Appendix 11H Salmonid Population Modeling

Appendix 11H Salmonid Population Modeling

11H.1 Introduction

This appendix provides SALMOD model outputs for the Project. SALMOD simulates Sacramento River populations of winter-run, spring-run, fall-run, and late fall-run Chinook salmon to assess potential flow- and temperature-related effects on early life stages. The interpretation of SALMOD outputs presented in this appendix is provided in Chapter 11, *Aquatic Biological Resources*, for Impacts FISH-2, FISH-3, and FISH-4.

11H.2 SALMOD

SALMOD simulates the population dynamics of the freshwater life stages of anadromous Chinook salmon. Model processes include spawning (egg deposition), egg and alevin development and growth, mortality, and movement (due to habitat limitation, freshets, and seasonal stimuli). Pre-smolts do not graduate to the smolt stage within the model. Instead, they exit the study area and the population is reinitialized with survey estimates of spawning adults each biological year. SALMOD is a spatially explicit model in which habitat quality and carrying capacity are characterized by the hydraulic and thermal properties of individual mesohabitats, which serve as spatial computational units in the model. SALMOD is organized around events occurring during a biological year beginning with spawning and typically concluding with fish that are physiologically "ready" (e.g., pre-smolts), swimming downstream toward the ocean. It operates on a weekly timestep for one or more biological years. Input variables (e.g., streamflow, water temperature, number and distribution of adult spawners) are represented by their weekly average values. SALMOD tracks a population of spatially distinct cohorts that originate as eggs and grow from one life stage to another as a function of local water temperature. The biological characteristics of fish within a cohort are the same. Fish cohorts are tracked by life stage and size class within the spatial computational units. SALMOD uses the weekly averages of the daily flow outputs fromthe Upper Sacramento River Daily Operations Model (USRDOM) and the daily temperature outputs from the HEC5Q model. The USRDOM model is described in Appendix 5C, *Upper Sacramento River Daily River Flow and Operations Modeling*, and the HEC5Q model is described in Appendix 5A, *Surface Water Resources Modeling of Alternatives*.

A full description of the model can be found in the California WaterFix Biological Assessment (DWR 2016), Attachment 5.D.2, *SALMOD Model*.

11H.3 Results

Table 1a-1 through Table 1d-4 compare the mortality of each Chinook salmon race by life stage and source between the No Action Alternative and Alternatives 1A, 1B, 2, and 3. Table 2a-1 through Table 2d-4 compare the annual potential production of each Chinook salmon race between the No Action Alternative and Alternatives 1A, 1B, 2, and 3. Figure B-a-1 through Figure B-d-19 provide exceedance plots of SALMOD outputs for all alternatives for winter-run, spring-run, fall-run, and late fall-run Chinook salmon for multiple metrics. These metrics include annual mortality, habitat-based mortality, and temperature-based mortality for early life stages.

Section	Output Parameter	Table Numbers	Figure Numbers
Tabular Results	Mortality by Life-stage and Source	1a-1 through 1d-4	NA
Tabular Results	Annual Potential Production	2a-1 through 2d-4	NA
Figure Results	Winter Run	NA	B-a-1 through B-a-19
Figure Results	Spring Run	NA	B-b-1 through B-b-19
Figure Results	Fall Run	NA	B-c-1 through B-c-19
Figure Results	Late Fall Run	NA	B-d-1 through B-d-19

