.21	0.21	0.00	-0.8
98.8	0.21	0.21	0.00	-1.6
100.0	0.20	0.20	0.00	-1.0
Min	0.20	0.20	-0.02	-5.7
Max	0.39	0.39	0.00	1.3
Mean	0.29	0.29	0.00	-1.6
Median	0.28	0.27	0.00	-1.3
P.I.	Percent of time -- (-1.1<X<1.1)			43.8
1.1<=X<10.0				3.8
X>=10.0				0.0
-10.0<X<=-1.1				53.8
X<=-10.0				0.0

Appendix 12M
Delta Passage Modeling

APPENDIX 12M
Delta Passage Modeling

12M.1 Overview

This appendix provides a summary of modeling performed to simulate migration and survival of fall-run and spring-run juvenile Chinook salmon while in the Sacramento-San Joaquin Delta (Delta). The Delta Passage Model (DPM), developed by Cramer Fish Sciences, was used for the Sacramento River for the North-of-the-Delta Offstream Storage Draft Environmental Impact Report/Environmental Impact Statement (NODOS DEIR/EIS). A description of the DPM and the results used in the detailed evaluation of the proposed Project action alternatives (alternatives) are included. Results were used or referenced in Chapter 12 Aquatic Biological Resources. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B and 12C. As an integrated component of the Interactive Object-oriented Simulation (IOS) model, the DPM was also applied to simulate migration and survival of winter-run juvenile Chinook salmon. A description of the IOS model and the results of the winter-run DPM for winter-run Chinook salmon are presented in Appendix 12L.

12M.1.1 Introduction

The analytical framework used to evaluate the alternatives is summarized in Chapter 5 Guide to the Resource Analyses and Appendix 6B. Assumptions used in modeling the alternatives are summarized in Appendix 6A.

DPM simulates migration, survival, and abundance of fall-run and spring-run juvenile Chinook salmon while in the Delta, entering from the Sacramento River and leaving at Chipps Island as they migrate to the ocean. To estimate survival, DPM considers migration pathways through the Delta, the speed of migration, reach conditions, and loss due to Delta exports at Banks and Jones pumping plants. DPM provides results of annual survival rates for juvenile Chinook salmon passage through the Delta. The report, “Delta Passage Model (DPM) for NODOS” by Cramer Fish Sciences, is included as part of this appendix.

DPM uses outputs from the SWP and CVP Hydrology and System Operations Model (CALSIM II), and daily and sub-daily flow results from the Delta Hydrodynamics Model (DSM2 HYDRO). The CALSIM II model is described in Appendix 6B and the DSM2 model is described in the Appendix 7D.

12M.2 Results

This section includes the results of the DPM for the alternatives evaluated in the NODOS DEIR/EIS. The fisheries impact assessment and methodology is described in Chapter 12 Aquatic Biological Resources and in Appendix 12B and 12C.

12M.2.1 Introduction

DPM annual survival results for fall-run and spring-run juvenile Chinook salmon are included in this appendix. IOS/DPM annual survival results for winter-run juvenile Chinook salmon are included in Appendix 12L. This document includes exceedance probability charts and tables comparing the results.

The exceedance probability charts and tables are organized by the Chinook salmon run, in the following order:

- Sacramento Fall-Run
- Sacramento Spring-Run

Exceedance probability charts and tables are included for the following parameter:

- Annual Overall Delta Survival Rates

DPM results are not intended to predict specific migration pathways and survival rates for juvenile Chinook salmon migrating through the Delta, but rather to indicate a trend in survival in response to the alternative evaluated. Further guidance on the appropriate use of model results is presented in Appendix 6B.

12M.2.2 Comparisons

For each run of Chinook salmon, a report is provided for the following seven comparisons:

- No Project/No Action Alternative compared to Existing Conditions
- Alternative A compared to Existing Conditions
- Alternative A compared to No Project/No Action Alternative
- Alternative B compared to Existing Conditions
- Alternative B compared to No Project/No Action Alternative
- Alternative C compared to Existing Conditions
- Alternative C compared to No Project/No Action Alternative

Delta Passage Model (DPM) for NODOS

Cramer
Fish Sciences

Oregon • California • Washington • Idaho • Alaska

Delta Passage Model (DPM) for NODOS

by

Brad Cavallo[1], Paul Bergman, Steve Zeug, and Jenny Melgo

DRAFT 4/18/2011

[1] Cramer Fish Sciences, 13300 New Airport Rd, Auburn, CA 95602. Questions? Please contact Brad Cavallo at bcavallo@fishsciences.net

Introduction

In order to assess how salmonid smolt survival to Chipps Island might be influenced by the proposed actions of the North-of-Delta Offstream Storage project (NODOS) we conducted a model-based assessment using the Delta Passage Model (DPM) developed by Cramer Fish Sciences. We used the DPM to simulate the migration of fall-run and spring-run juvenile Chinook salmon entering the Sacramento-San Joaquin Delta (Delta) from the Sacramento River and estimate relative survival to Chipps Island. Although the DPM is primarily based on studies of winter run Chinook surrogates (late fall run Chinook), we apply it here for spring-run and fall-run Chinook salmon by adjusting emigration timing and by assuming that all migrating Chinook salmon will respond similarly to Delta conditions. The biological functionality of the DPM is based upon the foundation provided by Perry et al. (2010) as well as other acoustic tagging based studies (SJRGA 2008; SJRGA 2010; Holbrook et al. 2009) and coded wire tag (CWT) based studies (Newman and Brandes 2009; Newman 2008). Uncertainty is explicitly modeled in the DPM by incorporating environmental stochasticity and estimation error for most model functions. Where empirical information was lacking, parameter values were informed by data inference from the relevant scientific literature.

The DPM is intended to allow for comparisons between proposed NODOS operational scenarios. Survival and abundance estimates generated by the DPM are not intended to predict future outcomes. While DPM has been calibrated to the best available information, in most cases it is not possible to validate DPM results against actual fish abundance or survivals values because such data does not exist.

Site Description

The transition between freshwater rivers, the low salinity Delta, and the fully marine waters of the San Francisco Bay (Bay) varies daily and seasonally as a function of tides, flows, and export diversions. Chipps Island is located just downstream from the confluence of the Sacramento and San Joaquin Rivers (Figure 1). Like previous Delta salmon studies (e.g. Brandes and McClain 2001, Perry et al. 2009) we define the Bay as the area West of Chipps Island, and the Delta as the area East of Chipps Island.

Model Description

The DPM is based on a detailed accounting of migratory pathways and reach-specific mortality as Chinook salmon smolts travel through a simplified network of reaches and junctions (Figure 1). The DPM is composed of 8 reaches and three junctions (Figure 1; Table 1) selected to represent primary salmonid migration corridors where high quality fish and hydrodynamic data were available. For simplification, Sutter Slough and Steamboat Slough are combined as the reach SS and the forks of the Mokelumne River and Georgiana Slough are combined as Geo/DCC. The Geo/DCC reach is entered by Sacramento runs through

the combined junction of Georgiana Slough and Delta Cross Channel (Junction C). The Interior Delta is entered from Geo/DCC. The three distributary junctions depicted in the DPM are: A) Sacramento River at Freemont Weir (head of Yolo Bypass), B) Sacramento River at head of Sutter and Steamboat Sloughs, and C) Sacramento River at the combined junction with Georgiana Slough and Delta Cross Channel (Figure 1; Table 1).

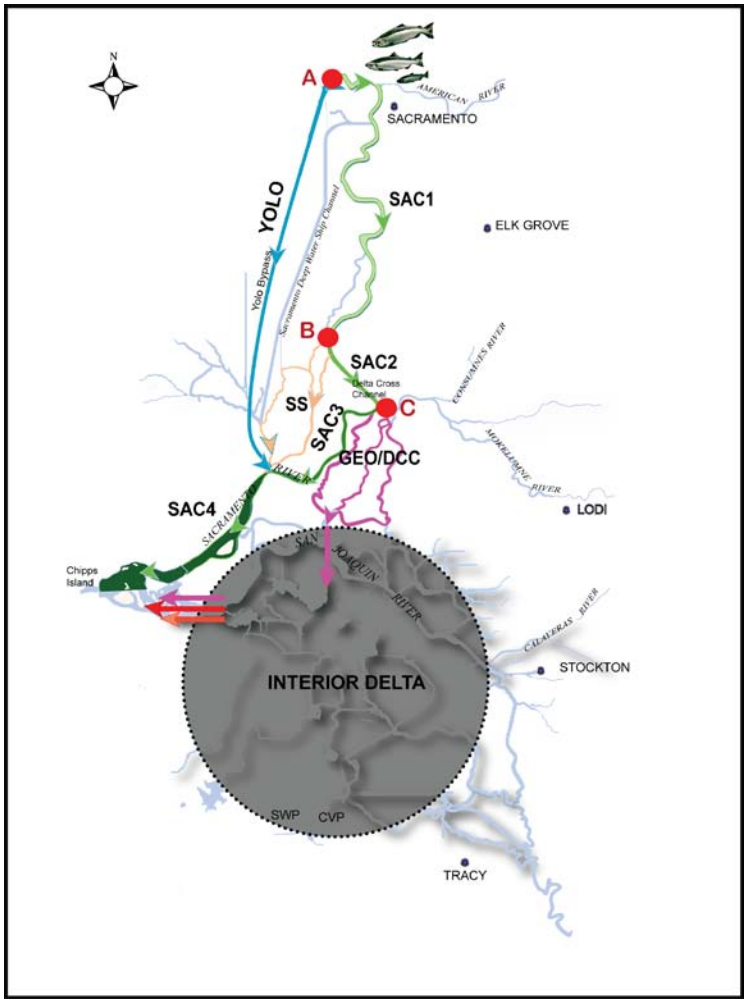


Figure 1. Map of the Sacramento-San Joaquin Delta showing the modeled reaches and junctions of the Delta. Colored river channels are modeled reaches and red circles are junctions. Salmonid icons indicate location where juvenile salmonids enter the Delta in the DPM.

Table 1. Description of modeled reaches and junctions in the Delta Passage Model.

Sac1	Sacramento River from Freeport to junction with Sutter Slough
Sac2	Sacramento River from Sutter Slough junction to junction with Delta Cross Channel
Sac3	Sacramento River from Delta Cross Channel junction to Rio Vista, CA
Sac4	Sacramento River from Rio Vista, CA to Chipps Island
Yolo	Yolo Bypass from entrance at Fremont Weir to Rio Vista, CA
SS	Combined reach of Sutter Slough and Steamboat Slough ending at Rio Vista, CA
Geo/DCC	Combined reach of Georgiana Slough, Delta Cross Channel, and South and North Forks of the Mokelumne River ending at confluence with the San Joaquin River
Interior Delta	Begins at end of GEO/DCC and ends at Chipps Island
A	Junction of the Yolo Bypass and the Sacramento River
B	Combined junction of Sutter Slough and Steamboat Slough with the Sacamento River
C	Combined junction of the Delta Cross Channel and Georgiana Slough with the Sacramento River

The DPM, as applied for NODOS, assesses the migrations of Sacramento fall-run and spring-run. Chinook salmon smolts are introduced into the model at Freeport on the Sacramento River.

The DPM operates on a daily time step using simulated daily average flows and Delta exports as model inputs. The DPM does not attempt to represent sub-daily flows or diel salmon smolt behavior in response to the interaction of tides, flows and specific channel features. The DPM is intended to represent the net outcome of migration and mortality occurring over days, not three dimensional movements occurring over minutes or hours (e.g. Blake and Horn 2003).

Flow Data

With the exception of flow into the SWP and CVP pumping plants, water movement though the Delta is modeled using daily (tidally averaged) flow output from the hydrology module of the Delta Simulation Model II (DSM2-HYDRO; http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/). Export flow into the CVP and SWP pumping plants is modeled using monthly flow output from the hydrologic simulation tool CALSIM II (Ferreira 2005) that are “disaggregated” into mean daily flows based on historical patterns. The nodes in the DSM2-HYDRO and CALSIM II models that were used to provide flow for specific reaches in the DPM are shown in Table A. Technical details for DSM2-Hydro and CALSIM II models are described in Kimmerer and Nobriga (2008). DSM2 flow data output for each of the 5 NODOS scenarios were used to inform the daily conditions experienced by migrating salmonids in the model.

Table 2. DPM reaches and associated channels from DSM2-HYDRO and CALSIM II models.

DPM Reach	DSM2 Hydro/CALSIM Channels
Sac1	NDD_US
Sac2	SAC_DS_STMBTSL
Sac3	SAC_US_ISLETON
Sac4	RSAC101
Yolo	Yolo
SS	SLSCT011
Geo/DCC	RSAN032
Exports	Total_Exports

Delta Entry Timing

The best available, most recent sampling data on Delta entry timing of emigrating juvenile smolts for fall-run and spring-run Chinook salmon (USFWS Sacramento trawls; 1995-2005) were used to inform the daily proportion of juveniles entering the Delta for each run. For each race we examined each brood year's catch distribution and visually approximated an average timing distribution which was then applied in the model (Figure 2).

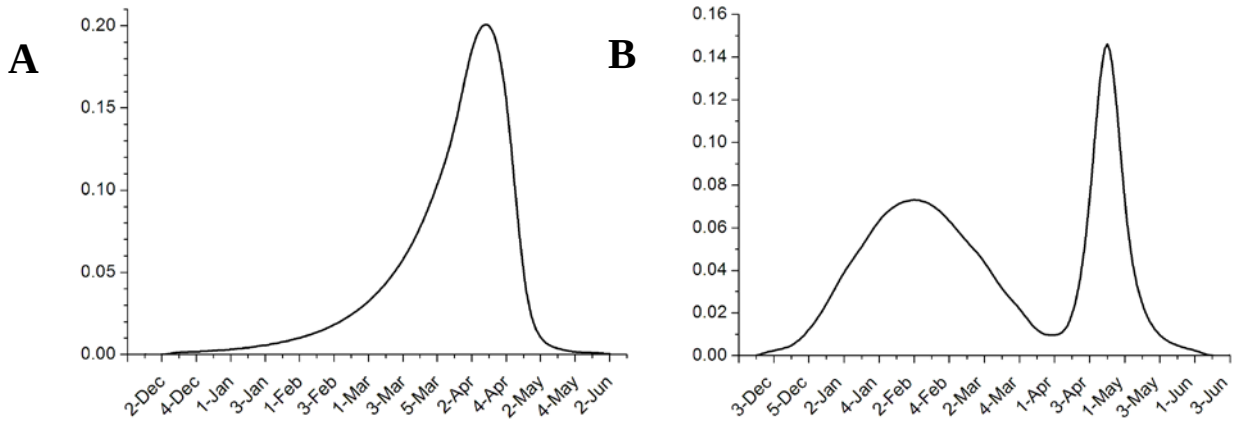


Figure 2. Delta Entry distributions for juvenile Sacramento River spring-run (A) and Sacramento River fall-run (B).

Migration Speed

Smolt movement in the DPM occurs daily and is a function of reach-specific length and migration speed as developed from acoustic tagging results. The DPM assumes a net daily movement of smolts in the downstream direction. The rate of smolt movement in the DPM affects the timing of arrival at Delta junctions and reaches which can effect route selection and survival if flow conditions or water project operations are changing rapidly. However, since migration speed only effects route selection or survival indirectly, its influence will be minor relative to other factors.

For north Delta reaches Sac1, Sac2, Sac3, SS, and Geo/DCC mean migration speed is predicted as a function of flow. Many studies have found a positive relationship between Juvenile Chinook salmon migration rate and flow in the Columbia River Basin (Raymond 1968, Berggren and Filardo 1993, Schreck et al. 1994), with Berggren and Filardo (1993) finding a logarithmic relationship for Snake River yearling Chinook salmon. We used observed flows and migration speeds from Vogel (2008) north Delta acoustic study for reach Sac1 to create a best-fit logarithmic relationship:

1) $$y = 0.4296\ln(x) - 3.5193;$$

where y is migration speed (mph) and x is flow into Sac1. We found a positive, significant relationship between migration speed and flow (ANOVA; F = 22.6; df = 144; $p < 0.001$), with flow explaining 13% of the variation in migration speed. This function is applied north Delta-wide because migration speed data is unavailable for all other north Delta reaches. Due to assumed strong tidal influences in reach Sac4 (between Rio Vista and Chipps Island) we chose to have mean migration speed independent of reach inflow in Sac4. For reach Sac4, mean migration speed is set at 22.6 km/day, the average speed of acoustic tagged smolts in the Sac1 reach (Vogel 2008).

Variance in migration speed is modeled using error estimates from acoustic tracking experiments. Migration speed variance from acoustic study data is used along with mean migration speed to define a normal probability distribution that is sampled from each day to determine the daily migration speed in each reach (Table 3).

Table 3. Mean and standard deviations used to define a normal probability distribution that is sampled from each day to determine the daily migration speed in each reach.

Reach	Mean (km/day)	Standard Deviation
Sac1	Linear function of flow	9.105
SS	Linear function of flow	9.105
Sac2	Linear function of flow	9.105
Sac3	Linear function of flow	9.105

Sac4	22.634	NA
Geo/DCC	Linear function of flow	9.105

Migration Pathways

Perry et al. (2010) found that acoustically tagged smolts arriving at Delta junctions exhibited inconsistent movement patterns in relation to the flow being diverted. For junction B, Perry et al. (2010) found that smolts consistently entered downstream reaches in proportion to the flow being diverted. Therefore, smolts arriving at junction B in our model move proportionally with flow. Similarly, with data lacking to inform the nature of the relationship, we also applied a proportional relationship between flow and fish movement for junction A.

For junction C, Perry (2010) found a linear, non-proportional relationship between flow and fish movement. We applied his relationship for junction C in our model:

$$y = 0.22 + 0.47x;$$

where y is the proportion of fish diverted into Geo/DCC and x is the proportion of flow diverted into Geo/DCC.