Table 1a-1 Mortality of Winter-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	9,120	389,672	50,758	757	104,686	178	6	555,178
Alternative 1A 011221	8,898	378,899	46,043	1,031	105,768	284	5	540,928
Difference	-222	-10,773	-4,715	274	1,082	106	-1	-14,250
Percent Difference[3]	-2	-3	-9	36	1	60	-18	-3
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	9,600	354,281	465	0	133,868	0	2	498,217
Alternative 1A 011221	9,030	348,719	512	0	133,833	0	1	492,094
Difference	-571	-5,563	47	0	-35	0	-1	-6,123
Percent Difference	-6	-2	10	0	0	0	-63	-1
Above Normal (14.6%)								
NOACTION 011221	9,000	301,027	391,942	6,056	100,886	1,423	11	810,346
Alternative 1A 011221	9,600	292,432	351,770	8,246	104,505	2,270	5	768,828
Difference	600	-8,595	-40,172	2,190	3,619	847	-6	-41,518
Percent Difference	7	-3	-10	36	4	60	-56	-5
Below Normal (17.1%)								
NOACTION 011221	7,929	368,975	2,522	0	94,025	0	7	473,457
Alternative 1A 011221	7,931	356,293	3,468	0	95,199	0	4	462,895
Difference	3	-12,682	946	0	1,173	0	-3	-10,562
Percent Difference	0	-3	38	0	1	0	-43	-2
Dry (22%)								
NOACTION 011221	9,334	456,215	1,819	0	91,838	0	10	559,217
Alternative 1A 011221	9,001	449,917	2,054	0	91,397	0	9	552,377
Difference	-333	-6,298	235	0	-441	0	-2	-6,840
Percent Difference	-4	-1	13	0	0	0	-16	-1
Critical (14.6%)								
NOACTION 011221	9,251	464,556	5,090	0	76,338	0	0	555,235
Alternative 1A 011221	9,004	436,192	5,575	0	79,904	0	8	530,682
Difference	-248	-28,364	484	0	3,566	0	8	-24,553
Percent Difference	-3	-6	10	0	5	0	0	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1a-2 Mortality of Winter-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
			Long-term					
Full Simulation Period[1]								
NOACTION 011221	9,120	389,672	50,758	757	104,686	178	6	555,178
Alternative 1B 011221	8,748	369,187	44,041	1,052	105,638	279	2	528,946
Difference	-372	-20,486	-6,717	295	952	101	-4	-26,232
Percent Difference[3]	-4	-5	-13	39	1	57	-65	-5
			Water Year Types[2]					
Wet (31.7%)								
NOACTION 011221	9,600	354,281	465	0	133,868	0	2	498,217
Alternative 1B 011221	8,915	327,090	575	0	136,188	0	1	472,770
Difference	-685	-27,192	110	0	2,320	0	-1	-25,447
Percent Difference	-7	-8	24	0	2	0	-38	-5
Above Normal (14.6%)								
NOACTION 011221	9,000	301,027	391,942	6,056	100,886	1,423	11	810,346
Alternative 1B 011221	9,600	287,914	334,627	8,412	105,378	2,232	0	748,163
Difference	600	-13,113	-57,316	2,356	4,492	809	-11	-62,183
Percent Difference	7	-4	-15	39	4	57	-99	-8
Below Normal (17.1%)								
NOACTION 011221	7,929	368,975	2,522	0	94,025	0	7	473,457
Alternative 1B 011221	7,503	348,604	4,791	0	94,071	0	2	454,970
Difference	-426	-20,371	2,269	0	46	0	-5	-18,487
Percent Difference	-5	-6	90	0	0	0	-71	-4
Dry (22%)								
NOACTION 011221	9,334	456,215	1,819	0	91,838	0	10	559,217
Alternative 1B 011221	8,667	435,110	1,871	0	88,619	0	5	534,271
Difference	-667	-21,105	52	0	-3,220	0	-6	-24,945
Percent Difference	-7	-5	3	0	-4	0	-57	-4
Critical (14.6%)								
NOACTION 011221	9,251	464,556	5,090	0	76,338	0	0	555,235
Alternative 1B 011221	9,251	453,251	5,107	0	78,688	0	1	546,298
Difference	-1	-11,305	17	0	2,351	0	1	-8,937
Percent Difference	0	-2	0	0	3	0	0	-2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1a-3 Mortality of Winter-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	9,120	389,672	50,758	757	104,686	178	6	555,178
Alternative 2 011221	9,160	379,977	46,438	1,050	104,177	283	4	541,090
Difference	40	-9,695	-4,320	293	-510	106	-2	-14,088
Percent Difference[3]	0	-2	-9	39	0	59	-26	-3
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	9,600	354,281	465	0	133,868	0	2	498,217
Alternative 2 011221	9,491	351,693	512	0	130,408	0	1	492,104
Difference	-109	-2,589	47	0	-3,460	0	-1	-6,113
Percent Difference	-1	-1	10	0	-3	0	-62	-1
Above Normal (14.6%)								
NOACTION 011221	9,000	301,027	391,942	6,056	100,886	1,423	11	810,346
Alternative 2 011221	9,300	292,850	351,177	8,400	104,284	2,268	5	768,283
Difference	300	-8,177	-40,766	2,344	3,398	845	-6	-42,062
Percent Difference	3	-3	-10	39	3	59	-56	-5
Below Normal (17.1%)								
NOACTION 011221	7,929	368,975	2,522	0	94,025	0	7	473,457
Alternative 2 011221	8,789	353,327	6,213	0	94,513	0	8	462,849
Difference	860	-15,648	3,691	0	488	0	1	-10,608
Percent Difference	11	-4	146	0	1	0	13	-2
Dry (22%)								
NOACTION 011221	9,334	456,215	1,819	0	91,838	0	10	559,217
Alternative 2 011221	9,001	450,797	2,036	0	90,266	0	9	552,108
Difference	-333	-5,418	217	0	-1,573	0	-2	-7,109
Percent Difference	-4	-1	12	0	-2	0	-17	-1
Critical (14.6%)								
NOACTION 011221	9,251	464,556	5,090	0	76,338	0	0	555,235
Alternative 2 011221	9,001	438,731	5,528	0	79,392	0	0	532,652
Difference	-250	-25,826	437	0	3,055	0	0	-22,584
Percent Difference	-3	-6	9	0	4	0	0	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1a-4 Mortality of Winter-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	9,120	389,672	50,758	757	104,686	178	6	555,178
Alternative 3 020121	8,673	361,625	32,099	663	109,384	241	4	512,689
Difference	-447	-28,047	-18,659	-94	4,698	63	-2	-42,489
Percent Difference[3]	-5	-7	-37	-12	4	35	-29	-8
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	9,600	354,281	465	0	133,868	0	2	498,217
Alternative 3 020121	9,031	313,541	535	0	139,815	0	1	462,922
Difference	-570	-40,740	70	0	5,947	0	-1	-35,295
Percent Difference	-6	-11	15	0	4	0	-57	-7
Above Normal (14.6%)								
NOACTION 011221	9,000	301,027	391,942	6,056	100,886	1,423	11	810,346
Alternative 3 020121	8,400	340,977	237,904	5,302	102,830	1,926	5	697,344
Difference	-600	39,950	-154,039	-754	1,944	504	-6	-113,001
Percent Difference	-7	13	-39	-12	2	35	-56	-14
Below Normal (17.1%)								
NOACTION 011221	7,929	368,975	2,522	0	94,025	0	7	473,457
Alternative 3 020121	7,074	335,899	5,836	0	97,575	0	10	446,394
Difference	-854	-33,076	3,314	0	3,550	0	3	-27,063
Percent Difference	-11	-9	131	0	4	0	46	-6
Dry (22%)								
NOACTION 011221	9,334	456,215	1,819	0	91,838	0	10	559,217
Alternative 3 020121	9,167	410,853	1,493	0	96,228	0	5	517,747
Difference	-167	-45,362	-326	0	4,390	0	-5	-41,470
Percent Difference	-2	-10	-18	0	5	0	-52	-7
Critical (14.6%)								
NOACTION 011221	9,251	464,556	5,090	0	76,338	0	0	555,235
Alternative 3 020121	9,251	439,185	5,532	0	82,426	0	2	536,396
Difference	-1	-25,371	442	0	6,088	0	2	-18,840
Percent Difference	0	-5	9	0	8	0	0	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-1 Mortality of Spring-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	5,266	3,944	18,785	0	2,682	2	0	30,678
Alternative 1A 011221	2,920	3,866	20,853	0	2,666	1	0	30,307
Difference	-2,346	-77	2,068	0	-16	0	0	-371
Percent Difference[3]	-45	-2	11	0	-1	-26	0	-1
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	341	4,879	2,329	0	2,211	0	0	9,761
Alternative 1A 011221	447	4,408	2,249	0	2,161	0	0	9,264
Difference	105	-471	-81	0	-50	0	0	-497
Percent Difference	31	-10	-3	0	-2	0	0	-5
Above Normal (14.6%)								
NOACTION 011221	40,862	1,435	96,688	0	2,495	0	0	141,479
Alternative 1A 011221	21,662	1,818	111,609	0	2,284	0	0	137,372
Difference	-19,200	383	14,921	0	-211	0	0	-4,107
Percent Difference	-47	27	15	0	-8	0	0	-3
Below Normal (17.1%)								
NOACTION 011221	21	3,407	11,239	0	2,825	0	0	17,492
Alternative 1A 011221	70	3,589	13,296	0	3,013	0	0	19,967
Difference	49	181	2,057	0	188	0	0	2,476
Percent Difference	233	5	18	0	7	0	0	14
Dry (22%)								
NOACTION 011221	38	3,581	9,081	0	3,218	0	0	15,919
Alternative 1A 011221	42	3,694	9,103	0	3,058	0	0	15,897
Difference	4	112	22	0	-160	0	0	-22
Percent Difference	9	3	0	0	-5	0	0	0
Critical (14.6%)								
NOACTION 011221	232	5,176	12,881	0	2,887	12	0	21,187
Alternative 1A 011221	300	4,982	11,976	0	3,089	9	0	20,355
Difference	68	-194	-906	0	202	-3	0	-832
Percent Difference	29	-4	-7	0	7	-26	0	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-2 Mortality of Spring-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
			Long-term					
Full Simulation Period[1]								
NOACTION 011221	5,266	3,944	18,785	0	2,682	2	0	30,678
Alternative 1B 011221	2,192	3,736	21,698	0	2,664	1	0	30,292
Difference	-3,074	-208	2,913	0	-17	0	0	-386
Percent Difference[3]	-58	-5	16	0	-1	-21	0	-1
			Water Year Types[2]					
Wet (31.7%)								
NOACTION 011221	341	4,879	2,329	0	2,211	0	0	9,761
Alternative 1B 011221	462	4,277	2,009	0	2,213	0	0	8,961
Difference	121	-602	-320	0	2	0	0	-800
Percent Difference	35	-12	-14	0	0	0	0	-8
Above Normal (14.6%)								
NOACTION 011221	40,862	1,435	96,688	0	2,495	0	0	141,479
Alternative 1B 011221	15,858	1,643	113,276	0	2,416	0	0	133,192
Difference	-25,004	209	16,588	0	-79	0	0	-8,287
Percent Difference	-61	15	17	0	-3	0	0	-6
Below Normal (17.1%)								
NOACTION 011221	21	3,407	11,239	0	2,825	0	0	17,492
Alternative 1B 011221	71	3,229	17,669	0	2,855	0	0	23,824
Difference	50	-179	6,430	0	31	0	0	6,332
Percent Difference	240	-5	57	0	1	0	0	36
Dry (22%)								
NOACTION 011221	38	3,581	9,081	0	3,218	0	0	15,919
Alternative 1B 011221	38	3,635	8,181	0	3,022	0	0	14,876
Difference	0	54	-900	0	-196	0	0	-1,044
Percent Difference	-1	1	-10	0	-6	0	0	-7
Critical (14.6%)								
NOACTION 011221	232	5,176	12,881	0	2,887	12	0	21,187
Alternative 1B 011221	258	5,049	13,022	0	3,091	9	0	21,429
Difference	26	-127	141	0	204	-2	0	242
Percent Difference	11	-2	1	0	7	-21	0	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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-3 Mortality of Spring-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	5,266	3,944	18,785	0	2,682	2	0	30,678
Alternative 2 011221	2,975	3,892	22,526	0	2,638	1	0	32,033
Difference	-2,290	-51	3,741	0	-44	0	0	1,355
Percent Difference[3]	-43	-1	20	0	-2	-24	0	4
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	341	4,879	2,329	0	2,211	0	0	9,761
Alternative 2 011221	445	4,521	2,269	0	2,154	0	0	9,390
Difference	104	-359	-60	0	-57	0	0	-371
Percent Difference	31	-7	-3	0	-3	0	0	-4
Above Normal (14.6%)								
NOACTION 011221	40,862	1,435	96,688	0	2,495	0	0	141,479
Alternative 2 011221	22,119	1,751	111,128	0	2,282	0	0	137,280
Difference	-18,743	317	14,440	0	-213	0	0	-4,199
Percent Difference	-46	22	15	0	-9	0	0	-3
Below Normal (17.1%)								
NOACTION 011221	21	3,407	11,239	0	2,825	0	0	17,492
Alternative 2 011221	76	3,454	21,250	0	2,983	0	0	27,762
Difference	55	46	10,011	0	158	0	0	10,271
Percent Difference	262	1	89	0	6	0	0	59
Dry (22%)								
NOACTION 011221	38	3,581	9,081	0	3,218	0	0	15,919
Alternative 2 011221	43	3,753	9,029	0	3,048	0	0	15,873
Difference	4	172	-53	0	-170	0	0	-47
Percent Difference	11	5	-1	0	-5	0	0	0
Critical (14.6%)								
NOACTION 011221	232	5,176	12,881	0	2,887	12	0	21,187
Alternative 2 011221	286	5,034	14,315	0	2,968	9	0	22,612
Difference	55	-142	1,434	0	81	-3	0	1,425
Percent Difference	24	-3	11	0	3	-24	0	7

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-4 Mortality of Spring-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	5,266	3,944	18,785	0	2,682	2	0	30,678
Alternative 3 020121	580	3,716	22,952	0	2,621	2	0	29,870
Difference	-4,686	-228	4,167	0	-61	0	0	-808
Percent Difference[3]	-89	-6	22	0	-2	-9	0	-3
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	341	4,879	2,329	0	2,211	0	0	9,761
Alternative 3 020121	457	4,112	2,142	0	2,220	0	0	8,932
Difference	116	-768	-187	0	10	0	0	-829
Percent Difference	34	-16	-8	0	0	0	0	-8
Above Normal (14.6%)								
NOACTION 011221	40,862	1,435	96,688	0	2,495	0	0	141,479
Alternative 3 020121	2,886	1,355	124,637	0	2,459	0	0	131,337
Difference	-37,975	-80	27,949	0	-36	0	0	-10,142
Percent Difference	-93	-6	29	0	-1	0	0	-7
Below Normal (17.1%)								
NOACTION 011221	21	3,407	11,239	0	2,825	0	0	17,492
Alternative 3 020121	85	3,119	19,707	0	2,908	0	0	25,819
Difference	64	-288	8,469	0	83	0	0	8,328
Percent Difference	305	-8	75	0	3	0	0	48
Dry (22%)								
NOACTION 011221	38	3,581	9,081	0	3,218	0	0	15,919
Alternative 3 020121	47	4,247	7,371	0	2,817	0	0	14,482
Difference	9	666	-1,710	0	-401	0	0	-1,437
Percent Difference	22	19	-19	0	-12	0	0	-9
Critical (14.6%)								
NOACTION 011221	232	5,176	12,881	0	2,887	12	0	21,187
Alternative 3 020121	300	4,723	10,459	0	2,994	11	0	18,486
Difference	68	-453	-2,422	0	107	-1	0	-2,701
Percent Difference	29	-9	-19	0	4	-9	0	-13