Reach-Specific Survival

Reach-specific survival data and associated error estimates were obtained from four separate Delta acoustic tagging studies (Perry 2010; SJRGA 2008; SJRGA 2010; Holbrook et al. 2009; Table 5). These studies primarily released large (>150mm) late-fall hatchery Chinook. Given the importance of acoustic data, the DPM is probably most applicable to large smolts (>100mm), but model results may also be representative for steelhead smolts and smaller salmon smolts. Salmon juveniles less than 80mm are more likely to exhibit rearing behavior in the Delta (Moyle 2002), and thus will likely be poorly represented by the DPM. Lastly, the degree to which tagged hatchery fish are representative of natural origin, untagged and volitionally migrating Chinook is largely unknown, but studies increasingly show that hatchery raised juvenile salmonids suffer greater mortality in the wild than do naturally-produced smolts (Kostow 2004; Araki et al. 2007). These factors illustrate again that survival values estimated by the DPM should be interpreted cautiously and only to make comparison between alternatives.

For all reaches except the Yolo Bypass, mean reach survival is used along with reach-specific standard deviation to define a normal probability distribution that is sampled from each day to determine the survival rate at each reach (Table 4). For reaches where literature showed support for reach-level responses to environmental variables, mean survival is predicted as a function of reach-specific flow (Sac3, SS) or Delta exports (Interior Delta for Sacramento River runs). For all other reaches, mean reach survival is calculated from acoustic tagging studies (Table 4; Table 5). For all reaches, the standard deviation of the estimated survival estimates is used to inform uncertainty in our model (Table 4; Table 5).

Table 4. Reach-specific mean survival and associated standard deviation used in the model to define a normal probability distribution that is sampled from each day to determine the survival rate at each reach.

Reach	Mean	SD
Sac1	0.845	0.058
Sac2	0.928	0.032
Sac3	function of flow	0.105
Sac4	0.698	0.153
Yolo	user-defined	N/A
SS	function of flow	0.15
Geo/DCC	0.65	0.126
Interior Delta	function of exports	0.089

River Flow-Survival

Perry (2010) evaluated the relationship between survival among acoustically tagged Sacramento River juvenile Chinook and river flow and found a significant relationship between survival and flow during the migration period for smolts that migrated through Sutter and Steamboat Sloughs to Chipps Island (SS and Sac4 combined) and smolts that migrated from Georgiana Slough to Chipps Island (Sac3 and Sac4 combined). Therefore, for reaches SS and Sac3 we used the logit survival function from Perry (2010) to predict mean reach survival (*S*) from reach flow (*flow*):

$$S = \frac{e^{(\beta_0 + \beta_1 flow)}}{1 + e^{(\beta_0 + \beta_1 flow)}};$$

where β_0 (SS = -0.175, Sac3 = -0.121) is the reach coefficient and β_1 (0.52) is the flow coefficient. All the benefits of increased flow observed by Perry (2010) are accounted for the in relationships we have applied for reaches SS and Sac3. In order to avoid overestimation of the flow-effect on survival in our model, we modeled reach Sac4 is being uninfluenced by flow (mean survival from the acoustic studies is applied). Estimated mean reach survival was then used along with the reach-specific standard deviation from the acoustic studies to define a normal probability distribution that was sampled from each day to determine the reach-specific survival rate.

Export Loss

As migratory juvenile salmon enter the Interior Delta from Geo/DCC they transition to an area strongly influenced by tides and where exports may influence survival. We apply the export-survival relationship described by Newman and Brandes (2009) as:

$$S = -0.000024 * Exports + 0.625;$$

where *S* is Interior Delta mean survival and the slope (-0.000024) is from the relationship between survival and Delta exports (*Exports*) for smolts migrating through the interior Delta from Newman and Brandes (2009; Figure 3). The intercept from Newman and Brandes (2009) was adjusted from 0.58 to 0.625 so that the regression line passes the point (6,500, 0.47), where 6,500 is the mean export level (cfs) observed during the acoustic studies and 0.47 is the mean survival rate observed during the acoustic studies (Figure 3). In effect, we used the slope of the relationship between survival and exports as estimated by Newman and Brandes (2009) as a scalar on the survival rates as observed from acoustic tagging studies. Estimated mean survival is then used along with the standard deviation of survival estimates from the acoustic studies to inform a normal probability distribution that is sampled from each day to determine Interior Delta survival.

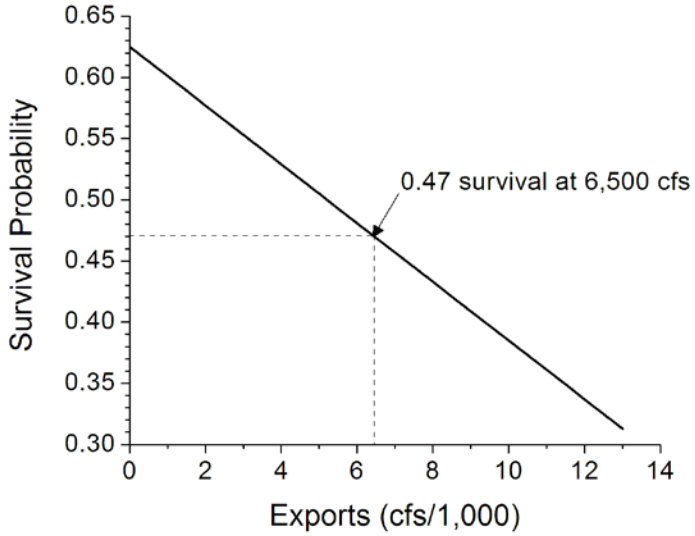


Figure 3. Linear function used to predict mean interior Delta survival from Delta exports for Sacramento River runs. The slope of the relationship is from Newman and Brandes (2009), and the intercept was set so that the regression line passes the point (6,500, 0.47), where 6,500 is the mean export level (cfs) observed during the acoustic studies and 0.47 is the mean survival rate observed during the acoustic studies. Estimated mean survival is then used along with the standard deviation of survival estimates from the acoustic studies to inform a normal probability distribution that is sampled from each day to determine Interior Delta survival.

Table 5. Individual release-group survival estimates and associated calculations used to inform reach-specific mean survival and standard deviation used in the DPM model.

DPM Reach	Survival	Release Dates	Source	Survival Calculation	Mean	Std. Dev
Sac1	0.844	12/5/06	Perry 2010	S_{A1} *S_{A2}	0.845	0.058
Sac1	0.876	1/17/07	Perry 2010	S_{A1} *S_{A2}		
Sac1	0.874	12/4/07-12/6/07	Perry 2010	S_{A1} *S_{A2}		
Sac1	0.892	1/15/08-1/17/08	Perry 2010	S_{A1} *S_{A2}		
Sac1	0.822	11/31/08-12/06/08	Perry 2010	S_{A1} *S_{A2}		
Sac1	0.760	1/13/09-1/19/09	Perry 2010	S_{A1} *S_{A2}		
Sac2	0.947	12/5/06	Perry 2010	S_{A3}	0.928	0.032
Sac2	0.976	1/17/07	Perry 2010	S_{A3}		
Sac2	0.919	12/4/07-12/6/07	Perry 2010	S_{A3}		
Sac2	0.915	1/15/08-1/17/08	Perry 2010	S_{A3}		
Sac2	0.928	11/31/08-12/06/08	Perry 2010	S_{A3}		
Sac2	0.881	1/13/09-1/19/09	Perry 2010	S_{A3}		
Sac3	0.691	12/5/06	Perry 2010	S_{A4}*S_{A5}	.680[a]	0.105
Sac3	0.703	1/17/07	Perry 2010	S_{A4}*S_{A5}		
Sac3	0.620	12/4/07-12/6/07	Perry 2010	S_{A4}*S_{A5}*S_{A6}		
Sac3	0.627	1/15/08-1/17/08	Perry 2010	S_{A4}*S_{A5}*S_{A6}		
Sac3	0.600	11/31/08-12/06/08	Perry 2010	$S_{A4, open}$		
Sac3	0.901	11/31/08-12/06/08	Perry 2010	$S_{A4, closed}$		
Sac3	0.616	1/13/10-1/19/10	Perry 2010	$S_{A4, closed}$		
Sac4	0.714	12/5/06	Perry 2010	S_{A6}*S_{A7}	0.698	0.153
Sac4	0.858	1/17/07	Perry 2010	S_{A6}*S_{A7}		
Sac4	0.548	12/4/07-12/6/07	Perry 2010	S_{A7}*S_{A8}		
Sac4	0.488	1/15/08-1/17/08	Perry 2010	S_{A7}*S_{A8}		
Sac4	0.731	11/31/08-12/06/08	Perry 2010	S_{A7}*S_{A8}		
Sac4	0.851	1/13/09-1/19/09	Perry 2010	S_{A7}*S_{A8}		

SS	0.389	12/5/06	Perry 2010	S_{B1}		
SS	0.681	1/17/07	Perry 2010	S_{B1}		
SS	0.274	12/4/07-12/6/07	Perry 2010	$\Psi_{B11}/(\Psi_{B11+}\Psi_{B21})*(\Phi_{B11,B12}S_{B12}S_{B13}+\Phi_{B11,B22}S_{B22}S_{B23})+\Psi_{B21}/(\Psi_{B21+}\Psi_{B11})*(S_{B21}S_{B22}S_{B23})$		
SS	0.576	1/15/08-1/17/08	Perry 2010	$\Psi_{B11}/(\Psi_{B11+}\Psi_{B21})*(\Phi_{B11,B12}S_{B12}S_{B13}+\Phi_{B11,B22}S_{B22}S_{B23})+\Psi_{B21}/(\Psi_{B21+}\Psi_{B11})*(S_{B21}S_{B22}S_{B23})$	.510[b]	0.150
SS	0.600	11/31/08-12/06/08	Perry 2010	$\Psi_{B11}/(\Psi_{B11}+\Psi_{B21})*(\Phi_{B11,B12}S_{B12}S_{B13}+\Phi_{B11,B22}S_{B22}S_{B23})+\Psi_{B21}/(\Psi_{B21}+\Psi_{B11})*(\Phi_{B21,B22}S_{B21}S_{B22}S_{B23}+\Phi_{B21,B12*}S_{B12*}S_{B13})$		
SS	0.539	1/13/09-1/19/09	Perry 2010	$\Psi_{B11}/(\Psi_{B11}+\Psi_{B21})*(\Phi_{B11,B12}S_{B12}S_{B13}+\Phi_{B11,B22}S_{B22}S_{B23})+\Psi_{B21}/(\Psi_{B21}+\Psi_{B11})*(\Phi_{B21,B22}S_{B21}S_{B22}S_{B23}+\Phi_{B21,B12*}S_{B12*}S_{B13})$		
Geo/DCC	0.648	12/5/06	Perry 2010	S_{D1}		
Geo/DCC	0.600	12/4/07-12/6/07	Perry 2010	$S_{D1,Sac*}S_{D2}$		
Geo/DCC	0.762	1/15/08-1/17/08	Perry 2010	$S_{D1,Sac*}S_{D2}$	0.650	0.126
Geo/DCC	0.774	11/31/08-12/06/08	Perry 2010	$S_{D1,Sac*}S_{D2}$		
Geo/DCC	0.467	1/13/09-1/19/09	Perry 2010	$S_{D1,Sac*}S_{D2}$		
Int. Delta via Geo/DCC	0.571	12/5/06	Perry 2010	$S_{D2}S_{D3}$		
Int. Delta via Geo/DCC	0.505	12/4/07-12/6/07	Perry 2010	$S_{D3}*S_{D4}*S_{D5}*S_{D6}*S_{D7}$		
Int. Delta via Geo/DCC	0.510	1/15/08-1/17/08	Perry 2010	$S_{D3}*S_{D4}*S_{D5}*S_{D6}*S_{D7}$	0.470	0.089
Int. Delta via Geo/DCC	0.419	11/31/08-12/06/08	Perry 2010	$S_{D2}*S_{D4}*S_{D7}$		
Int. Delta via Geo/DCC	0.343	1/13/09-1/19/09	Perry 2010	$S_{D2}*S_{D4}*S_{D7}$		

a,b = Calculated mean survival for reaches Sac and SS were not used in the model. Instead, mean reach survival was calculated as a function of flow.

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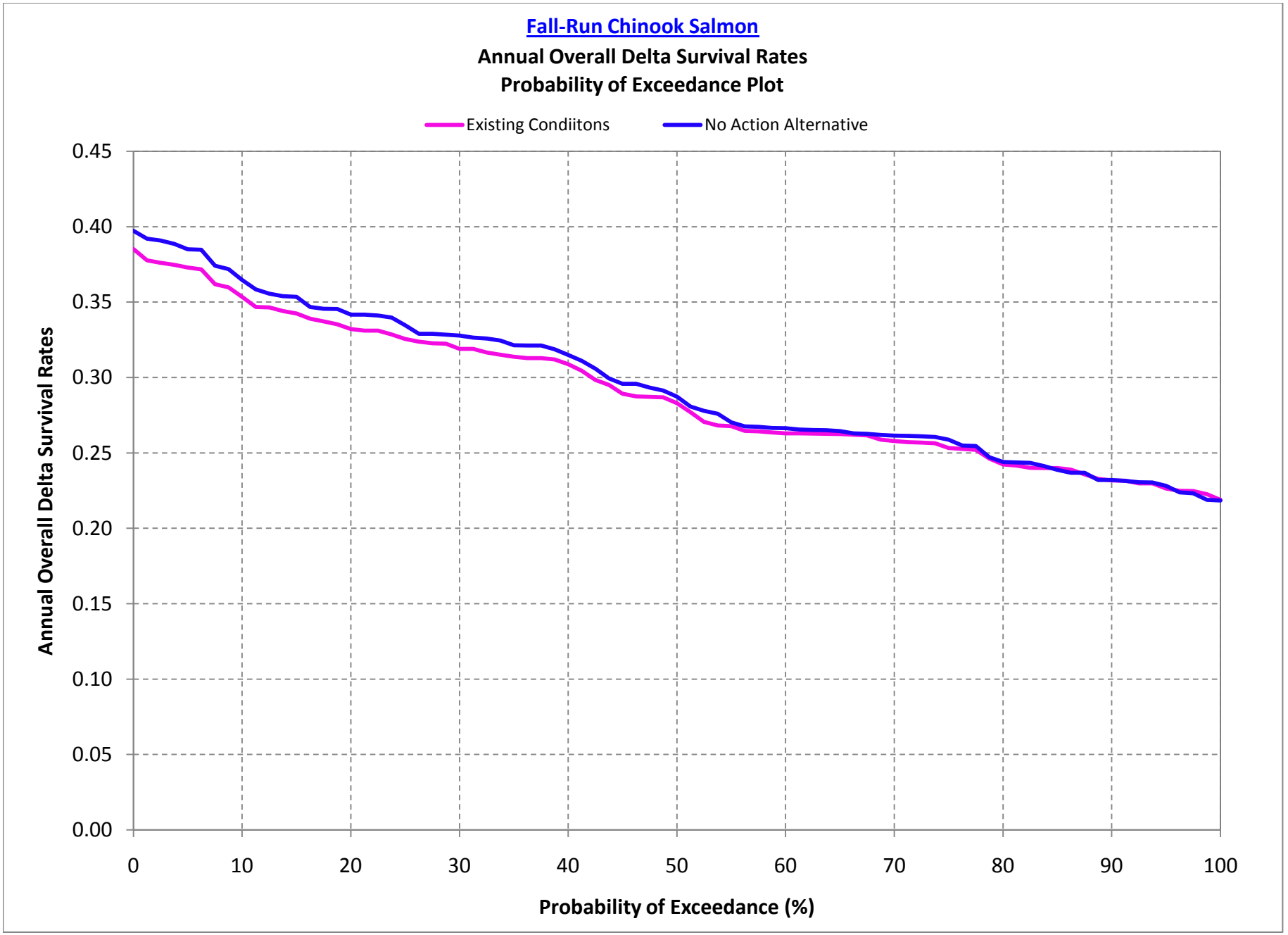
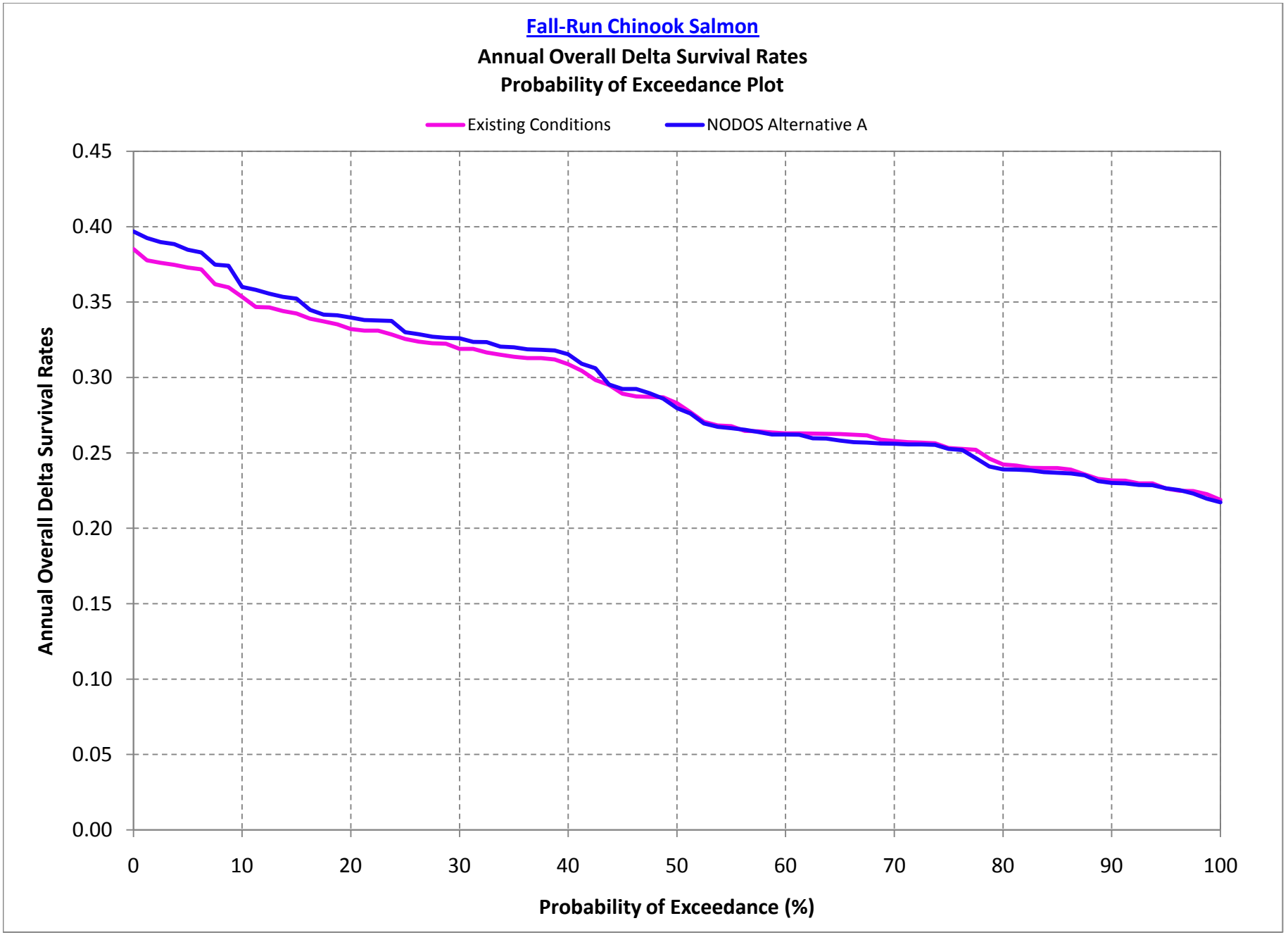
No Action Alternative Compared to Existing Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Condiitons	No Action Alternative	Absolute Difference	Relative Difference (%)
0.0	0.39	0.40	0.01	3.1
1.3	0.38	0.39	0.01	3.8
2.5	0.38	0.39	0.01	4.0
3.8	0.37	0.39	0.01	3.7
5.0	0.37	0.39	0.01	3.3
6.3	0.37	0.38	0.01	3.5
7.5	0.36	0.37	0.01	3.4
8.8	0.36	0.37	0.01	3.4
10.0	0.35	0.36	0.01	3.2
11.3	0.35	0.36	0.01	3.3
12.5	0.35	0.36	0.01	2.6
13.8	0.34	0.35	0.01	2.9
15.0	0.34	0.35	0.01	3.2
16.3	0.34	0.35	0.01	2.3
17.5	0.34	0.35	0.01	2.5
18.8	0.34	0.35	0.01	3.0
20.0	0.33	0.34	0.01	2.9
21.3	0.33	0.34	0.01	3.2
22.5	0.33	0.34	0.01	3.0
23.8	0.33	0.34	0.01	3.4
25.0	0.33	0.33	0.01	2.8
26.3	0.32	0.33	0.01	1.6
27.5	0.32	0.33	0.01	2.0
28.8	0.32	0.33	0.01	1.8
30.0	0.32	0.33	0.01	2.8
31.3	0.32	0.33	0.01	2.4
32.5	0.32	0.33	0.01	3.0
33.8	0.32	0.32	0.01	3.0
35.0	0.31	0.32	0.01	2.4
36.3	0.31	0.32	0.01	2.7
37.5	0.31	0.32	0.01	2.7
38.8	0.31	0.32	0.01	2.1
40.0	0.31	0.31	0.01	2.0
41.3	0.30	0.31	0.01	2.2
42.5	0.30	0.31	0.01	2.5
43.8	0.30	0.30	0.00	1.5
45.0	0.29	0.30	0.01	2.3
46.3	0.29	0.30	0.01	2.9
47.5	0.29	0.29	0.01	2.1
48.8	0.29	0.29	0.00	1.6
50.0	0.28	0.29	0.00	1.5
51.3	0.28	0.28	0.00	1.3
52.5	0.27	0.28	0.01	2.7
53.8	0.27	0.28	0.01	2.9
55.0	0.27	0.27	0.00	0.9
56.3	0.26	0.27	0.00	1.2
57.5	0.26	0.27	0.00	1.1
58.8	0.26	0.27	0.00	1.1
60.0	0.26	0.27	0.00	1.3
61.3	0.26	0.27	0.00	1.0

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Condiitons	No Action Alternative	Absolute Difference	Relative Difference (%)
62.5	0.26	0.27	0.00	0.9
63.8	0.26	0.27	0.00	0.9
65.0	0.26	0.26	0.00	0.7
66.3	0.26	0.26	0.00	0.3
67.5	0.26	0.26	0.00	0.4
68.8	0.26	0.26	0.00	1.2
70.0	0.26	0.26	0.00	1.4
71.3	0.26	0.26	0.00	1.6
72.5	0.26	0.26	0.00	1.7
73.8	0.26	0.26	0.00	1.7
75.0	0.25	0.26	0.01	2.2
76.3	0.25	0.25	0.00	0.9
77.5	0.25	0.25	0.00	1.0
78.8	0.25	0.25	0.00	0.4
80.0	0.24	0.24	0.00	0.7
81.3	0.24	0.24	0.00	0.8
82.5	0.24	0.24	0.00	1.4
83.8	0.24	0.24	0.00	0.5
85.0	0.24	0.24	0.00	-0.5
86.3	0.24	0.24	0.00	-0.9
87.5	0.24	0.24	0.00	0.4
88.8	0.23	0.23	0.00	-0.3
90.0	0.23	0.23	0.00	0.2
91.3	0.23	0.23	0.00	-0.1
92.5	0.23	0.23	0.00	0.3
93.8	0.23	0.23	0.00	0.3
95.0	0.23	0.23	0.00	0.8
96.3	0.22	0.22	0.00	-0.4
97.5	0.22	0.22	0.00	-0.7
98.8	0.22	0.22	0.00	-1.6
100.0	0.22	0.22	0.00	-0.2
Min	0.22	0.22	0.00	-1.6
Max	0.39	0.40	0.01	4.0
Mean	0.29	0.30	0.01	1.7
Median	0.28	0.29	0.01	1.7
P.I.	Percent of time -- (-1.1<X<1.1)			31.3
1.1<=X<10.0				68.8
X>=10.0				0.0
-10.0<X<=-1.1				1.3
X<=-10.0				0.0

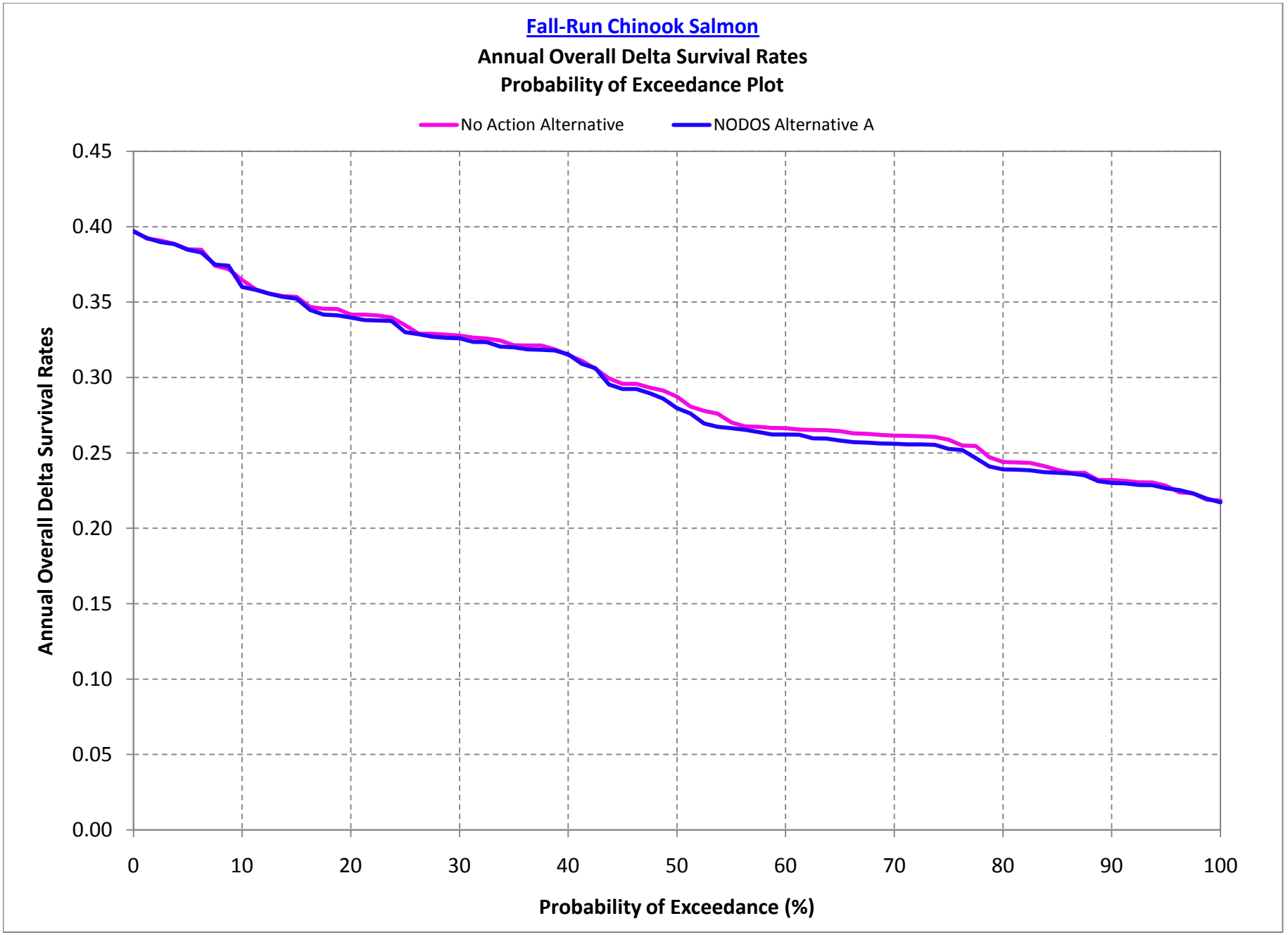
Alternative A Compared to Existing Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.39	0.40	0.01	3.0
1.3	0.38	0.39	0.01	3.9
2.5	0.38	0.39	0.01	3.7
3.8	0.37	0.39	0.01	3.7
5.0	0.37	0.38	0.01	3.1
6.3	0.37	0.38	0.01	3.0
7.5	0.36	0.37	0.01	3.6
8.8	0.36	0.37	0.01	4.0
10.0	0.35	0.36	0.01	1.9
11.3	0.35	0.36	0.01	3.3
12.5	0.35	0.36	0.01	2.6
13.8	0.34	0.35	0.01	2.7
15.0	0.34	0.35	0.01	2.8
16.3	0.34	0.34	0.01	1.7
17.5	0.34	0.34	0.00	1.3
18.8	0.34	0.34	0.01	1.8
20.0	0.33	0.34	0.01	2.3
21.3	0.33	0.34	0.01	2.1
22.5	0.33	0.34	0.01	2.1
23.8	0.33	0.34	0.01	2.7
25.0	0.33	0.33	0.00	1.4
26.3	0.32	0.33	0.00	1.5
27.5	0.32	0.33	0.00	1.4
28.8	0.32	0.33	0.00	1.2
30.0	0.32	0.33	0.01	2.2
31.3	0.32	0.32	0.00	1.5
32.5	0.32	0.32	0.01	2.2
33.8	0.32	0.32	0.01	1.7
35.0	0.31	0.32	0.01	2.0
36.3	0.31	0.32	0.01	1.9
37.5	0.31	0.32	0.01	1.8
38.8	0.31	0.32	0.01	1.9
40.0	0.31	0.32	0.01	2.1
41.3	0.30	0.31	0.00	1.5
42.5	0.30	0.31	0.01	2.6
43.8	0.30	0.30	0.00	0.1
45.0	0.29	0.29	0.00	1.1
46.3	0.29	0.29	0.00	1.7
47.5	0.29	0.29	0.00	0.8
48.8	0.29	0.29	0.00	-0.3
50.0	0.28	0.28	0.00	-1.1
51.3	0.28	0.28	0.00	-0.3
52.5	0.27	0.27	0.00	-0.4
53.8	0.27	0.27	0.00	-0.3
55.0	0.27	0.27	0.00	-0.5
56.3	0.26	0.27	0.00	0.3
57.5	0.26	0.26	0.00	-0.2
58.8	0.26	0.26	0.00	-0.5
60.0	0.26	0.26	0.00	-0.3
61.3	0.26	0.26	0.00	-0.3

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-1.2
63.8	0.26	0.26	0.00	-1.2
65.0	0.26	0.26	0.00	-1.6
66.3	0.26	0.26	0.00	-1.9
67.5	0.26	0.26	0.00	-1.8
68.8	0.26	0.26	0.00	-1.0
70.0	0.26	0.26	0.00	-0.7
71.3	0.26	0.26	0.00	-0.6
72.5	0.26	0.26	0.00	-0.5
73.8	0.26	0.26	0.00	-0.4
75.0	0.25	0.25	0.00	-0.3
76.3	0.25	0.25	0.00	-0.3
77.5	0.25	0.25	-0.01	-2.2
78.8	0.25	0.24	-0.01	-2.1
80.0	0.24	0.24	0.00	-1.4
81.3	0.24	0.24	0.00	-1.2
82.5	0.24	0.24	0.00	-0.7
83.8	0.24	0.24	0.00	-1.2
85.0	0.24	0.24	0.00	-1.3
86.3	0.24	0.24	0.00	-1.1
87.5	0.24	0.24	0.00	-0.2
88.8	0.23	0.23	0.00	-0.6
90.0	0.23	0.23	0.00	-0.7
91.3	0.23	0.23	0.00	-0.8
92.5	0.23	0.23	0.00	-0.5
93.8	0.23	0.23	0.00	-0.5
95.0	0.23	0.23	0.00	0.0
96.3	0.22	0.23	0.00	0.2
97.5	0.22	0.22	0.00	-0.7
98.8	0.22	0.22	0.00	-1.4
100.0	0.22	0.22	0.00	-0.8
Min	0.22	0.22	-0.01	-2.2
Max	0.39	0.40	0.01	4.0
Mean	0.29	0.29	0.00	0.7
Median	0.28	0.28	0.00	0.1
P.I.	Percent of time -- (-1.1<X<1.1)			37.5
1.1<=X<10.0				46.3
X>=10.0				0.0
-10.0<X<=-1.1				17.5
X<=-10.0				0.0

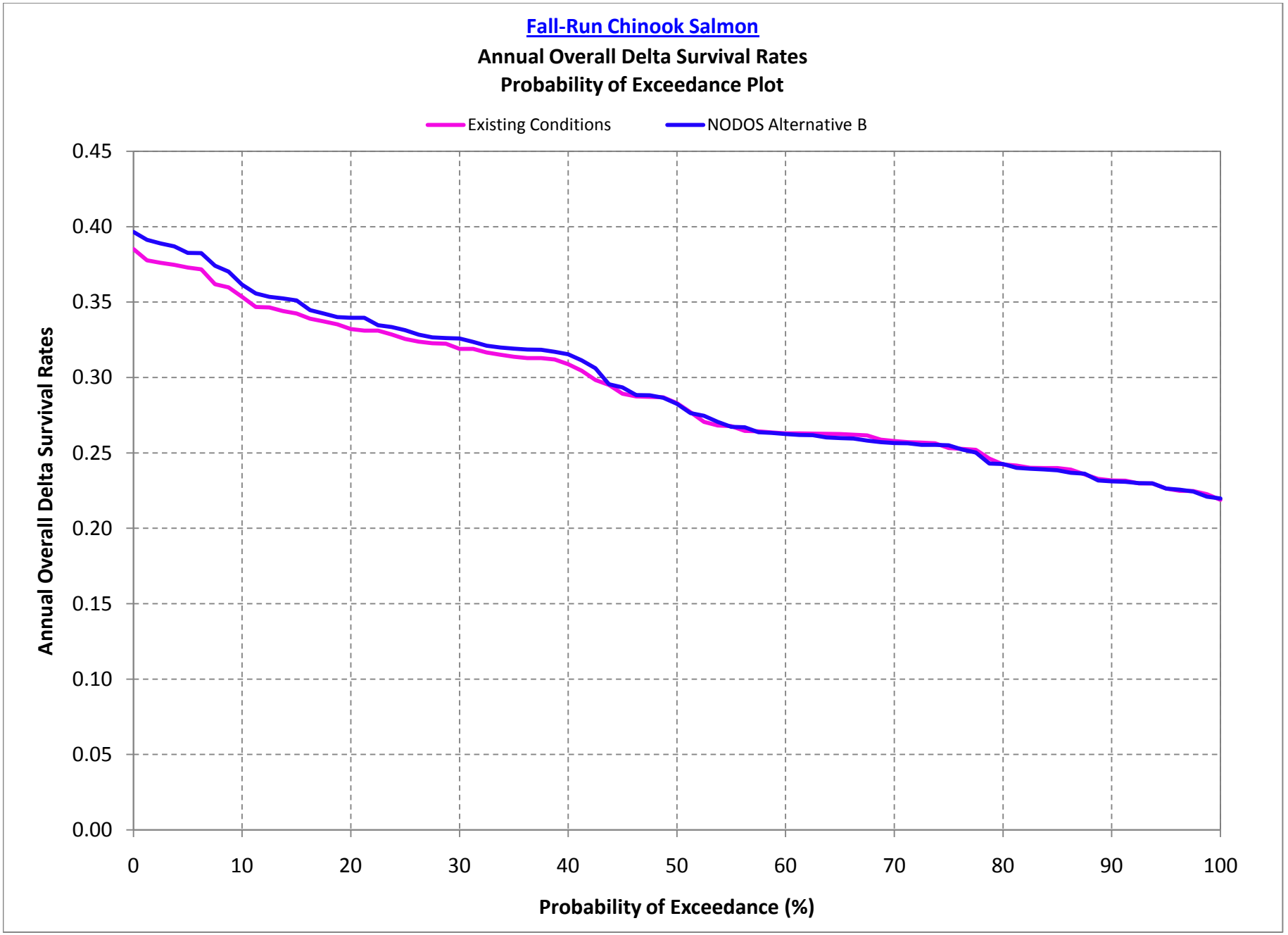
Alternative A Compared to No Action Alternative Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	-0.1
1.3	0.39	0.39	0.00	0.1
2.5	0.39	0.39	0.00	-0.3
3.8	0.39	0.39	0.00	0.0
5.0	0.39	0.38	0.00	-0.1
6.3	0.38	0.38	0.00	-0.5
7.5	0.37	0.37	0.00	0.2
8.8	0.37	0.37	0.00	0.6
10.0	0.36	0.36	0.00	-1.3
11.3	0.36	0.36	0.00	-0.1
12.5	0.36	0.36	0.00	0.0
13.8	0.35	0.35	0.00	-0.2
15.0	0.35	0.35	0.00	-0.3
16.3	0.35	0.34	0.00	-0.5
17.5	0.35	0.34	0.00	-1.1
18.8	0.35	0.34	0.00	-1.2
20.0	0.34	0.34	0.00	-0.6
21.3	0.34	0.34	0.00	-1.1
22.5	0.34	0.34	0.00	-1.0
23.8	0.34	0.34	0.00	-0.7
25.0	0.33	0.33	0.00	-1.4
26.3	0.33	0.33	0.00	-0.1
27.5	0.33	0.33	0.00	-0.6
28.8	0.33	0.33	0.00	-0.6
30.0	0.33	0.33	0.00	-0.5
31.3	0.33	0.32	0.00	-0.9
32.5	0.33	0.32	0.00	-0.7
33.8	0.32	0.32	0.00	-1.3
35.0	0.32	0.32	0.00	-0.4
36.3	0.32	0.32	0.00	-0.8
37.5	0.32	0.32	0.00	-0.9
38.8	0.32	0.32	0.00	-0.2
40.0	0.31	0.32	0.00	0.1
41.3	0.31	0.31	0.00	-0.6
42.5	0.31	0.31	0.00	0.1
43.8	0.30	0.30	0.00	-1.3
45.0	0.30	0.29	0.00	-1.2
46.3	0.30	0.29	0.00	-1.2
47.5	0.29	0.29	0.00	-1.3
48.8	0.29	0.29	-0.01	-1.8
50.0	0.29	0.28	-0.01	-2.6
51.3	0.28	0.28	0.00	-1.6
52.5	0.28	0.27	-0.01	-3.0
53.8	0.28	0.27	-0.01	-3.1
55.0	0.27	0.27	0.00	-1.4
56.3	0.27	0.27	0.00	-0.9
57.5	0.27	0.26	0.00	-1.2
58.8	0.27	0.26	0.00	-1.6
60.0	0.27	0.26	0.00	-1.5
61.3	0.27	0.26	0.00	-1.3