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-1 Mortality of Fall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	679,120	1,567,969	183,984	687	5,497,027	16,253	409,349	8,354,390
Alternative 1A 011221	616,765	1,577,386	211,411	706	5,469,192	19,354	410,914	8,305,729
Difference	-62,355	9,417	27,427	20	-27,835	3,101	1,565	-48,661
Percent Difference[3]	-9	1	15	3	-1	19	0	-1
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	1,008	3,794,900	14,826	1,328	5,929,397	14,612	109,469	9,865,540
Alternative 1A 011221	1,147	3,817,710	14,679	1,483	5,869,840	17,901	106,573	9,829,334
Difference	139	22,810	-147	155	-59,557	3,290	-2,895	-36,206
Percent Difference	14	1	-1	12	-1	23	-3	0
Above Normal (14.6%)								
NOACTION 011221	5,396,514	228,774	576,009	90	5,681,441	3,219	217,218	12,103,264
Alternative 1A 011221	4,897,805	228,845	748,930	152	5,757,701	3,977	206,799	11,844,207
Difference	-498,709	71	172,921	61	76,260	757	-10,419	-259,057
Percent Difference	-9	0	30	68	1	24	-5	-2
Below Normal (17.1%)								
NOACTION 011221	770	686,544	261,505	95	5,308,797	4,798	426,966	6,689,475
Alternative 1A 011221	0	685,724	321,279	183	5,374,099	9,427	431,410	6,822,121
Difference	-770	-821	59,774	88	65,302	4,629	4,444	132,646
Percent Difference	-100	0	23	92	1	96	1	2
Dry (22%)								
NOACTION 011221	2,020	516,160	174,312	256	5,098,008	16,638	702,477	6,509,871
Alternative 1A 011221	1,740	522,450	176,515	349	5,055,588	21,994	737,430	6,516,066
Difference	-280	6,290	2,202	93	-42,420	5,356	34,953	6,195
Percent Difference	-14	1	1	36	-1	32	5	0
Critical (14.6%)								
NOACTION 011221	24,261	464,988	147,873	1,132	5,224,679	43,456	758,958	6,665,346
Alternative 1A 011221	25,168	469,811	113,900	634	5,092,045	42,935	726,730	6,471,223
Difference	907	4,823	-33,973	-498	-132,634	-521	-32,227	-194,123
Percent Difference	4	1	-23	-44	-3	-1	-4	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-2 Mortality of Fall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	679,120	1,567,969	183,984	687	5,497,027	16,253	409,349	8,354,390
Alternative 1B 011221	560,637	1,602,605	239,392	676	5,472,615	18,900	399,171	8,293,997
Difference	-118,483	34,636	55,408	-11	-24,412	2,648	-10,178	-60,392
Percent Difference[3]	-17	2	30	-2	0	16	-2	-1
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	1,008	3,794,900	14,826	1,328	5,929,397	14,612	109,469	9,865,540
Alternative 1B 011221	382	3,895,088	14,518	1,464	5,908,852	17,960	103,501	9,941,766
Difference	-626	100,188	-308	136	-20,545	3,349	-5,968	76,226
Percent Difference	-62	3	-2	10	0	23	-5	1
Above Normal (14.6%)								
NOACTION 011221	5,396,514	228,774	576,009	90	5,681,441	3,219	217,218	12,103,264
Alternative 1B 011221	4,452,024	231,320	802,165	144	5,824,231	7,069	189,397	11,506,349
Difference	-944,490	2,546	226,156	54	142,790	3,849	-27,821	-596,916
Percent Difference	-18	1	39	59	3	120	-13	-5
Below Normal (17.1%)								
NOACTION 011221	770	686,544	261,505	95	5,308,797	4,798	426,966	6,689,475
Alternative 1B 011221	314	684,375	421,387	252	5,300,652	9,944	409,214	6,826,137
Difference	-456	-2,169	159,882	157	-8,145	5,146	-17,752	136,662
Percent Difference	-59	0	61	165	0	107	-4	2
Dry (22%)								
NOACTION 011221	2,020	516,160	174,312	256	5,098,008	16,638	702,477	6,509,871
Alternative 1B 011221	1,263	525,478	163,115	236	4,990,175	15,996	711,567	6,407,829
Difference	-757	9,318	-11,197	-20	-107,833	-643	9,090	-102,042
Percent Difference	-37	2	-6	-8	-2	-4	1	-2
Critical (14.6%)								
NOACTION 011221	24,261	464,988	147,873	1,132	5,224,679	43,456	758,958	6,665,346
Alternative 1B 011221	24,471	465,253	159,733	568	5,158,706	45,603	734,294	6,588,629
Difference	211	265	11,860	-564	-65,973	2,147	-24,663	-76,718
Percent Difference	1	0	8	-50	-1	5	-3	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-3 Mortality of Fall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	679,120	1,567,969	183,984	687	5,497,027	16,253	409,349	8,354,390
Alternative 2 011221	617,056	1,583,189	248,478	711	5,470,794	19,020	402,744	8,341,993
Difference	-62,064	15,221	64,494	24	-26,234	2,768	-6,605	-12,397
Percent Difference[3]	-9	1	35	3	0	17	-2	0
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	1,008	3,794,900	14,826	1,328	5,929,397	14,612	109,469	9,865,540
Alternative 2 011221	1,269	3,838,537	14,772	1,491	5,920,248	17,857	101,833	9,896,007
Difference	261	43,636	-53	162	-9,149	3,245	-7,636	30,467
Percent Difference	26	1	0	12	0	22	-7	0
Above Normal (14.6%)								
NOACTION 011221	5,396,514	228,774	576,009	90	5,681,441	3,219	217,218	12,103,264
Alternative 2 011221	4,898,762	228,461	747,101	152	5,723,192	3,938	211,877	11,813,483
Difference	-497,752	-313	171,092	62	41,751	719	-5,340	-289,782
Percent Difference	-9	0	30	68	1	22	-2	-2
Below Normal (17.1%)								
NOACTION 011221	770	686,544	261,505	95	5,308,797	4,798	426,966	6,689,475
Alternative 2 011221	534	682,865	460,992	248	5,352,146	9,207	397,937	6,903,929
Difference	-236	-3,680	199,487	153	43,349	4,409	-29,029	214,454
Percent Difference	-31	-1	76	161	1	92	-7	3
Dry (22%)								
NOACTION 011221	2,020	516,160	174,312	256	5,098,008	16,638	702,477	6,509,871
Alternative 2 011221	1,911	521,839	171,671	306	4,999,700	20,940	740,828	6,457,195
Difference	-109	5,679	-2,641	50	-98,308	4,302	38,351	-52,676
Percent Difference	-5	1	-2	20	-2	26	5	-1
Critical (14.6%)								
NOACTION 011221	24,261	464,988	147,873	1,132	5,224,679	43,456	758,958	6,665,346
Alternative 2 011221	25,168	467,949	206,601	634	5,131,705	42,680	712,258	6,586,994
Difference	907	2,961	58,727	-498	-92,974	-776	-46,700	-78,352
Percent Difference	4	1	40	-44	-2	-2	-6	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-4 Mortality of Fall-Run Chinook Salmon by Life-stage and Source

NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	679,120	1,567,969	183,984	687	5,497,027	16,253	409,349	8,354,390
Alternative 3 020121	262,927	1,668,231	331,663	680	5,456,495	18,044	375,929	8,113,969
Difference	-416,193	100,262	147,679	-7	-40,532	1,791	-33,421	-240,421
Percent Difference[3]	-61	6	80	-1	-1	11	-8	-3
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	1,008	3,794,900	14,826	1,328	5,929,397	14,612	109,469	9,865,540
Alternative 3 020121	713	4,077,768	14,522	1,436	5,818,562	18,061	98,579	10,029,640
Difference	-296	282,867	-303	107	-110,835	3,449	-10,890	164,100
Percent Difference	-29	7	-2	8	-2	24	-10	2
Above Normal (14.6%)								
NOACTION 011221	5,396,514	228,774	576,009	90	5,681,441	3,219	217,218	12,103,264
Alternative 3 020121	2,069,584	254,094	1,642,974	126	5,911,296	7,060	185,321	10,070,455
Difference	-3,326,930	25,320	1,066,966	36	229,856	3,841	-31,897	-2,032,809
Percent Difference	-62	11	185	40	4	119	-15	-17
Below Normal (17.1%)								
NOACTION 011221	770	686,544	261,505	95	5,308,797	4,798	426,966	6,689,475
Alternative 3 020121	754	695,701	440,321	290	5,251,836	9,910	374,947	6,773,760
Difference	-16	9,157	178,816	195	-56,961	5,112	-52,019	84,285
Percent Difference	-2	1	68	205	-1	107	-12	1
Dry (22%)								
NOACTION 011221	2,020	516,160	174,312	256	5,098,008	16,638	702,477	6,509,871
Alternative 3 020121	966	519,633	155,509	256	5,079,164	19,956	646,678	6,422,163
Difference	-1,054	3,473	-18,803	0	-18,844	3,318	-55,799	-87,708
Percent Difference	-52	1	-11	0	0	20	-8	-1
Critical (14.6%)								
NOACTION 011221	24,261	464,988	147,873	1,132	5,224,679	43,456	758,958	6,665,346
Alternative 3 020121	24,321	483,531	63,501	593	5,097,783	33,784	730,715	6,434,228
Difference	60	18,542	-84,372	-539	-126,896	-9,672	-28,242	-231,118
Percent Difference	0	4	-57	-48	-2	-22	-4	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-1 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Mortality[4] (# of Fish/year) Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	0	493,970	58,222	193	1,881,741	10,613	16,294	2,461,033
Alternative 1A 011221	0	494,307	63,499	292	1,866,228	8,474	17,927	2,450,727
Difference	0	338	5,276	99	-15,514	-2,139	1,632	-10,307
Percent Difference[3]	0	0	9	51	-1	-20	10	0
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	0	1,211,664	39,966	190	1,550,879	9	4,946	2,807,654
Alternative 1A 011221	0	1,211,582	43,196	236	1,547,742	39	6,195	2,808,989
Difference	0	-82	3,230	45	-3,137	30	1,249	1,335
Percent Difference	0	0	8	24	0	321	25	0
Above Normal (14.6%)								
NOACTION 011221	0	646,238	36,350	50	1,737,198	7	3,388	2,423,230
Alternative 1A 011221	0	653,984	40,606	67	1,739,484	16	4,188	2,438,345
Difference	0	7,746	4,256	17	2,287	9	800	15,115
Percent Difference	0	1	12	34	0	134	24	1
Below Normal (17.1%)								
NOACTION 011221	0	42,050	58,869	146	2,105,037	0	8,827	2,214,928
Alternative 1A 011221	0	41,357	61,107	327	2,069,091	0	11,996	2,183,877
Difference	0	-693	2,238	180	-35,946	0	3,170	-31,051
Percent Difference	0	-2	4	123	-2	0	36	-1
Dry (22%)								
NOACTION 011221	0	32,077	87,547	182	2,181,053	808	21,893	2,323,559
Alternative 1A 011221	0	30,903	100,806	320	2,170,104	707	22,749	2,325,589
Difference	0	-1,174	13,259	138	-10,949	-101	856	2,030
Percent Difference	0	-4	15	75	-1	-12	4	0
Critical (14.6%)								
NOACTION 011221	0	32,153	71,264	390	2,009,583	69,516	51,954	2,234,859
Alternative 1A 011221	0	30,695	73,395	522	1,969,412	55,337	54,479	2,183,841
Difference	0	-1,458	2,131	133	-40,171	-14,179	2,526	-51,018
Percent Difference	0	-5	3	34	-2	-20	5	-2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-2 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Pre-Spawn Mortality	Annual Mortality[4] (# of Fish/year) Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
			Long-term					
Full Simulation Period[1]								
NOACTION 011221	0	493,970	58,222	193	1,881,741	10,613	16,294	2,461,033
Alternative 1B 011221	0	494,538	64,197	231	1,860,955	7,537	21,336	2,448,794
Difference	0	568	5,975	38	-20,786	-3,076	5,042	-12,240
Percent Difference[3]	0	0	10	19	-1	-29	31	0
			Water Year Types[2]					
Wet (31.7%)								
NOACTION 011221	0	1,211,664	39,966	190	1,550,879	9	4,946	2,807,654
Alternative 1B 011221	0	1,215,207	43,854	228	1,555,467	34	5,579	2,820,370
Difference	0	3,543	3,889	38	4,588	25	634	12,717
Percent Difference	0	0	10	20	0	272	13	0
Above Normal (14.6%)								
NOACTION 011221	0	646,238	36,350	50	1,737,198	7	3,388	2,423,230
Alternative 1B 011221	0	645,362	40,840	79	1,654,501	50	4,058	2,344,891
Difference	0	-876	4,490	30	-82,697	43	671	-78,339
Percent Difference	0	0	12	60	-5	637	20	-3
Below Normal (17.1%)								
NOACTION 011221	0	42,050	58,869	146	2,105,037	0	8,827	2,214,928
Alternative 1B 011221	0	43,033	68,882	333	2,084,250	0	10,881	2,207,379
Difference	0	983	10,014	187	-20,786	0	2,054	-7,549
Percent Difference	0	2	17	128	-1	0	23	0
Dry (22%)								
NOACTION 011221	0	32,077	87,547	182	2,181,053	808	21,893	2,323,559
Alternative 1B 011221	0	30,828	96,099	161	2,164,406	488	32,750	2,324,732
Difference	0	-1,248	8,552	-21	-16,647	-320	10,858	1,173
Percent Difference	0	-4	10	-12	-1	-40	50	0
Critical (14.6%)								
NOACTION 011221	0	32,153	71,264	390	2,009,583	69,516	51,954	2,234,859
Alternative 1B 011221	0	29,719	74,416	347	1,979,203	49,401	64,952	2,198,038
Difference	0	-2,434	3,153	-42	-30,380	-20,115	12,998	-36,821
Percent Difference	0	-8	4	-11	-2	-29	25	-2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-3 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source
NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Pre-Spawn Mortality	Annual Mortality[4] (# of Fish/year) Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	0	493,970	58,222	193	1,881,741	10,613	16,294	2,461,033
Alternative 2 011221	0	494,301	63,224	258	1,870,820	8,674	19,245	2,456,522
Difference	0	332	5,002	65	-10,921	-1,939	2,950	-4,511
Percent Difference[3]	0	0	9	34	-1	-18	18	0
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	0	1,211,664	39,966	190	1,550,879	9	4,946	2,807,654
Alternative 2 011221	0	1,211,469	43,489	218	1,561,712	39	5,136	2,822,063
Difference	0	-195	3,523	27	10,833	30	191	14,409
Percent Difference	0	0	9	14	1	326	4	1
Above Normal (14.6%)								
NOACTION 011221	0	646,238	36,350	50	1,737,198	7	3,388	2,423,230
Alternative 2 011221	0	653,966	40,832	67	1,738,859	16	3,201	2,436,939
Difference	0	7,727	4,481	17	1,662	9	-187	13,710
Percent Difference	0	1	12	34	0	134	-6	1
Below Normal (17.1%)								
NOACTION 011221	0	42,050	58,869	146	2,105,037	0	8,827	2,214,928
Alternative 2 011221	0	41,631	60,392	326	2,062,831	0	11,754	2,176,935
Difference	0	-419	1,524	180	-42,205	0	2,927	-37,994
Percent Difference	0	-1	3	123	-2	0	33	-2
Dry (22%)								
NOACTION 011221	0	32,077	87,547	182	2,181,053	808	21,893	2,323,559
Alternative 2 011221	0	30,980	98,227	297	2,158,033	702	28,206	2,316,445
Difference	0	-1,096	10,680	115	-23,020	-106	6,313	-7,114
Percent Difference	0	-3	12	63	-1	-13	29	0
Critical (14.6%)								
NOACTION 011221	0	32,153	71,264	390	2,009,583	69,516	51,954	2,234,859
Alternative 2 011221	0	30,480	75,441	367	1,995,691	56,677	58,480	2,217,136
Difference	0	-1,674	4,177	-23	-13,892	-12,838	6,527	-17,723
Percent Difference	0	-5	6	-6	-1	-18	13	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-4 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source

NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Pre-Spawn Mortality	Annual Mortality[4] (# of Fish/year) Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 011221	0	493,970	58,222	193	1,881,741	10,613	16,294	2,461,033
Alternative 3 020121	0	504,404	64,171	239	1,865,776	4,223	18,292	2,457,106
Difference	0	10,434	5,949	46	-15,965	-6,390	1,998	-3,927
Percent Difference[3]	0	2	10	24	-1	-60	12	0
Water Year Types[2]								
Wet (31.7%)								
NOACTION 011221	0	1,211,664	39,966	190	1,550,879	9	4,946	2,807,654
Alternative 3 020121	0	1,241,614	44,137	225	1,564,127	31	4,833	2,854,968
Difference	0	29,950	4,172	35	13,249	22	-113	47,314
Percent Difference	0	2	10	18	1	240	-2	2
Above Normal (14.6%)								
NOACTION 011221	0	646,238	36,350	50	1,737,198	7	3,388	2,423,230
Alternative 3 020121	0	651,668	41,839	94	1,680,852	50	3,546	2,378,048
Difference	0	5,429	5,489	45	-56,346	43	158	-45,181
Percent Difference	0	1	15	91	-3	637	5	-2
Below Normal (17.1%)								
NOACTION 011221	0	42,050	58,869	146	2,105,037	0	8,827	2,214,928
Alternative 3 020121	0	43,542	64,886	295	2,032,370	5	16,370	2,157,467
Difference	0	1,492	6,017	149	-72,667	5	7,543	-57,461
Percent Difference	0	4	10	102	-3	0	85	-3
Dry (22%)								
NOACTION 011221	0	32,077	87,547	182	2,181,053	808	21,893	2,323,559
Alternative 3 020121	0	30,870	96,120	232	2,128,497	697	32,295	2,288,710
Difference	0	-1,207	8,573	50	-52,556	-111	10,402	-34,849
Percent Difference	0	-4	10	27	-2	-14	48	-1
Critical (14.6%)								
NOACTION 011221	0	32,153	71,264	390	2,009,583	69,516	51,954	2,234,859
Alternative 3 020121	0	32,370	77,433	335	2,085,011	26,996	40,982	2,263,126
Difference	0	216	6,170	-55	75,428	-42,520	-10,972	28,267
Percent Difference	0	1	9	-14	4	-61	-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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 2a-1 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	1,927,994
Alternative 1A 011221	1,935,464
Difference	7,470
Percent Difference[3]	0.4
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	1,930,166
Alternative 1A 011221	1,933,662
Difference	3,496
Percent Difference	0.2
Above Normal (14.6%)	
NOACTION 011221	1,796,018
Alternative 1A 011221	1,814,424
Difference	18,406
Percent Difference	1.0
Below Normal (17.1%)	
NOACTION 011221	1,970,579
Alternative 1A 011221	1,979,272
Difference	8,693
Percent Difference	0.4
Dry (22%)	
NOACTION 011221	1,933,233
Alternative 1A 011221	1,935,508
Difference	2,275
Percent Difference	0.1
Critical (14.6%)	
NOACTION 011221	1,975,725
Alternative 1A 011221	1,989,062
Difference	13,337
Percent Difference	0.7

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2a-2 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	1,927,994
Alternative 1B 011221	1,940,421
Difference	12,427
Percent Difference[3]	0.6
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	1,930,166
Alternative 1B 011221	1,940,975
Difference	10,809
Percent Difference	0.6
Above Normal (14.6%)	
NOACTION 011221	1,796,018
Alternative 1B 011221	1,822,958
Difference	26,939
Percent Difference	1.5
Below Normal (17.1%)	
NOACTION 011221	1,970,579
Alternative 1B 011221	1,983,087
Difference	12,508
Percent Difference	0.6
Dry (22%)	
NOACTION 011221	1,933,233
Alternative 1B 011221	1,945,620
Difference	12,387
Percent Difference	0.6
Critical (14.6%)	
NOACTION 011221	1,975,725
Alternative 1B 011221	1,979,531
Difference	3,806
Percent Difference	0.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2a-3 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	1,927,994
Alternative 2 011221	1,935,385
Difference	7,391
Percent Difference[3]	0.4
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	1,930,166
Alternative 2 011221	1,934,619
Difference	4,453
Percent Difference	0.2
Above Normal (14.6%)	
NOACTION 011221	1,796,018
Alternative 2 011221	1,811,729
Difference	15,710
Percent Difference	0.9
Below Normal (17.1%)	
NOACTION 011221	1,970,579
Alternative 2 011221	1,980,821
Difference	10,242
Percent Difference	0.5
Dry (22%)	
NOACTION 011221	1,933,233
Alternative 2 011221	1,935,511
Difference	2,278
Percent Difference	0.1
Critical (14.6%)	
NOACTION 011221	1,975,725
Alternative 2 011221	1,986,895
Difference	11,169
Percent Difference	0.6