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.27	0.26	-0.01	-2.1
63.8	0.27	0.26	-0.01	-2.1
65.0	0.26	0.26	-0.01	-2.3
66.3	0.26	0.26	-0.01	-2.2
67.5	0.26	0.26	-0.01	-2.2
68.8	0.26	0.26	-0.01	-2.2
70.0	0.26	0.26	-0.01	-2.1
71.3	0.26	0.26	-0.01	-2.1
72.5	0.26	0.26	-0.01	-2.1
73.8	0.26	0.26	-0.01	-2.0
75.0	0.26	0.25	-0.01	-2.4
76.3	0.25	0.25	0.00	-1.2
77.5	0.25	0.25	-0.01	-3.1
78.8	0.25	0.24	-0.01	-2.5
80.0	0.24	0.24	0.00	-2.0
81.3	0.24	0.24	0.00	-2.0
82.5	0.24	0.24	0.00	-2.0
83.8	0.24	0.24	0.00	-1.7
85.0	0.24	0.24	0.00	-0.8
86.3	0.24	0.24	0.00	-0.2
87.5	0.24	0.24	0.00	-0.6
88.8	0.23	0.23	0.00	-0.4
90.0	0.23	0.23	0.00	-0.8
91.3	0.23	0.23	0.00	-0.7
92.5	0.23	0.23	0.00	-0.8
93.8	0.23	0.23	0.00	-0.7
95.0	0.23	0.23	0.00	-0.7
96.3	0.22	0.23	0.00	0.7
97.5	0.22	0.22	0.00	-0.1
98.8	0.22	0.22	0.00	0.3
100.0	0.22	0.22	0.00	-0.6
Min	0.22	0.22	-0.01	-3.1
Max	0.40	0.40	0.00	0.7
Mean	0.30	0.29	0.00	-1.1
Median	0.29	0.28	0.00	-0.9
P.I.	Percent of time -- (-1.1<X<1.1)			53.8
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				47.5
X<=-10.0				0.0

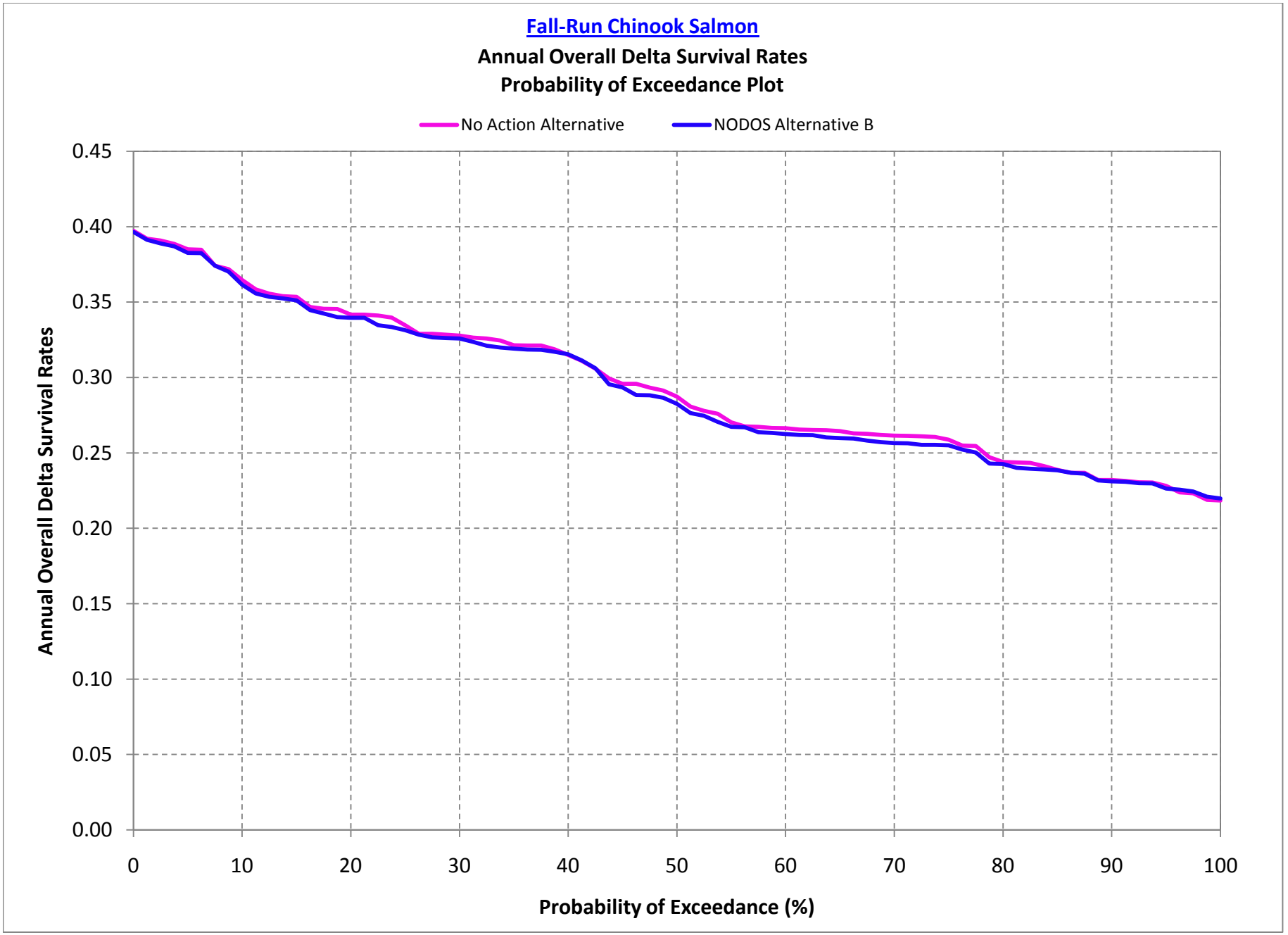
Alternative B Compared to Existing Condition
Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.39	0.40	0.01	2.9
1.3	0.38	0.39	0.01	3.6
2.5	0.38	0.39	0.01	3.4
3.8	0.37	0.39	0.01	3.3
5.0	0.37	0.38	0.01	2.6
6.3	0.37	0.38	0.01	2.9
7.5	0.36	0.37	0.01	3.4
8.8	0.36	0.37	0.01	2.9
10.0	0.35	0.36	0.01	2.3
11.3	0.35	0.36	0.01	2.6
12.5	0.35	0.35	0.01	2.0
13.8	0.34	0.35	0.01	2.4
15.0	0.34	0.35	0.01	2.5
16.3	0.34	0.34	0.01	1.7
17.5	0.34	0.34	0.01	1.6
18.8	0.34	0.34	0.00	1.4
20.0	0.33	0.34	0.01	2.3
21.3	0.33	0.34	0.01	2.6
22.5	0.33	0.33	0.00	1.1
23.8	0.33	0.33	0.00	1.5
25.0	0.33	0.33	0.01	1.8
26.3	0.32	0.33	0.00	1.4
27.5	0.32	0.33	0.00	1.2
28.8	0.32	0.33	0.00	1.1
30.0	0.32	0.33	0.01	2.2
31.3	0.32	0.32	0.00	1.5
32.5	0.32	0.32	0.00	1.5
33.8	0.32	0.32	0.00	1.5
35.0	0.31	0.32	0.01	1.7
36.3	0.31	0.32	0.01	1.8
37.5	0.31	0.32	0.01	1.7
38.8	0.31	0.32	0.01	1.6
40.0	0.31	0.32	0.01	2.1
41.3	0.30	0.31	0.01	2.2
42.5	0.30	0.31	0.01	2.6
43.8	0.30	0.30	0.00	0.1
45.0	0.29	0.29	0.00	1.4
46.3	0.29	0.29	0.00	0.3
47.5	0.29	0.29	0.00	0.4
48.8	0.29	0.29	0.00	-0.1
50.0	0.28	0.28	0.00	-0.2
51.3	0.28	0.28	0.00	-0.2
52.5	0.27	0.27	0.00	1.5
53.8	0.27	0.27	0.00	0.9
55.0	0.27	0.27	0.00	-0.2
56.3	0.26	0.27	0.00	0.9
57.5	0.26	0.26	0.00	-0.2
58.8	0.26	0.26	0.00	-0.1
60.0	0.26	0.26	0.00	-0.2
61.3	0.26	0.26	0.00	-0.4

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-0.4
63.8	0.26	0.26	0.00	-0.9
65.0	0.26	0.26	0.00	-1.0
66.3	0.26	0.26	0.00	-0.9
67.5	0.26	0.26	0.00	-1.3
68.8	0.26	0.26	0.00	-0.6
70.0	0.26	0.26	0.00	-0.5
71.3	0.26	0.26	0.00	-0.3
72.5	0.26	0.26	0.00	-0.5
73.8	0.26	0.26	0.00	-0.4
75.0	0.25	0.26	0.00	0.7
76.3	0.25	0.25	0.00	-0.2
77.5	0.25	0.25	0.00	-0.7
78.8	0.25	0.24	0.00	-1.3
80.0	0.24	0.24	0.00	0.1
81.3	0.24	0.24	0.00	-0.6
82.5	0.24	0.24	0.00	-0.2
83.8	0.24	0.24	0.00	-0.4
85.0	0.24	0.24	0.00	-0.7
86.3	0.24	0.24	0.00	-0.9
87.5	0.24	0.24	0.00	0.2
88.8	0.23	0.23	0.00	-0.4
90.0	0.23	0.23	0.00	-0.3
91.3	0.23	0.23	0.00	-0.3
92.5	0.23	0.23	0.00	0.1
93.8	0.23	0.23	0.00	0.0
95.0	0.23	0.23	0.00	0.0
96.3	0.22	0.23	0.00	0.3
97.5	0.22	0.22	0.00	-0.2
98.8	0.22	0.22	0.00	-0.7
100.0	0.22	0.22	0.00	0.4
Min	0.22	0.22	0.00	-1.3
Max	0.39	0.40	0.01	3.6
Mean	0.29	0.29	0.00	0.8
Median	0.28	0.28	0.00	0.4
P.I.	Percent of time -- (-1.1<X<1.1)			52.5
1.1<=X<10.0				46.3
X>=10.0				0.0
-10.0<X<=-1.1				2.5
X<=-10.0				0.0

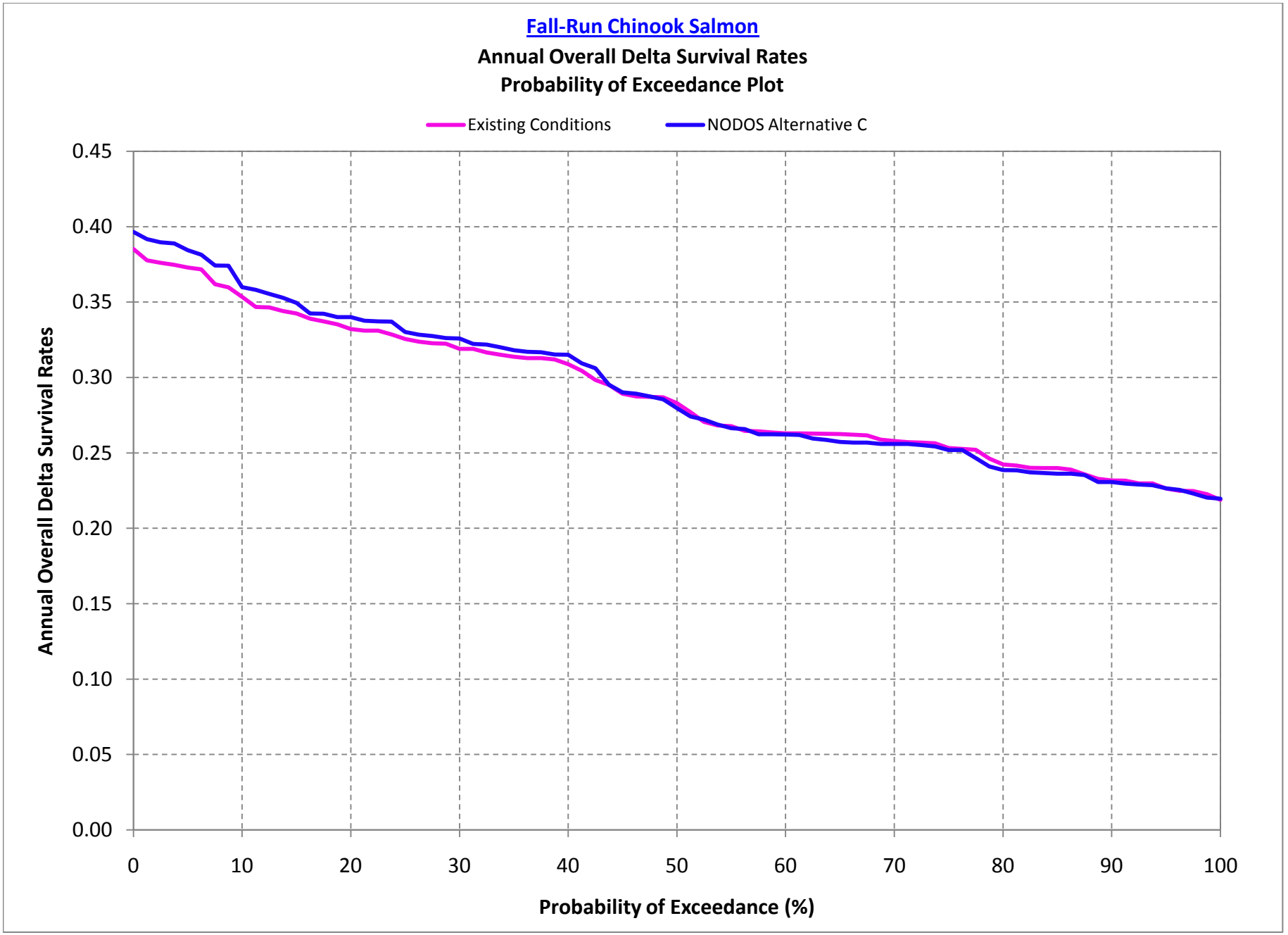
Alternative B Compared to No Action Alternative Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	-0.2
1.3	0.39	0.39	0.00	-0.2
2.5	0.39	0.39	0.00	-0.5
3.8	0.39	0.39	0.00	-0.4
5.0	0.39	0.38	0.00	-0.6
6.3	0.38	0.38	0.00	-0.6
7.5	0.37	0.37	0.00	0.0
8.8	0.37	0.37	0.00	-0.5
10.0	0.36	0.36	0.00	-0.9
11.3	0.36	0.36	0.00	-0.8
12.5	0.36	0.35	0.00	-0.6
13.8	0.35	0.35	0.00	-0.4
15.0	0.35	0.35	0.00	-0.7
16.3	0.35	0.34	0.00	-0.6
17.5	0.35	0.34	0.00	-0.9
18.8	0.35	0.34	-0.01	-1.6
20.0	0.34	0.34	0.00	-0.6
21.3	0.34	0.34	0.00	-0.6
22.5	0.34	0.33	-0.01	-1.9
23.8	0.34	0.33	-0.01	-1.9
25.0	0.33	0.33	0.00	-1.0
26.3	0.33	0.33	0.00	-0.2
27.5	0.33	0.33	0.00	-0.7
28.8	0.33	0.33	0.00	-0.7
30.0	0.33	0.33	0.00	-0.6
31.3	0.33	0.32	0.00	-0.8
32.5	0.33	0.32	0.00	-1.5
33.8	0.32	0.32	0.00	-1.5
35.0	0.32	0.32	0.00	-0.7
36.3	0.32	0.32	0.00	-0.8
37.5	0.32	0.32	0.00	-0.9
38.8	0.32	0.32	0.00	-0.5
40.0	0.31	0.32	0.00	0.1
41.3	0.31	0.31	0.00	0.1
42.5	0.31	0.31	0.00	0.1
43.8	0.30	0.30	0.00	-1.3
45.0	0.30	0.29	0.00	-0.8
46.3	0.30	0.29	-0.01	-2.5
47.5	0.29	0.29	-0.01	-1.7
48.8	0.29	0.29	0.00	-1.7
50.0	0.29	0.28	0.00	-1.7
51.3	0.28	0.28	0.00	-1.5
52.5	0.28	0.27	0.00	-1.2
53.8	0.28	0.27	-0.01	-1.9
55.0	0.27	0.27	0.00	-1.1
56.3	0.27	0.27	0.00	-0.2
57.5	0.27	0.26	0.00	-1.3
58.8	0.27	0.26	0.00	-1.2
60.0	0.27	0.26	0.00	-1.4
61.3	0.27	0.26	0.00	-1.3

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.27	0.26	0.00	-1.3
63.8	0.27	0.26	0.00	-1.8
65.0	0.26	0.26	0.00	-1.8
66.3	0.26	0.26	0.00	-1.3
67.5	0.26	0.26	0.00	-1.7
68.8	0.26	0.26	0.00	-1.8
70.0	0.26	0.26	0.00	-1.9
71.3	0.26	0.26	0.00	-1.9
72.5	0.26	0.26	-0.01	-2.2
73.8	0.26	0.26	-0.01	-2.0
75.0	0.26	0.26	0.00	-1.4
76.3	0.25	0.25	0.00	-1.0
77.5	0.25	0.25	0.00	-1.7
78.8	0.25	0.24	0.00	-1.7
80.0	0.24	0.24	0.00	-0.5
81.3	0.24	0.24	0.00	-1.5
82.5	0.24	0.24	0.00	-1.6
83.8	0.24	0.24	0.00	-0.9
85.0	0.24	0.24	0.00	-0.2
86.3	0.24	0.24	0.00	0.0
87.5	0.24	0.24	0.00	-0.2
88.8	0.23	0.23	0.00	-0.2
90.0	0.23	0.23	0.00	-0.4
91.3	0.23	0.23	0.00	-0.3
92.5	0.23	0.23	0.00	-0.2
93.8	0.23	0.23	0.00	-0.2
95.0	0.23	0.23	0.00	-0.8
96.3	0.22	0.23	0.00	0.8
97.5	0.22	0.22	0.00	0.5
98.8	0.22	0.22	0.00	1.0
100.0	0.22	0.22	0.00	0.6
Min	0.22	0.22	-0.01	-2.5
Max	0.40	0.40	0.00	1.0
Mean	0.30	0.29	0.00	-0.9
Median	0.29	0.28	0.00	-0.8
P.I.	Percent of time -- (-1.1<X<1.1)			60.0
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				41.3
X<=-10.0				0.0

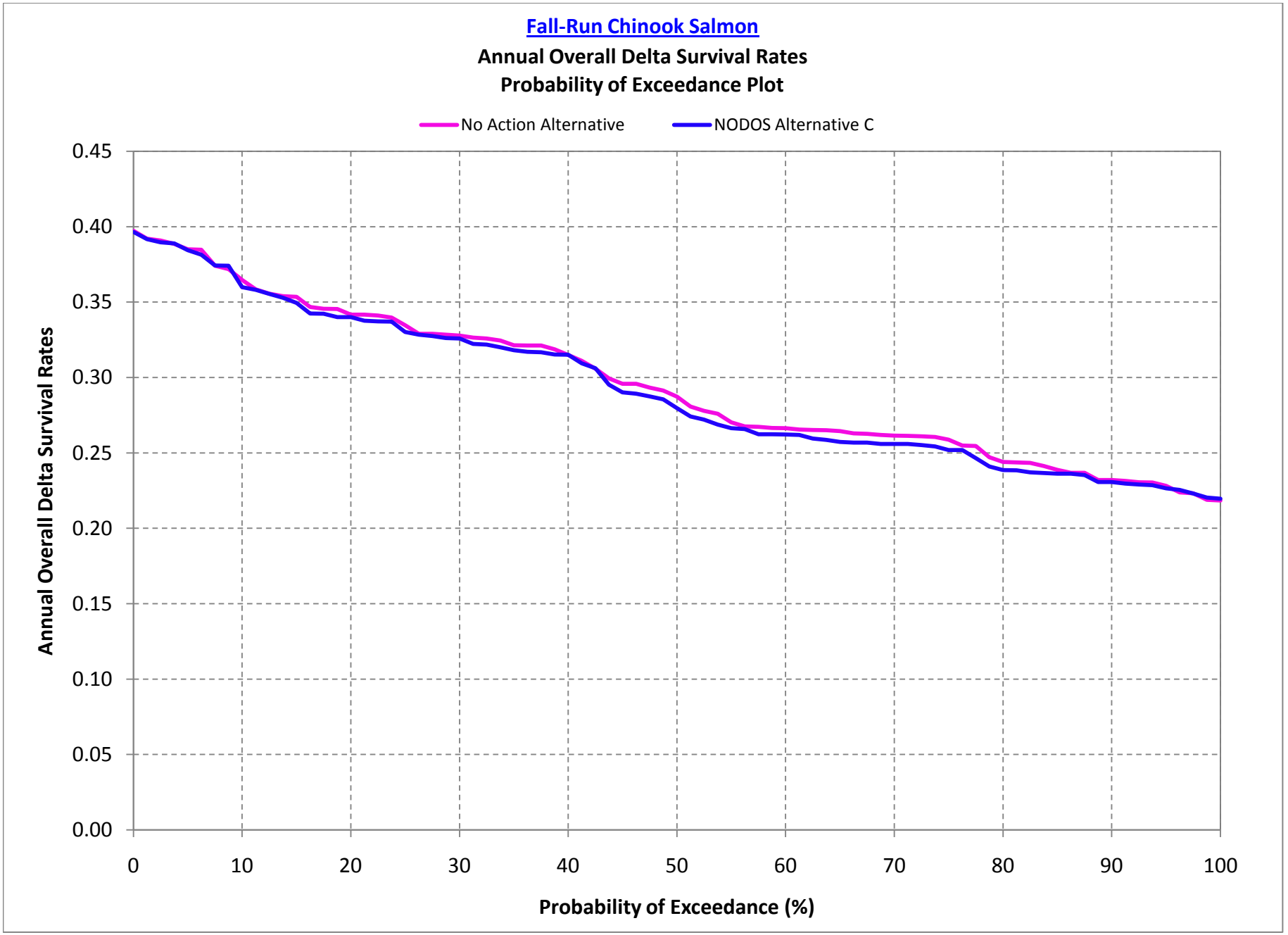
Alternative C Compared to Existing Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.39	0.40	0.01	2.9
1.3	0.38	0.39	0.01	3.7
2.5	0.38	0.39	0.01	3.6
3.8	0.37	0.39	0.01	3.8
5.0	0.37	0.38	0.01	3.1
6.3	0.37	0.38	0.01	2.6
7.5	0.36	0.37	0.01	3.4
8.8	0.36	0.37	0.01	4.0
10.0	0.35	0.36	0.01	1.8
11.3	0.35	0.36	0.01	3.3
12.5	0.35	0.36	0.01	2.6
13.8	0.34	0.35	0.01	2.5
15.0	0.34	0.35	0.01	2.0
16.3	0.34	0.34	0.00	1.0
17.5	0.34	0.34	0.01	1.5
18.8	0.34	0.34	0.00	1.4
20.0	0.33	0.34	0.01	2.4
21.3	0.33	0.34	0.01	2.0
22.5	0.33	0.34	0.01	1.8
23.8	0.33	0.34	0.01	2.6
25.0	0.33	0.33	0.00	1.4
26.3	0.32	0.33	0.00	1.4
27.5	0.32	0.33	0.00	1.5
28.8	0.32	0.33	0.00	1.2
30.0	0.32	0.33	0.01	2.2
31.3	0.32	0.32	0.00	1.0
32.5	0.32	0.32	0.01	1.7
33.8	0.32	0.32	0.01	1.6
35.0	0.31	0.32	0.00	1.3
36.3	0.31	0.32	0.00	1.3
37.5	0.31	0.32	0.00	1.2
38.8	0.31	0.32	0.00	1.1
40.0	0.31	0.32	0.01	2.1
41.3	0.30	0.31	0.00	1.6
42.5	0.30	0.31	0.01	2.6
43.8	0.30	0.30	0.00	0.0
45.0	0.29	0.29	0.00	0.3
46.3	0.29	0.29	0.00	0.7
47.5	0.29	0.29	0.00	0.1
48.8	0.29	0.29	0.00	-0.5
50.0	0.28	0.28	0.00	-1.1
51.3	0.28	0.27	0.00	-1.1
52.5	0.27	0.27	0.00	0.6
53.8	0.27	0.27	0.00	0.2
55.0	0.27	0.27	0.00	-0.5
56.3	0.26	0.27	0.00	0.5
57.5	0.26	0.26	0.00	-0.7
58.8	0.26	0.26	0.00	-0.5
60.0	0.26	0.26	0.00	-0.3
61.3	0.26	0.26	0.00	-0.4

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-1.3
63.8	0.26	0.26	0.00	-1.6
65.0	0.26	0.26	-0.01	-2.0
66.3	0.26	0.26	-0.01	-2.0
67.5	0.26	0.26	0.00	-1.8
68.8	0.26	0.26	0.00	-1.1
70.0	0.26	0.26	0.00	-0.8
71.3	0.26	0.26	0.00	-0.5
72.5	0.26	0.26	0.00	-0.7
73.8	0.26	0.25	0.00	-0.8
75.0	0.25	0.25	0.00	-0.5
76.3	0.25	0.25	0.00	-0.3
77.5	0.25	0.25	-0.01	-2.2
78.8	0.25	0.24	-0.01	-2.1
80.0	0.24	0.24	0.00	-1.5
81.3	0.24	0.24	0.00	-1.3
82.5	0.24	0.24	0.00	-1.3
83.8	0.24	0.24	0.00	-1.4
85.0	0.24	0.24	0.00	-1.5
86.3	0.24	0.24	0.00	-1.1
87.5	0.24	0.24	0.00	-0.2
88.8	0.23	0.23	0.00	-0.9
90.0	0.23	0.23	0.00	-0.4
91.3	0.23	0.23	0.00	-0.8
92.5	0.23	0.23	0.00	-0.4
93.8	0.23	0.23	0.00	-0.5
95.0	0.23	0.23	0.00	0.1
96.3	0.22	0.23	0.00	0.3
97.5	0.22	0.22	0.00	-0.7
98.8	0.22	0.22	0.00	-1.0
100.0	0.22	0.22	0.00	0.3
Min	0.22	0.22	-0.01	-2.2
Max	0.39	0.40	0.01	4.0
Mean	0.29	0.29	0.00	0.5
Median	0.28	0.28	0.00	0.3
P.I.	Percent of time -- (-1.1<X<1.1)			40.0
1.1<=X<10.0				41.3
X>=10.0				0.0
-10.0<X<=-1.1				20.0
X<=-10.0				0.0

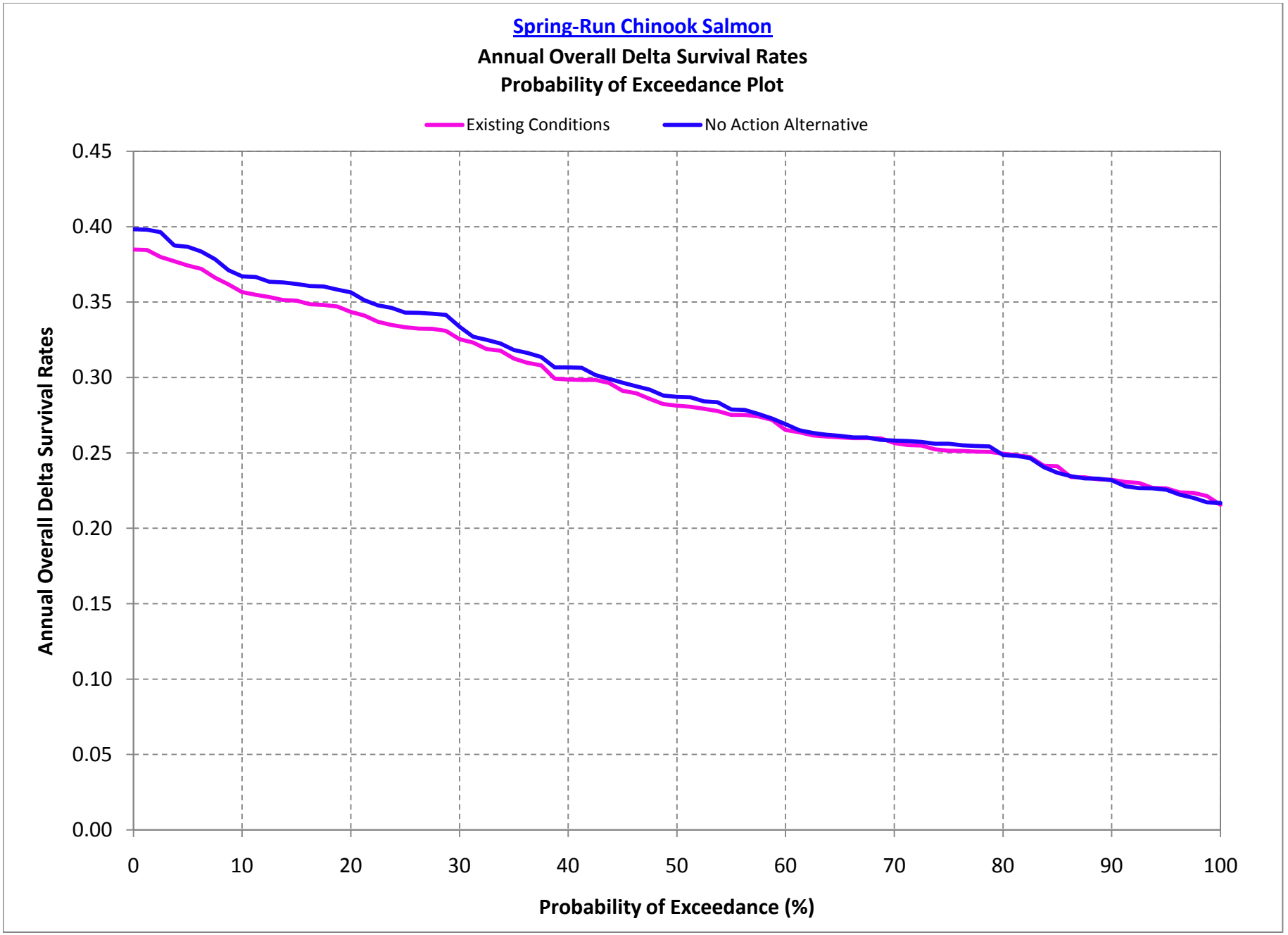
Alternative C Compared to No Action Alternative Condition Fall-Run Chinook Salmon



Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	-0.2
1.3	0.39	0.39	0.00	-0.1
2.5	0.39	0.39	0.00	-0.3
3.8	0.39	0.39	0.00	0.1
5.0	0.39	0.38	0.00	-0.2
6.3	0.38	0.38	0.00	-0.9
7.5	0.37	0.37	0.00	0.0
8.8	0.37	0.37	0.00	0.6
10.0	0.36	0.36	0.00	-1.3
11.3	0.36	0.36	0.00	-0.1
12.5	0.36	0.36	0.00	0.0
13.8	0.35	0.35	0.00	-0.3
15.0	0.35	0.35	0.00	-1.1
16.3	0.35	0.34	0.00	-1.3
17.5	0.35	0.34	0.00	-0.9
18.8	0.35	0.34	-0.01	-1.5
20.0	0.34	0.34	0.00	-0.5
21.3	0.34	0.34	0.00	-1.2
22.5	0.34	0.34	0.00	-1.2
23.8	0.34	0.34	0.00	-0.8
25.0	0.33	0.33	0.00	-1.3
26.3	0.33	0.33	0.00	-0.2
27.5	0.33	0.33	0.00	-0.5
28.8	0.33	0.33	0.00	-0.7
30.0	0.33	0.33	0.00	-0.6
31.3	0.33	0.32	0.00	-1.3
32.5	0.33	0.32	0.00	-1.3
33.8	0.32	0.32	0.00	-1.4
35.0	0.32	0.32	0.00	-1.0
36.3	0.32	0.32	0.00	-1.3
37.5	0.32	0.32	0.00	-1.4
38.8	0.32	0.32	0.00	-1.0
40.0	0.31	0.32	0.00	0.1
41.3	0.31	0.31	0.00	-0.5
42.5	0.31	0.31	0.00	0.1
43.8	0.30	0.30	0.00	-1.4
45.0	0.30	0.29	-0.01	-1.9
46.3	0.30	0.29	-0.01	-2.2
47.5	0.29	0.29	-0.01	-2.0
48.8	0.29	0.29	-0.01	-2.0
50.0	0.29	0.28	-0.01	-2.6
51.3	0.28	0.27	-0.01	-2.3
52.5	0.28	0.27	-0.01	-2.1
53.8	0.28	0.27	-0.01	-2.6
55.0	0.27	0.27	0.00	-1.4
56.3	0.27	0.27	0.00	-0.7
57.5	0.27	0.26	0.00	-1.8
58.8	0.27	0.26	0.00	-1.5
60.0	0.27	0.26	0.00	-1.6
61.3	0.27	0.26	0.00	-1.3

Fall-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.27	0.26	-0.01	-2.2
63.8	0.27	0.26	-0.01	-2.4
65.0	0.26	0.26	-0.01	-2.7
66.3	0.26	0.26	-0.01	-2.3
67.5	0.26	0.26	-0.01	-2.2
68.8	0.26	0.26	-0.01	-2.3
70.0	0.26	0.26	-0.01	-2.1
71.3	0.26	0.26	-0.01	-2.1
72.5	0.26	0.26	-0.01	-2.3
73.8	0.26	0.25	-0.01	-2.4
75.0	0.26	0.25	-0.01	-2.6
76.3	0.25	0.25	0.00	-1.2
77.5	0.25	0.25	-0.01	-3.1
78.8	0.25	0.24	-0.01	-2.5
80.0	0.24	0.24	-0.01	-2.2
81.3	0.24	0.24	-0.01	-2.1
82.5	0.24	0.24	-0.01	-2.6
83.8	0.24	0.24	0.00	-1.9
85.0	0.24	0.24	0.00	-1.1
86.3	0.24	0.24	0.00	-0.2
87.5	0.24	0.24	0.00	-0.6
88.8	0.23	0.23	0.00	-0.6
90.0	0.23	0.23	0.00	-0.6
91.3	0.23	0.23	0.00	-0.8
92.5	0.23	0.23	0.00	-0.6
93.8	0.23	0.23	0.00	-0.8
95.0	0.23	0.23	0.00	-0.7
96.3	0.22	0.23	0.00	0.7
97.5	0.22	0.22	0.00	-0.1
98.8	0.22	0.22	0.00	0.7
100.0	0.22	0.22	0.00	0.5
Min	0.22	0.22	-0.01	-3.1
Max	0.40	0.40	0.00	0.7
Mean	0.30	0.29	0.00	-1.2
Median	0.29	0.28	0.00	-1.2
P.I.	Percent of time -- (-1.1<X<1.1)			45.0
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				56.3
X<=-10.0				0.0