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2a-4 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	1,927,994
Alternative 3 020121	1,950,501
Difference	22,507
Percent Difference[3]	1.2
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	1,930,166
Alternative 3 020121	1,950,201
Difference	20,034
Percent Difference	1.0
Above Normal (14.6%)	
NOACTION 011221	1,796,018
Alternative 3 020121	1,849,042
Difference	53,024
Percent Difference	3.0
Below Normal (17.1%)	
NOACTION 011221	1,970,579
Alternative 3 020121	1,987,497
Difference	16,918
Percent Difference	0.9
Dry (22%)	
NOACTION 011221	1,933,233
Alternative 3 020121	1,955,276
Difference	22,043
Percent Difference	1.1
Critical (14.6%)	
NOACTION 011221	1,975,725
Alternative 3 020121	1,985,377
Difference	9,652
Percent Difference	0.5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-1 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	446,054
Alternative 1A 011221	446,027
Difference	-28
Percent Difference[3]	0.0
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	446,722
Alternative 1A 011221	446,858
Difference	136
Percent Difference	0.0
Above Normal (14.6%)	
NOACTION 011221	400,639
Alternative 1A 011221	401,618
Difference	979
Percent Difference	0.2
Below Normal (17.1%)	
NOACTION 011221	449,067
Alternative 1A 011221	447,656
Difference	-1,411
Percent Difference	-0.3
Dry (22%)	
NOACTION 011221	457,582
Alternative 1A 011221	457,783
Difference	201
Percent Difference	0.0
Critical (14.6%)	
NOACTION 011221	461,649
Alternative 1A 011221	461,699
Difference	50
Percent Difference	0.0

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-2 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	446,054
Alternative 1B 011221	445,878
Difference	-176
Percent Difference[3]	0.0
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	446,722
Alternative 1B 011221	446,702
Difference	-20
Percent Difference	0.0
Above Normal (14.6%)	
NOACTION 011221	400,639
Alternative 1B 011221	403,529
Difference	2,890
Percent Difference	0.7
Below Normal (17.1%)	
NOACTION 011221	449,067
Alternative 1B 011221	445,669
Difference	-3,398
Percent Difference	-0.8
Dry (22%)	
NOACTION 011221	457,582
Alternative 1B 011221	457,906
Difference	323
Percent Difference	0.1
Critical (14.6%)	
NOACTION 011221	461,649
Alternative 1B 011221	461,587
Difference	-62
Percent Difference	0.0

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-3 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	446,054
Alternative 2 011221	445,208
Difference	-846
Percent Difference[3]	-0.2
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	446,722
Alternative 2 011221	446,788
Difference	66
Percent Difference	0.0
Above Normal (14.6%)	
NOACTION 011221	400,639
Alternative 2 011221	401,682
Difference	1,043
Percent Difference	0.3
Below Normal (17.1%)	
NOACTION 011221	449,067
Alternative 2 011221	443,966
Difference	-5,101
Percent Difference	-1.1
Dry (22%)	
NOACTION 011221	457,582
Alternative 2 011221	457,698
Difference	116
Percent Difference	0.0
Critical (14.6%)	
NOACTION 011221	461,649
Alternative 2 011221	460,773
Difference	-875
Percent Difference	-0.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-4 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	446,054
Alternative 3 020121	445,451
Difference	-603
Percent Difference[3]	-0.1
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	446,722
Alternative 3 020121	446,481
Difference	-240
Percent Difference	-0.1
Above Normal (14.6%)	
NOACTION 011221	400,639
Alternative 3 020121	402,740
Difference	2,101
Percent Difference	0.5
Below Normal (17.1%)	
NOACTION 011221	449,067
Alternative 3 020121	444,394
Difference	-4,673
Percent Difference	-1.0
Dry (22%)	
NOACTION 011221	457,582
Alternative 3 020121	457,349
Difference	-233
Percent Difference	-0.1
Critical (14.6%)	
NOACTION 011221	461,649
Alternative 3 020121	462,198
Difference	549
Percent Difference	0.1

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-1 Annual Potential Production for Fall-Run Chinook Salmon,
NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	18,215,670
Alternative 1A 011221	18,235,927
Difference	20,256
Percent Difference[3]	0.1
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	17,062,773
Alternative 1A 011221	17,087,773
Difference	25,000
Percent Difference	0.1
Above Normal (14.6%)	
NOACTION 011221	17,175,665
Alternative 1A 011221	17,241,937
Difference	66,272
Percent Difference	0.4
Below Normal (17.1%)	
NOACTION 011221	18,947,118
Alternative 1A 011221	18,889,514
Difference	-57,604
Percent Difference	-0.3
Dry (22%)	
NOACTION 011221	19,176,506
Alternative 1A 011221	19,176,192
Difference	-315
Percent Difference	0.0
Critical (14.6%)	
NOACTION 011221	19,285,676
Alternative 1A 011221	19,379,002
Difference	93,326
Percent Difference	0.5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-2 Annual Potential Production for Fall-Run Chinook Salmon,
NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	18,215,670
Alternative 1B 011221	18,233,807
Difference	18,137
Percent Difference[3]	0.1
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	17,062,773
Alternative 1B 011221	17,018,019
Difference	-44,754
Percent Difference	-0.3
Above Normal (14.6%)	
NOACTION 011221	17,175,665
Alternative 1B 011221	17,334,317
Difference	158,652
Percent Difference	0.9
Below Normal (17.1%)	
NOACTION 011221	18,947,118
Alternative 1B 011221	18,904,670
Difference	-42,448
Percent Difference	-0.2
Dry (22%)	
NOACTION 011221	19,176,506
Alternative 1B 011221	19,235,262
Difference	58,756
Percent Difference	0.3
Critical (14.6%)	
NOACTION 011221	19,285,676
Alternative 1B 011221	19,332,732
Difference	47,056
Percent Difference	0.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-3 Annual Potential Production for Fall-Run Chinook Salmon,
NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	18,215,670
Alternative 2 011221	18,227,958
Difference	12,288
Percent Difference[3]	0.1
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	17,062,773
Alternative 2 011221	17,049,033
Difference	-13,740
Percent Difference	-0.1
Above Normal (14.6%)	
NOACTION 011221	17,175,665
Alternative 2 011221	17,255,309
Difference	79,645
Percent Difference	0.5
Below Normal (17.1%)	
NOACTION 011221	18,947,118
Alternative 2 011221	18,882,055
Difference	-65,063
Percent Difference	-0.3
Dry (22%)	
NOACTION 011221	19,176,506
Alternative 2 011221	19,211,399
Difference	34,892
Percent Difference	0.2
Critical (14.6%)	
NOACTION 011221	19,285,676
Alternative 2 011221	19,354,560
Difference	68,884
Percent Difference	0.4