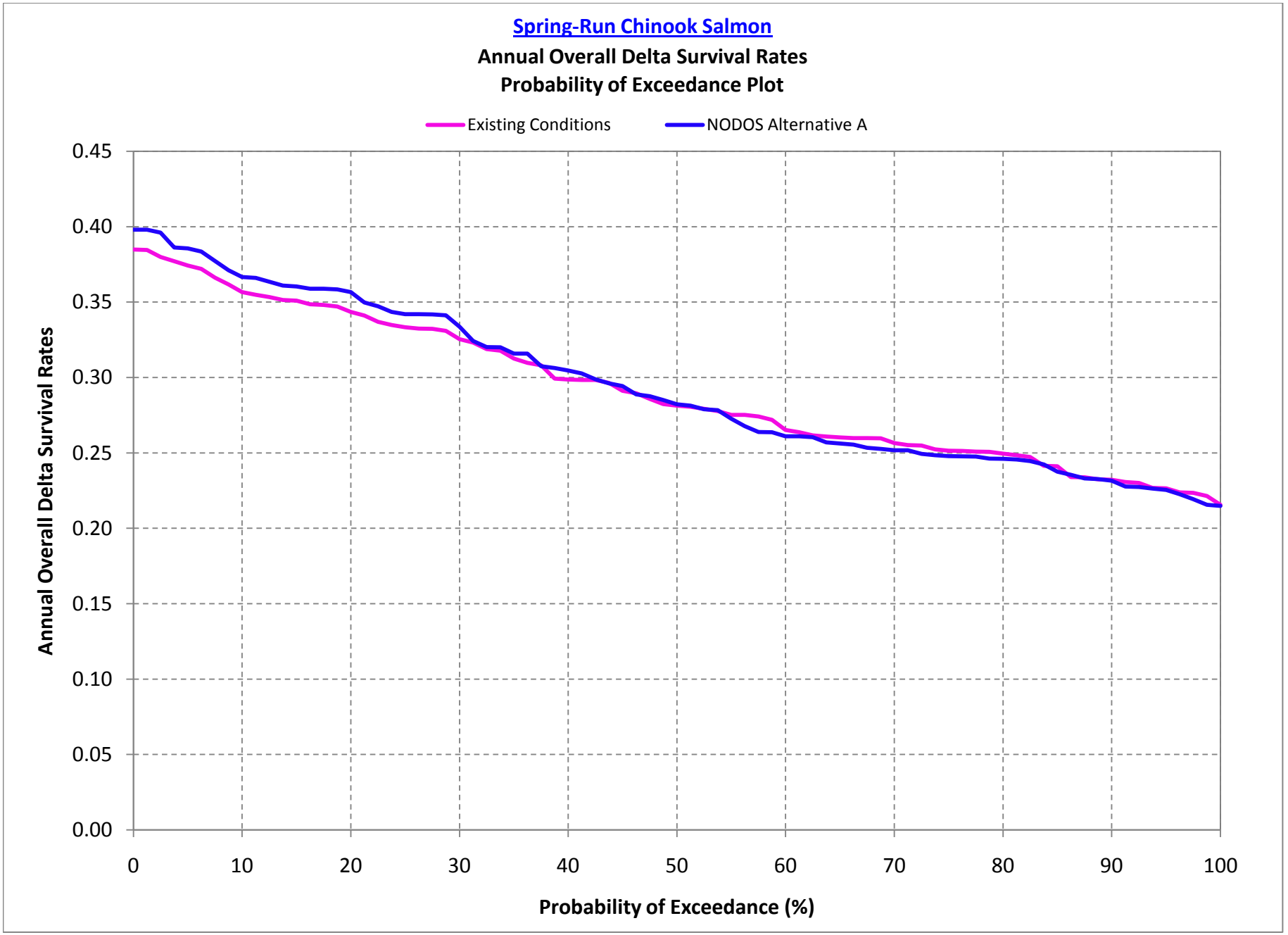
No Action Alternative Compared to Existing Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
0.0	0.38	0.40	0.01	3.5
1.3	0.38	0.40	0.01	3.5
2.5	0.38	0.40	0.02	4.3
3.8	0.38	0.39	0.01	2.8
5.0	0.37	0.39	0.01	3.3
6.3	0.37	0.38	0.01	3.1
7.5	0.37	0.38	0.01	3.3
8.8	0.36	0.37	0.01	2.6
10.0	0.36	0.37	0.01	2.9
11.3	0.35	0.37	0.01	3.3
12.5	0.35	0.36	0.01	2.9
13.8	0.35	0.36	0.01	3.3
15.0	0.35	0.36	0.01	3.2
16.3	0.35	0.36	0.01	3.5
17.5	0.35	0.36	0.01	3.5
18.8	0.35	0.36	0.01	3.2
20.0	0.34	0.36	0.01	3.8
21.3	0.34	0.35	0.01	3.0
22.5	0.34	0.35	0.01	3.3
23.8	0.33	0.35	0.01	3.4
25.0	0.33	0.34	0.01	3.0
26.3	0.33	0.34	0.01	3.2
27.5	0.33	0.34	0.01	3.0
28.8	0.33	0.34	0.01	3.2
30.0	0.33	0.33	0.01	2.5
31.3	0.32	0.33	0.00	1.2
32.5	0.32	0.33	0.01	2.0
33.8	0.32	0.32	0.00	1.5
35.0	0.31	0.32	0.01	1.8
36.3	0.31	0.32	0.01	2.1
37.5	0.31	0.31	0.01	1.8
38.8	0.30	0.31	0.01	2.5
40.0	0.30	0.31	0.01	2.7
41.3	0.30	0.31	0.01	2.7
42.5	0.30	0.30	0.00	1.1
43.8	0.30	0.30	0.00	0.9
45.0	0.29	0.30	0.01	1.8
46.3	0.29	0.29	0.00	1.6
47.5	0.29	0.29	0.01	2.2
48.8	0.28	0.29	0.01	2.0
50.0	0.28	0.29	0.01	2.1
51.3	0.28	0.29	0.01	2.3
52.5	0.28	0.28	0.00	1.8
53.8	0.28	0.28	0.01	2.1
55.0	0.28	0.28	0.00	1.3
56.3	0.28	0.28	0.00	1.2
57.5	0.27	0.28	0.00	0.6
58.8	0.27	0.27	0.00	0.4
60.0	0.27	0.27	0.00	1.4
61.3	0.26	0.27	0.00	0.6

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	No Action Alternative	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	0.6
63.8	0.26	0.26	0.00	0.5
65.0	0.26	0.26	0.00	0.4
66.3	0.26	0.26	0.00	0.2
67.5	0.26	0.26	0.00	0.2
68.8	0.26	0.26	0.00	-0.4
70.0	0.26	0.26	0.00	0.6
71.3	0.26	0.26	0.00	1.1
72.5	0.25	0.26	0.00	1.0
73.8	0.25	0.26	0.00	1.5
75.0	0.25	0.26	0.00	1.8
76.3	0.25	0.26	0.00	1.5
77.5	0.25	0.25	0.00	1.5
78.8	0.25	0.25	0.00	1.4
80.0	0.25	0.25	0.00	-0.3
81.3	0.25	0.25	0.00	-0.2
82.5	0.25	0.25	0.00	-0.3
83.8	0.24	0.24	0.00	-0.3
85.0	0.24	0.24	0.00	-1.8
86.3	0.23	0.23	0.00	0.2
87.5	0.23	0.23	0.00	-0.4
88.8	0.23	0.23	0.00	0.2
90.0	0.23	0.23	0.00	-0.1
91.3	0.23	0.23	0.00	-1.2
92.5	0.23	0.23	0.00	-1.5
93.8	0.23	0.23	0.00	-0.1
95.0	0.23	0.23	0.00	-0.4
96.3	0.22	0.22	0.00	-0.6
97.5	0.22	0.22	0.00	-1.5
98.8	0.22	0.22	0.00	-1.9
100.0	0.22	0.22	0.00	0.6
Min	0.22	0.22	0.00	-1.9
Max	0.38	0.40	0.02	4.3
Mean	0.29	0.30	0.01	1.5
Median	0.28	0.29	0.00	1.6
P.I.	Percent of time -- (-1.1<X<1.1)			30.0
1.1<=X<10.0				65.0
X>=10.0				0.0
-10.0<X<=-1.1				6.3
X<=-10.0				0.0

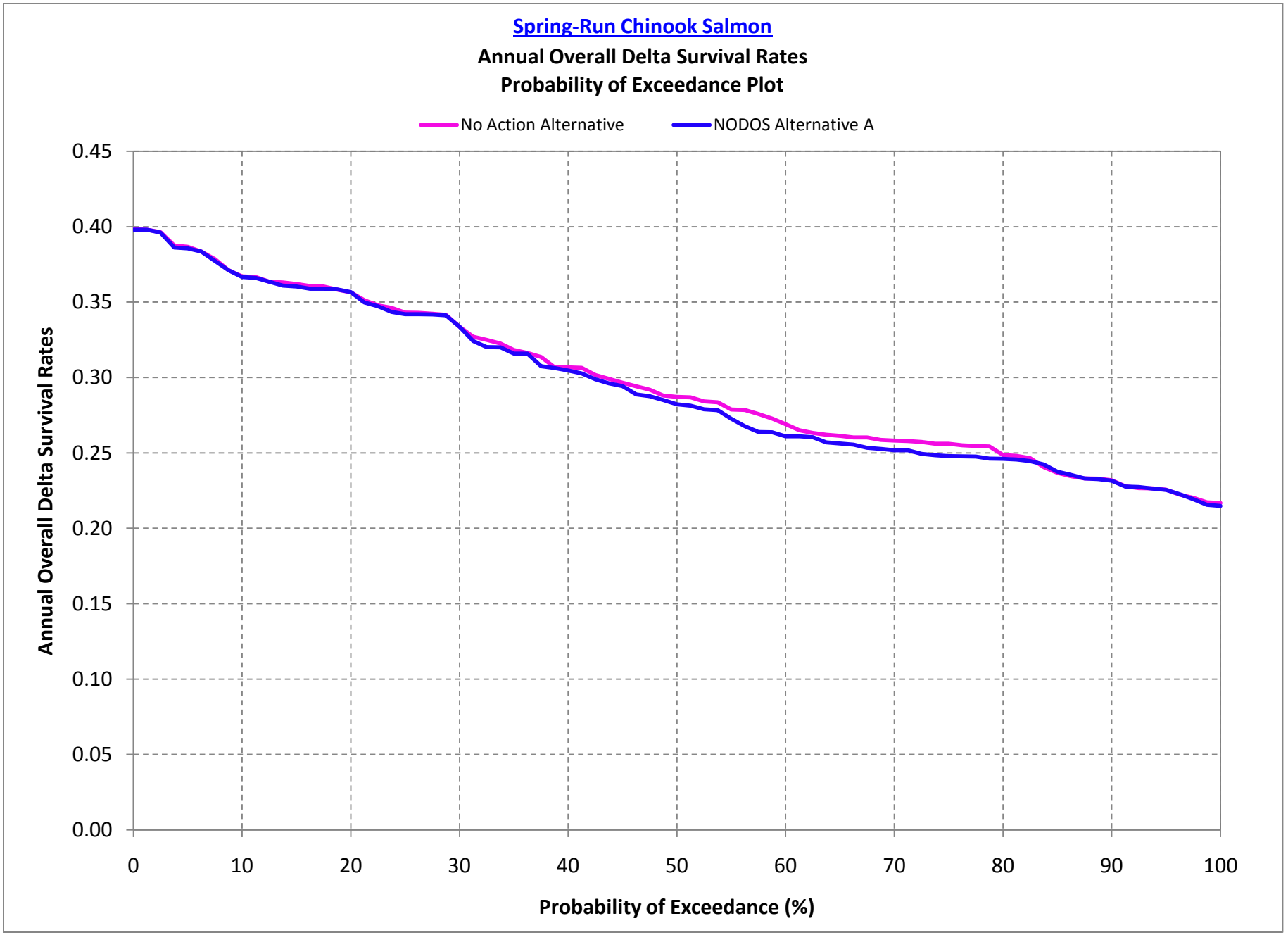
Alternative A Compared to Existing Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.38	0.40	0.01	3.4
1.3	0.38	0.40	0.01	3.5
2.5	0.38	0.40	0.02	4.3
3.8	0.38	0.39	0.01	2.4
5.0	0.37	0.39	0.01	3.0
6.3	0.37	0.38	0.01	3.1
7.5	0.37	0.38	0.01	3.0
8.8	0.36	0.37	0.01	2.6
10.0	0.36	0.37	0.01	2.8
11.3	0.35	0.37	0.01	3.2
12.5	0.35	0.36	0.01	2.9
13.8	0.35	0.36	0.01	2.7
15.0	0.35	0.36	0.01	2.7
16.3	0.35	0.36	0.01	3.0
17.5	0.35	0.36	0.01	3.1
18.8	0.35	0.36	0.01	3.3
20.0	0.34	0.36	0.01	3.8
21.3	0.34	0.35	0.01	2.5
22.5	0.34	0.35	0.01	3.1
23.8	0.33	0.34	0.01	2.6
25.0	0.33	0.34	0.01	2.6
26.3	0.33	0.34	0.01	2.9
27.5	0.33	0.34	0.01	2.9
28.8	0.33	0.34	0.01	3.1
30.0	0.33	0.33	0.01	2.5
31.3	0.32	0.32	0.00	0.3
32.5	0.32	0.32	0.00	0.4
33.8	0.32	0.32	0.00	0.7
35.0	0.31	0.32	0.00	1.1
36.3	0.31	0.32	0.01	2.0
37.5	0.31	0.31	0.00	-0.2
38.8	0.30	0.31	0.01	2.4
40.0	0.30	0.30	0.01	2.0
41.3	0.30	0.30	0.00	1.4
42.5	0.30	0.30	0.00	0.2
43.8	0.30	0.30	0.00	-0.1
45.0	0.29	0.29	0.00	1.1
46.3	0.29	0.29	0.00	-0.3
47.5	0.29	0.29	0.00	0.7
48.8	0.28	0.29	0.00	0.9
50.0	0.28	0.28	0.00	0.3
51.3	0.28	0.28	0.00	0.3
52.5	0.28	0.28	0.00	-0.1
53.8	0.28	0.28	0.00	0.2
55.0	0.28	0.27	0.00	-0.9
56.3	0.28	0.27	-0.01	-2.7
57.5	0.27	0.26	-0.01	-3.8
58.8	0.27	0.26	-0.01	-3.0
60.0	0.27	0.26	0.00	-1.6
61.3	0.26	0.26	0.00	-1.0

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-0.5
63.8	0.26	0.26	0.00	-1.5
65.0	0.26	0.26	0.00	-1.5
66.3	0.26	0.26	0.00	-1.6
67.5	0.26	0.25	-0.01	-2.4
68.8	0.26	0.25	-0.01	-2.7
70.0	0.26	0.25	0.00	-1.9
71.3	0.26	0.25	0.00	-1.4
72.5	0.25	0.25	-0.01	-2.2
73.8	0.25	0.25	0.00	-1.6
75.0	0.25	0.25	0.00	-1.4
76.3	0.25	0.25	0.00	-1.4
77.5	0.25	0.25	0.00	-1.3
78.8	0.25	0.25	0.00	-1.8
80.0	0.25	0.25	0.00	-1.3
81.3	0.25	0.25	0.00	-1.1
82.5	0.25	0.24	0.00	-1.1
83.8	0.24	0.24	0.00	0.4
85.0	0.24	0.24	0.00	-1.5
86.3	0.23	0.24	0.00	0.6
87.5	0.23	0.23	0.00	-0.3
88.8	0.23	0.23	0.00	0.0
90.0	0.23	0.23	0.00	-0.2
91.3	0.23	0.23	0.00	-1.3
92.5	0.23	0.23	0.00	-1.2
93.8	0.23	0.23	0.00	-0.2
95.0	0.23	0.23	0.00	-0.4
96.3	0.22	0.22	0.00	-0.5
97.5	0.22	0.22	0.00	-1.9
98.8	0.22	0.22	-0.01	-2.6
100.0	0.22	0.21	0.00	-0.3
Min	0.22	0.21	-0.01	-3.8
Max	0.38	0.40	0.02	4.3
Mean	0.29	0.29	0.00	0.5
Median	0.28	0.28	0.00	0.2
P.I.	Percent of time -- (-1.1<X<1.1)			31.3
1.1<=X<10.0				38.8
X>=10.0				0.0
-10.0<X<=-1.1				31.3
X<=-10.0				0.0

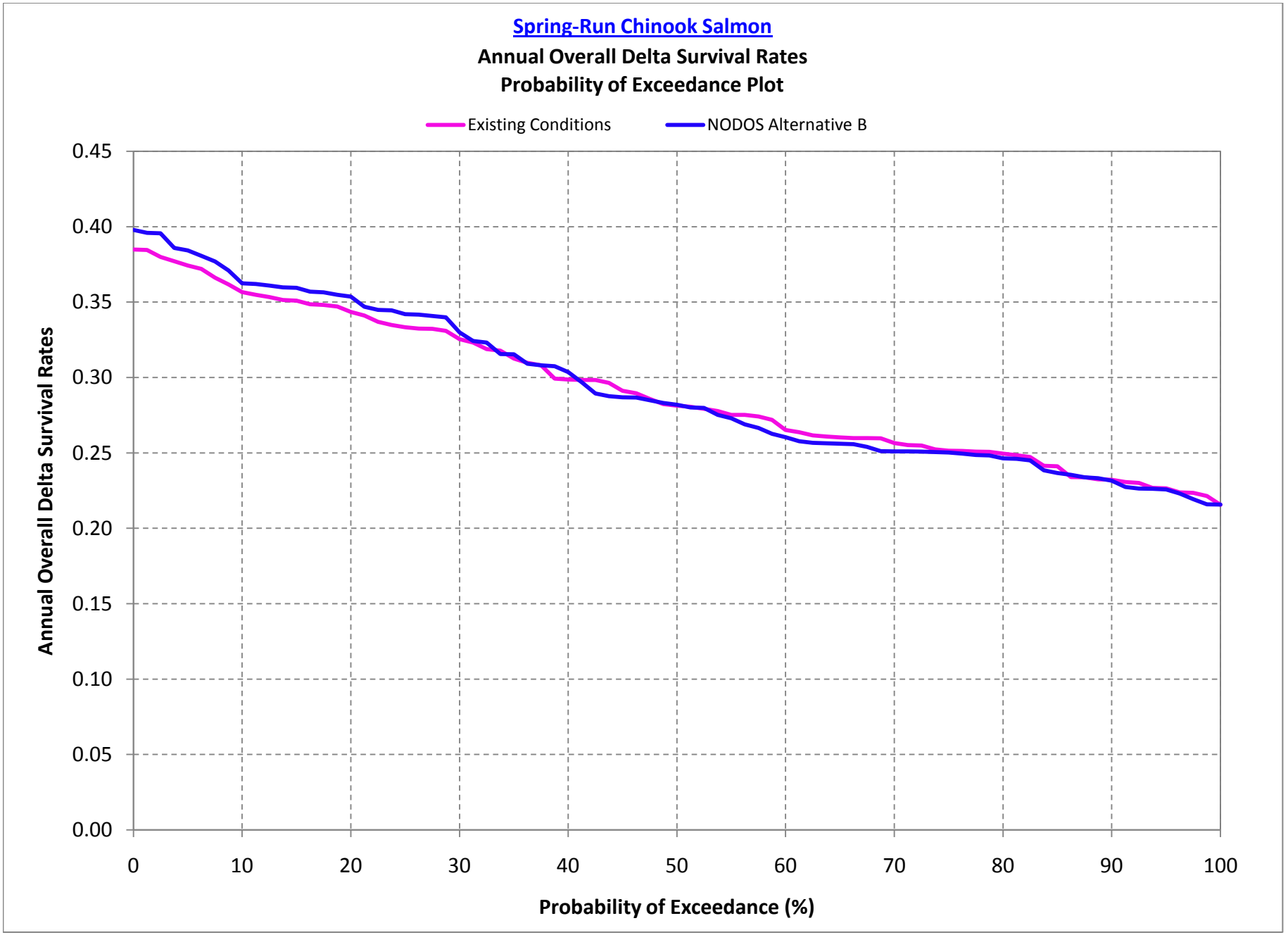
Alternative A Compared to No Action Alternative Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	-0.1
1.3	0.40	0.40	0.00	0.0
2.5	0.40	0.40	0.00	-0.1
3.8	0.39	0.39	0.00	-0.4
5.0	0.39	0.39	0.00	-0.3
6.3	0.38	0.38	0.00	0.0
7.5	0.38	0.38	0.00	-0.3
8.8	0.37	0.37	0.00	0.0
10.0	0.37	0.37	0.00	-0.1
11.3	0.37	0.37	0.00	-0.2
12.5	0.36	0.36	0.00	0.0
13.8	0.36	0.36	0.00	-0.6
15.0	0.36	0.36	0.00	-0.5
16.3	0.36	0.36	0.00	-0.5
17.5	0.36	0.36	0.00	-0.4
18.8	0.36	0.36	0.00	0.1
20.0	0.36	0.36	0.00	0.0
21.3	0.35	0.35	0.00	-0.5
22.5	0.35	0.35	0.00	-0.2
23.8	0.35	0.34	0.00	-0.8
25.0	0.34	0.34	0.00	-0.3
26.3	0.34	0.34	0.00	-0.3
27.5	0.34	0.34	0.00	-0.2
28.8	0.34	0.34	0.00	-0.1
30.0	0.33	0.33	0.00	0.0
31.3	0.33	0.32	0.00	-0.9
32.5	0.33	0.32	0.00	-1.5
33.8	0.32	0.32	0.00	-0.8
35.0	0.32	0.32	0.00	-0.8
36.3	0.32	0.32	0.00	-0.1
37.5	0.31	0.31	-0.01	-1.9
38.8	0.31	0.31	0.00	-0.1
40.0	0.31	0.30	0.00	-0.7
41.3	0.31	0.30	0.00	-1.2
42.5	0.30	0.30	0.00	-0.9
43.8	0.30	0.30	0.00	-1.0
45.0	0.30	0.29	0.00	-0.8
46.3	0.29	0.29	-0.01	-1.8
47.5	0.29	0.29	0.00	-1.5
48.8	0.29	0.29	0.00	-1.0
50.0	0.29	0.28	0.00	-1.7
51.3	0.29	0.28	-0.01	-1.9
52.5	0.28	0.28	-0.01	-1.8
53.8	0.28	0.28	-0.01	-1.9
55.0	0.28	0.27	-0.01	-2.2
56.3	0.28	0.27	-0.01	-3.9
57.5	0.28	0.26	-0.01	-4.3
58.8	0.27	0.26	-0.01	-3.3
60.0	0.27	0.26	-0.01	-3.0
61.3	0.27	0.26	0.00	-1.6

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative A	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-1.1
63.8	0.26	0.26	-0.01	-1.9
65.0	0.26	0.26	0.00	-1.9
66.3	0.26	0.26	0.00	-1.8
67.5	0.26	0.25	-0.01	-2.7
68.8	0.26	0.25	-0.01	-2.3
70.0	0.26	0.25	-0.01	-2.5
71.3	0.26	0.25	-0.01	-2.4
72.5	0.26	0.25	-0.01	-3.1
73.8	0.26	0.25	-0.01	-3.0
75.0	0.26	0.25	-0.01	-3.2
76.3	0.26	0.25	-0.01	-2.9
77.5	0.25	0.25	-0.01	-2.8
78.8	0.25	0.25	-0.01	-3.2
80.0	0.25	0.25	0.00	-1.0
81.3	0.25	0.25	0.00	-0.9
82.5	0.25	0.24	0.00	-0.8
83.8	0.24	0.24	0.00	0.7
85.0	0.24	0.24	0.00	0.3
86.3	0.23	0.24	0.00	0.3
87.5	0.23	0.23	0.00	0.0
88.8	0.23	0.23	0.00	-0.1
90.0	0.23	0.23	0.00	-0.1
91.3	0.23	0.23	0.00	-0.1
92.5	0.23	0.23	0.00	0.3
93.8	0.23	0.23	0.00	-0.1
95.0	0.23	0.23	0.00	0.0
96.3	0.22	0.22	0.00	0.1
97.5	0.22	0.22	0.00	-0.4
98.8	0.22	0.22	0.00	-0.7
100.0	0.22	0.21	0.00	-0.9
Min	0.22	0.21	-0.01	-4.3
Max	0.40	0.40	0.00	0.7
Mean	0.30	0.29	0.00	-1.0
Median	0.29	0.28	0.00	-0.8
P.I.	Percent of time -- (-1.1<X<1.1)			65.0
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				36.3
X<=-10.0				0.0

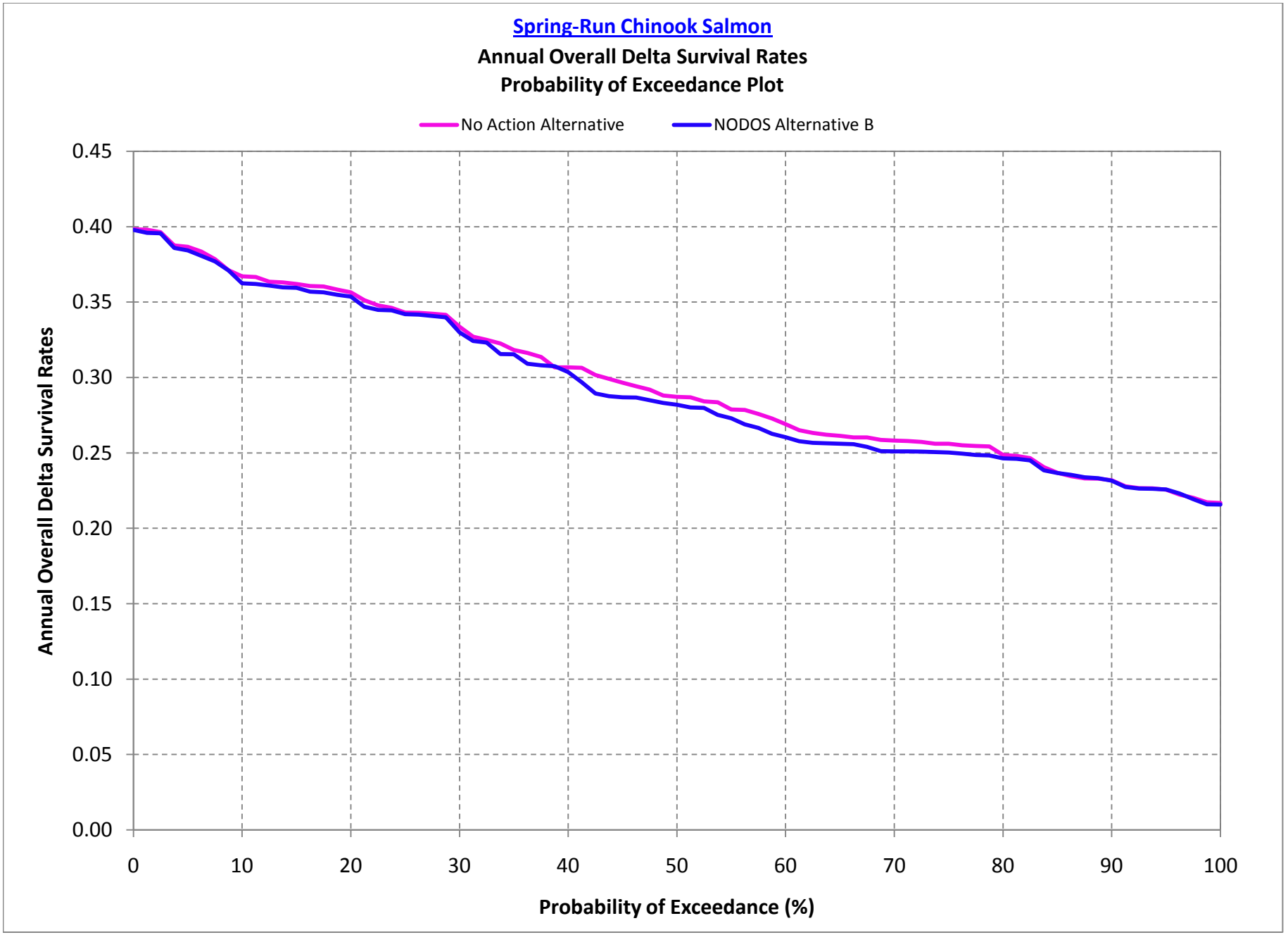
Alternative B Compared to Existing Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.38	0.40	0.01	3.4
1.3	0.38	0.40	0.01	3.0
2.5	0.38	0.40	0.02	4.1
3.8	0.38	0.39	0.01	2.3
5.0	0.37	0.38	0.01	2.7
6.3	0.37	0.38	0.01	2.3
7.5	0.37	0.38	0.01	2.9
8.8	0.36	0.37	0.01	2.6
10.0	0.36	0.36	0.01	1.7
11.3	0.35	0.36	0.01	2.0
12.5	0.35	0.36	0.01	2.2
13.8	0.35	0.36	0.01	2.4
15.0	0.35	0.36	0.01	2.4
16.3	0.35	0.36	0.01	2.4
17.5	0.35	0.36	0.01	2.4
18.8	0.35	0.35	0.01	2.2
20.0	0.34	0.35	0.01	2.9
21.3	0.34	0.35	0.01	1.7
22.5	0.34	0.34	0.01	2.4
23.8	0.33	0.34	0.01	2.9
25.0	0.33	0.34	0.01	2.6
26.3	0.33	0.34	0.01	2.8
27.5	0.33	0.34	0.01	2.6
28.8	0.33	0.34	0.01	2.7
30.0	0.33	0.33	0.00	1.4
31.3	0.32	0.32	0.00	0.3
32.5	0.32	0.32	0.00	1.4
33.8	0.32	0.32	0.00	-0.7
35.0	0.31	0.32	0.00	0.9
36.3	0.31	0.31	0.00	-0.2
37.5	0.31	0.31	0.00	0.0
38.8	0.30	0.31	0.01	2.8
40.0	0.30	0.30	0.00	1.7
41.3	0.30	0.30	0.00	-0.5
42.5	0.30	0.29	-0.01	-3.0
43.8	0.30	0.29	-0.01	-3.0
45.0	0.29	0.29	0.00	-1.5
46.3	0.29	0.29	0.00	-1.0
47.5	0.29	0.28	0.00	-0.3
48.8	0.28	0.28	0.00	0.3
50.0	0.28	0.28	0.00	0.2
51.3	0.28	0.28	0.00	-0.2
52.5	0.28	0.28	0.00	0.2
53.8	0.28	0.28	0.00	-0.9
55.0	0.28	0.27	0.00	-0.8
56.3	0.28	0.27	-0.01	-2.3
57.5	0.27	0.27	-0.01	-2.8
58.8	0.27	0.26	-0.01	-3.4
60.0	0.27	0.26	0.00	-1.8
61.3	0.26	0.26	-0.01	-2.2

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-1.9
63.8	0.26	0.26	0.00	-1.7
65.0	0.26	0.26	0.00	-1.6
66.3	0.26	0.26	0.00	-1.6
67.5	0.26	0.25	-0.01	-2.2
68.8	0.26	0.25	-0.01	-3.3
70.0	0.26	0.25	-0.01	-2.1
71.3	0.26	0.25	0.00	-1.7
72.5	0.25	0.25	0.00	-1.6
73.8	0.25	0.25	0.00	-0.7
75.0	0.25	0.25	0.00	-0.5
76.3	0.25	0.25	0.00	-0.7
77.5	0.25	0.25	0.00	-0.9
78.8	0.25	0.25	0.00	-1.0
80.0	0.25	0.25	0.00	-1.3
81.3	0.25	0.25	0.00	-1.0
82.5	0.25	0.24	0.00	-1.0
83.8	0.24	0.24	0.00	-1.2
85.0	0.24	0.24	0.00	-1.8
86.3	0.23	0.24	0.00	0.6
87.5	0.23	0.23	0.00	0.0
88.8	0.23	0.23	0.00	0.3
90.0	0.23	0.23	0.00	-0.3
91.3	0.23	0.23	0.00	-1.4
92.5	0.23	0.23	0.00	-1.7
93.8	0.23	0.23	0.00	-0.2
95.0	0.23	0.23	0.00	-0.3
96.3	0.22	0.22	0.00	-0.3
97.5	0.22	0.22	0.00	-1.9
98.8	0.22	0.22	-0.01	-2.5
100.0	0.22	0.22	0.00	0.1
Min	0.22	0.22	-0.01	-3.4
Max	0.38	0.40	0.02	4.1
Mean	0.29	0.29	0.00	0.1
Median	0.28	0.28	0.00	-0.2
P.I.	Percent of time -- (-1.1<X<1.1)			36.3
1.1<=X<10.0				35.0
X>=10.0				0.0
-10.0<X<=-1.1				30.0
X<=-10.0				0.0

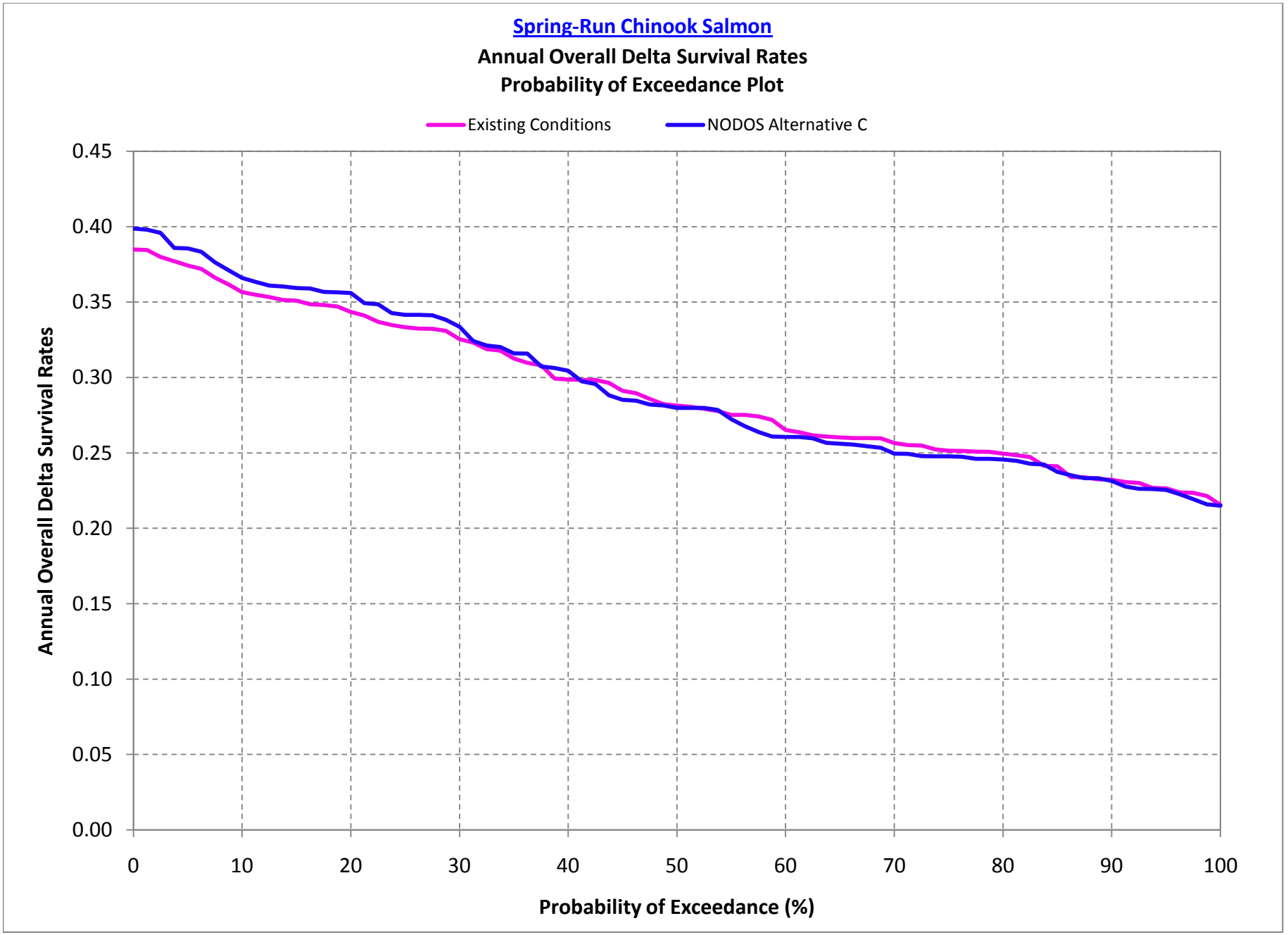
Alternative B Compared to No Action Alternative Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	-0.1
1.3	0.40	0.40	0.00	-0.5
2.5	0.40	0.40	0.00	-0.2
3.8	0.39	0.39	0.00	-0.4
5.0	0.39	0.38	0.00	-0.6
6.3	0.38	0.38	0.00	-0.8
7.5	0.38	0.38	0.00	-0.4
8.8	0.37	0.37	0.00	0.0
10.0	0.37	0.36	0.00	-1.2
11.3	0.37	0.36	0.00	-1.3
12.5	0.36	0.36	0.00	-0.7
13.8	0.36	0.36	0.00	-0.9
15.0	0.36	0.36	0.00	-0.7
16.3	0.36	0.36	0.00	-1.0
17.5	0.36	0.36	0.00	-1.1
18.8	0.36	0.35	0.00	-1.0
20.0	0.36	0.35	0.00	-0.8
21.3	0.35	0.35	0.00	-1.3
22.5	0.35	0.34	0.00	-0.9
23.8	0.35	0.34	0.00	-0.5
25.0	0.34	0.34	0.00	-0.3
26.3	0.34	0.34	0.00	-0.3
27.5	0.34	0.34	0.00	-0.5
28.8	0.34	0.34	0.00	-0.5
30.0	0.33	0.33	0.00	-1.1
31.3	0.33	0.32	0.00	-0.9
32.5	0.33	0.32	0.00	-0.6
33.8	0.32	0.32	-0.01	-2.2
35.0	0.32	0.32	0.00	-0.9
36.3	0.32	0.31	-0.01	-2.3
37.5	0.31	0.31	-0.01	-1.8
38.8	0.31	0.31	0.00	0.3
40.0	0.31	0.30	0.00	-1.0
41.3	0.31	0.30	-0.01	-3.1
42.5	0.30	0.29	-0.01	-4.1
43.8	0.30	0.29	-0.01	-3.9
45.0	0.30	0.29	-0.01	-3.3
46.3	0.29	0.29	-0.01	-2.5
47.5	0.29	0.28	-0.01	-2.4
48.8	0.29	0.28	0.00	-1.7
50.0	0.29	0.28	-0.01	-1.8
51.3	0.29	0.28	-0.01	-2.4
52.5	0.28	0.28	0.00	-1.5
53.8	0.28	0.28	-0.01	-3.0
55.0	0.28	0.27	-0.01	-2.1
56.3	0.28	0.27	-0.01	-3.5
57.5	0.28	0.27	-0.01	-3.4
58.8	0.27	0.26	-0.01	-3.7
60.0	0.27	0.26	-0.01	-3.2
61.3	0.27	0.26	-0.01	-2.8

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative B	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	-0.01	-2.5
63.8	0.26	0.26	-0.01	-2.1
65.0	0.26	0.26	-0.01	-2.0
66.3	0.26	0.26	0.00	-1.8
67.5	0.26	0.25	-0.01	-2.5
68.8	0.26	0.25	-0.01	-2.9
70.0	0.26	0.25	-0.01	-2.7
71.3	0.26	0.25	-0.01	-2.7
72.5	0.26	0.25	-0.01	-2.5
73.8	0.26	0.25	-0.01	-2.1
75.0	0.26	0.25	-0.01	-2.3
76.3	0.26	0.25	-0.01	-2.2
77.5	0.25	0.25	-0.01	-2.4
78.8	0.25	0.25	-0.01	-2.4
80.0	0.25	0.25	0.00	-0.9
81.3	0.25	0.25	0.00	-0.8
82.5	0.25	0.24	0.00	-0.6
83.8	0.24	0.24	0.00	-0.9
85.0	0.24	0.24	0.00	-0.1
86.3	0.23	0.24	0.00	0.4
87.5	0.23	0.23	0.00	0.4
88.8	0.23	0.23	0.00	0.1
90.0	0.23	0.23	0.00	-0.1
91.3	0.23	0.23	0.00	-0.2
92.5	0.23	0.23	0.00	-0.2
93.8	0.23	0.23	0.00	-0.1
95.0	0.23	0.23	0.00	0.1
96.3	0.22	0.22	0.00	0.3
97.5	0.22	0.22	0.00	-0.4
98.8	0.22	0.22	0.00	-0.6
100.0	0.22	0.22	0.00	-0.5
Min	0.22	0.22	-0.01	-4.1
Max	0.40	0.40	0.00	0.4
Mean	0.30	0.29	0.00	-1.4
Median	0.29	0.28	0.00	-1.0
P.I.	Percent of time -- (-1.1<X<1.1)			52.5
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				48.8
X<=-10.0				0.0

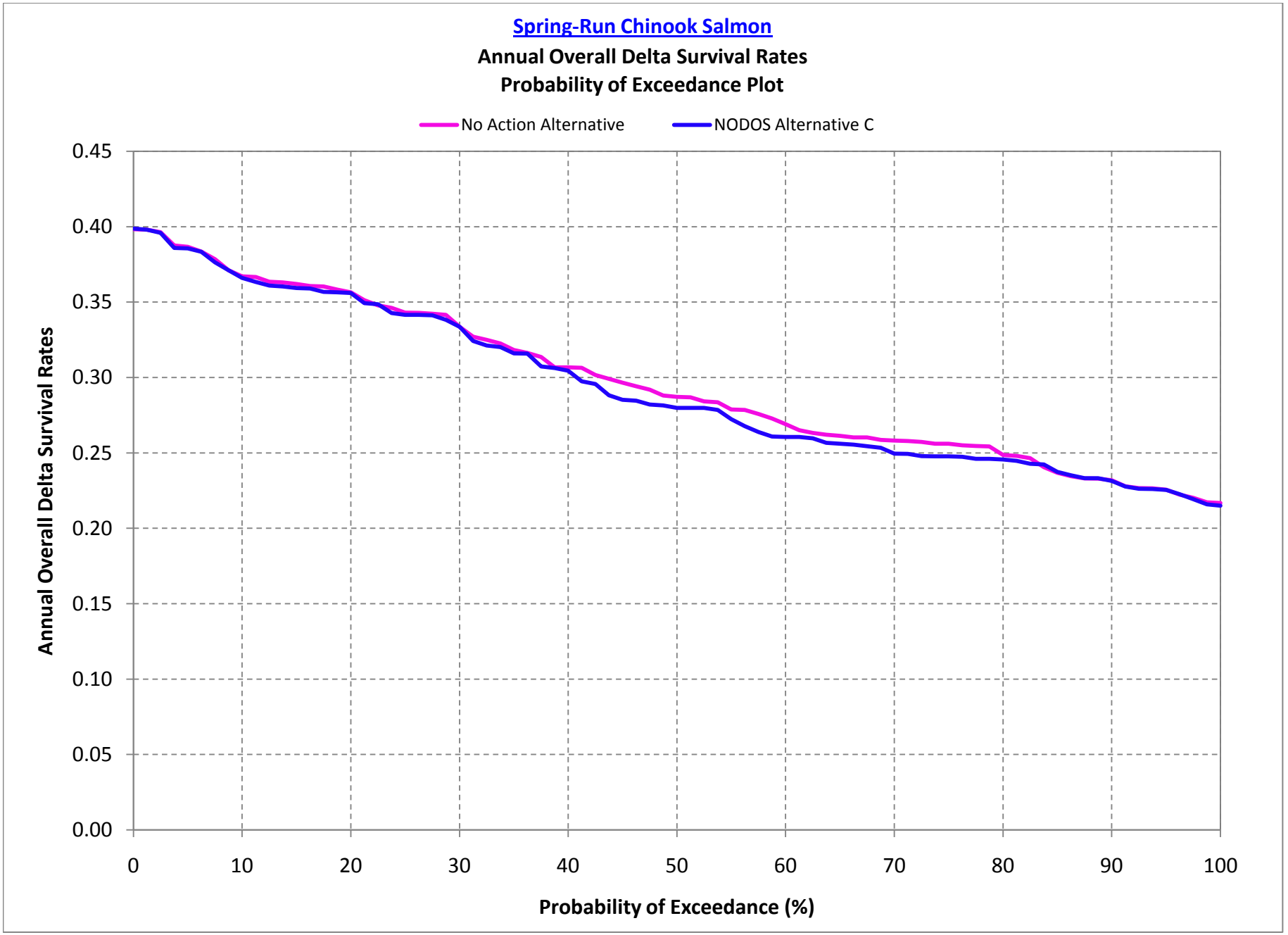
Alternative C Compared to Existing Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.38	0.40	0.01	3.6
1.3	0.38	0.40	0.01	3.5
2.5	0.38	0.40	0.02	4.2
3.8	0.38	0.39	0.01	2.4
5.0	0.37	0.39	0.01	3.1
6.3	0.37	0.38	0.01	3.0
7.5	0.37	0.38	0.01	2.8
8.8	0.36	0.37	0.01	2.6
10.0	0.36	0.37	0.01	2.6
11.3	0.35	0.36	0.01	2.4
12.5	0.35	0.36	0.01	2.2
13.8	0.35	0.36	0.01	2.5
15.0	0.35	0.36	0.01	2.4
16.3	0.35	0.36	0.01	3.0
17.5	0.35	0.36	0.01	2.5
18.8	0.35	0.36	0.01	2.7
20.0	0.34	0.36	0.01	3.6
21.3	0.34	0.35	0.01	2.4
22.5	0.34	0.35	0.01	3.5
23.8	0.33	0.34	0.01	2.4
25.0	0.33	0.34	0.01	2.5
26.3	0.33	0.34	0.01	2.8
27.5	0.33	0.34	0.01	2.7
28.8	0.33	0.34	0.01	2.2
30.0	0.33	0.33	0.01	2.5
31.3	0.32	0.32	0.00	0.3
32.5	0.32	0.32	0.00	0.8
33.8	0.32	0.32	0.00	0.7
35.0	0.31	0.32	0.00	1.1
36.3	0.31	0.32	0.01	2.0
37.5	0.31	0.31	0.00	-0.2
38.8	0.30	0.31	0.01	2.4
40.0	0.30	0.30	0.01	2.0
41.3	0.30	0.30	0.00	-0.3
42.5	0.30	0.30	0.00	-0.9
43.8	0.30	0.29	-0.01	-2.8
45.0	0.29	0.29	-0.01	-2.0
46.3	0.29	0.28	-0.01	-1.7
47.5	0.29	0.28	0.00	-1.3
48.8	0.28	0.28	0.00	-0.4
50.0	0.28	0.28	0.00	-0.5
51.3	0.28	0.28	0.00	-0.3
52.5	0.28	0.28	0.00	0.2
53.8	0.28	0.28	0.00	0.2
55.0	0.28	0.27	0.00	-1.1
56.3	0.28	0.27	-0.01	-2.7
57.5	0.27	0.26	-0.01	-3.8
58.8	0.27	0.26	-0.01	-4.0
60.0	0.27	0.26	0.00	-1.8
61.3	0.26	0.26	0.00	-1.2

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	Existing Conditions	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-0.7
63.8	0.26	0.26	0.00	-1.6
65.0	0.26	0.26	0.00	-1.6
66.3	0.26	0.26	0.00	-1.7
67.5	0.26	0.25	-0.01	-2.0
68.8	0.26	0.25	-0.01	-2.4
70.0	0.26	0.25	-0.01	-2.8
71.3	0.26	0.25	-0.01	-2.3
72.5	0.25	0.25	-0.01	-2.7
73.8	0.25	0.25	0.00	-1.8
75.0	0.25	0.25	0.00	-1.5
76.3	0.25	0.25	0.00	-1.5
77.5	0.25	0.25	0.00	-1.9
78.8	0.25	0.25	0.00	-1.9
80.0	0.25	0.25	0.00	-1.5
81.3	0.25	0.24	0.00	-1.5
82.5	0.25	0.24	0.00	-1.8
83.8	0.24	0.24	0.00	0.4
85.0	0.24	0.24	0.00	-1.5
86.3	0.23	0.24	0.00	0.5
87.5	0.23	0.23	0.00	-0.3
88.8	0.23	0.23	0.00	0.3
90.0	0.23	0.23	0.00	-0.3
91.3	0.23	0.23	0.00	-1.3
92.5	0.23	0.23	0.00	-1.7
93.8	0.23	0.23	0.00	-0.3
95.0	0.23	0.23	0.00	-0.4
96.3	0.22	0.22	0.00	-0.5
97.5	0.22	0.22	0.00	-1.9
98.8	0.22	0.22	-0.01	-2.5
100.0	0.22	0.21	0.00	-0.3
Min	0.22	0.21	-0.01	-4.0
Max	0.38	0.40	0.02	4.2
Mean	0.29	0.29	0.00	0.2
Median	0.28	0.28	0.00	-0.3
P.I.	Percent of time -- (-1.1<X<1.1)			26.3
1.1<=X<10.0				36.3
X>=10.0				0.0
-10.0<X<=-1.1				38.8
X<=-10.0				0.0

Alternative C Compared to No Action Alternative Condition Spring-Run Chinook Salmon



Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
0.0	0.40	0.40	0.00	0.1
1.3	0.40	0.40	0.00	0.0
2.5	0.40	0.40	0.00	-0.1
3.8	0.39	0.39	0.00	-0.4
5.0	0.39	0.39	0.00	-0.3
6.3	0.38	0.38	0.00	-0.1
7.5	0.38	0.38	0.00	-0.5
8.8	0.37	0.37	0.00	0.0
10.0	0.37	0.37	0.00	-0.3
11.3	0.37	0.36	0.00	-0.9
12.5	0.36	0.36	0.00	-0.7
13.8	0.36	0.36	0.00	-0.8
15.0	0.36	0.36	0.00	-0.8
16.3	0.36	0.36	0.00	-0.4
17.5	0.36	0.36	0.00	-1.0
18.8	0.36	0.36	0.00	-0.5
20.0	0.36	0.36	0.00	-0.1
21.3	0.35	0.35	0.00	-0.5
22.5	0.35	0.35	0.00	0.2
23.8	0.35	0.34	0.00	-1.0
25.0	0.34	0.34	0.00	-0.4
26.3	0.34	0.34	0.00	-0.4
27.5	0.34	0.34	0.00	-0.3
28.8	0.34	0.34	0.00	-1.0
30.0	0.33	0.33	0.00	0.0
31.3	0.33	0.32	0.00	-0.9
32.5	0.33	0.32	0.00	-1.2
33.8	0.32	0.32	0.00	-0.7
35.0	0.32	0.32	0.00	-0.7
36.3	0.32	0.32	0.00	-0.1
37.5	0.31	0.31	-0.01	-2.0
38.8	0.31	0.31	0.00	-0.1
40.0	0.31	0.30	0.00	-0.7
41.3	0.31	0.30	-0.01	-2.9
42.5	0.30	0.30	-0.01	-2.0
43.8	0.30	0.29	-0.01	-3.7
45.0	0.30	0.29	-0.01	-3.8
46.3	0.29	0.28	-0.01	-3.3
47.5	0.29	0.28	-0.01	-3.4
48.8	0.29	0.28	-0.01	-2.3
50.0	0.29	0.28	-0.01	-2.5
51.3	0.29	0.28	-0.01	-2.5
52.5	0.28	0.28	0.00	-1.5
53.8	0.28	0.28	-0.01	-1.8
55.0	0.28	0.27	-0.01	-2.3
56.3	0.28	0.27	-0.01	-3.9
57.5	0.28	0.26	-0.01	-4.4
58.8	0.27	0.26	-0.01	-4.4
60.0	0.27	0.26	-0.01	-3.2
61.3	0.27	0.26	0.00	-1.7

Spring-Run Chinook Salmon				
Annual Overall Delta Survival Rates				
Probability of Exceedance				
Percent Exceedance Probability	No Action Alternative	NODOS Alternative C	Absolute Difference	Relative Difference (%)
62.5	0.26	0.26	0.00	-1.4
63.8	0.26	0.26	-0.01	-2.1
65.0	0.26	0.26	-0.01	-2.0
66.3	0.26	0.26	0.00	-1.9
67.5	0.26	0.25	-0.01	-2.2
68.8	0.26	0.25	-0.01	-2.0
70.0	0.26	0.25	-0.01	-3.4
71.3	0.26	0.25	-0.01	-3.3
72.5	0.26	0.25	-0.01	-3.7
73.8	0.26	0.25	-0.01	-3.2
75.0	0.26	0.25	-0.01	-3.2
76.3	0.26	0.25	-0.01	-3.0
77.5	0.25	0.25	-0.01	-3.4
78.8	0.25	0.25	-0.01	-3.3
80.0	0.25	0.25	0.00	-1.2
81.3	0.25	0.24	0.00	-1.3
82.5	0.25	0.24	0.00	-1.5
83.8	0.24	0.24	0.00	0.8
85.0	0.24	0.24	0.00	0.2
86.3	0.23	0.24	0.00	0.2
87.5	0.23	0.23	0.00	0.1
88.8	0.23	0.23	0.00	0.1
90.0	0.23	0.23	0.00	-0.2
91.3	0.23	0.23	0.00	-0.1
92.5	0.23	0.23	0.00	-0.2
93.8	0.23	0.23	0.00	-0.2
95.0	0.23	0.23	0.00	0.0
96.3	0.22	0.22	0.00	0.1
97.5	0.22	0.22	0.00	-0.4
98.8	0.22	0.22	0.00	-0.6
100.0	0.22	0.21	0.00	-0.9
Min	0.22	0.21	-0.01	-4.4
Max	0.40	0.40	0.00	0.8
Mean	0.30	0.29	0.00	-1.4
Median	0.29	0.28	0.00	-0.9
P.I.	Percent of time -- (-1.1<X<1.1)			56.3
1.1<=X<10.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				45.0
X<=-10.0				0.0