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-4 Annual Potential Production for Fall-Run Chinook Salmon,
NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	18,215,670
Alternative 3 020121	18,294,178
Difference	78,507
Percent Difference[3]	0.4
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	17,062,773
Alternative 3 020121	16,985,039
Difference	-77,734
Percent Difference	-0.5
Above Normal (14.6%)	
NOACTION 011221	17,175,665
Alternative 3 020121	17,786,237
Difference	610,573
Percent Difference	3.6
Below Normal (17.1%)	
NOACTION 011221	18,947,118
Alternative 3 020121	18,941,658
Difference	-5,460
Percent Difference	0.0
Dry (22%)	
NOACTION 011221	19,176,506
Alternative 3 020121	19,236,372
Difference	59,866
Percent Difference	0.3
Critical (14.6%)	
NOACTION 011221	19,285,676
Alternative 3 020121	19,385,242
Difference	99,567
Percent Difference	0.5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-1 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1A 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	2,880,539
Alternative 1A 011221	2,889,522
Difference	8,983
Percent Difference[3]	0.3
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	2,758,553
Alternative 1A 011221	2,757,150
Difference	-1,403
Percent Difference	-0.1
Above Normal (14.6%)	
NOACTION 011221	2,899,521
Alternative 1A 011221	2,893,097
Difference	-6,424
Percent Difference	-0.2
Below Normal (17.1%)	
NOACTION 011221	2,923,658
Alternative 1A 011221	2,945,014
Difference	21,356
Percent Difference	0.7
Dry (22%)	
NOACTION 011221	2,943,910
Alternative 1A 011221	2,947,408
Difference	3,498
Percent Difference	0.1
Critical (14.6%)	
NOACTION 011221	2,983,661
Alternative 1A 011221	3,021,779
Difference	38,118
Percent Difference	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 D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-2 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 011221 vs. Alternative 1B 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	2,880,539
Alternative 1B 011221	2,889,355
Difference	8,816
Percent Difference[3]	0.3
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	2,758,553
Alternative 1B 011221	2,749,538
Difference	-9,015
Percent Difference	-0.3
Above Normal (14.6%)	
NOACTION 011221	2,899,521
Alternative 1B 011221	2,950,987
Difference	51,465
Percent Difference	1.8
Below Normal (17.1%)	
NOACTION 011221	2,923,658
Alternative 1B 011221	2,930,087
Difference	6,429
Percent Difference	0.2
Dry (22%)	
NOACTION 011221	2,943,910
Alternative 1B 011221	2,943,248
Difference	-662
Percent Difference	0.0
Critical (14.6%)	
NOACTION 011221	2,983,661
Alternative 1B 011221	3,012,571
Difference	28,910
Percent Difference	1.0

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-3 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 011221 vs. Alternative 2 011221

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	2,880,539
Alternative 2 011221	2,885,779
Difference	5,240
Percent Difference[3]	0.2
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	2,758,553
Alternative 2 011221	2,748,619
Difference	-9,935
Percent Difference	-0.4
Above Normal (14.6%)	
NOACTION 011221	2,899,521
Alternative 2 011221	2,894,131
Difference	-5,390
Percent Difference	-0.2
Below Normal (17.1%)	
NOACTION 011221	2,923,658
Alternative 2 011221	2,947,998
Difference	24,340
Percent Difference	0.8
Dry (22%)	
NOACTION 011221	2,943,910
Alternative 2 011221	2,952,542
Difference	8,632
Percent Difference	0.3
Critical (14.6%)	
NOACTION 011221	2,983,661
Alternative 2 011221	3,003,266
Difference	19,605
Percent Difference	0.7

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-4 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 011221 vs. Alternative 3 020121

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

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 011221	2,880,539
Alternative 3 020121	2,889,112
Difference	8,573
Percent Difference[3]	0.3
Water Year Types[2]	
Wet (31.7%)	
NOACTION 011221	2,758,553
Alternative 3 020121	2,737,640
Difference	-20,914
Percent Difference	-0.8
Above Normal (14.6%)	
NOACTION 011221	2,899,521
Alternative 3 020121	2,937,273
Difference	37,752
Percent Difference	1.3
Below Normal (17.1%)	
NOACTION 011221	2,923,658
Alternative 3 020121	2,957,965
Difference	34,307
Percent Difference	1.2
Dry (22%)	
NOACTION 011221	2,943,910
Alternative 3 020121	2,968,582
Difference	24,672
Percent Difference	0.8
Critical (14.6%)	
NOACTION 011221	2,983,661
Alternative 3 020121	2,977,633
Difference	-6,028
Percent Difference	-0.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Figure B-a-1. Annual Potential Production for Winter-Run Chinook Salmon

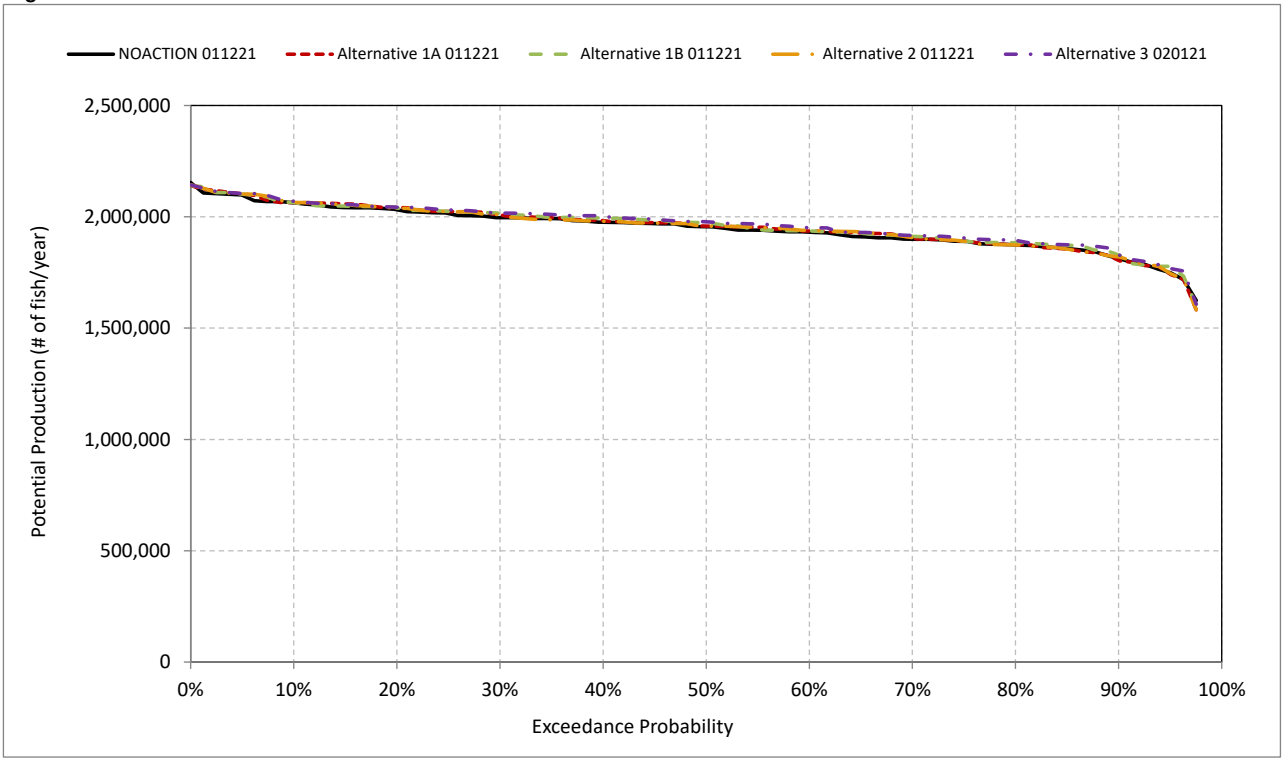


Figure B-a-2. Annual Mortality for Winter-Run Chinook Salmon - Eggs

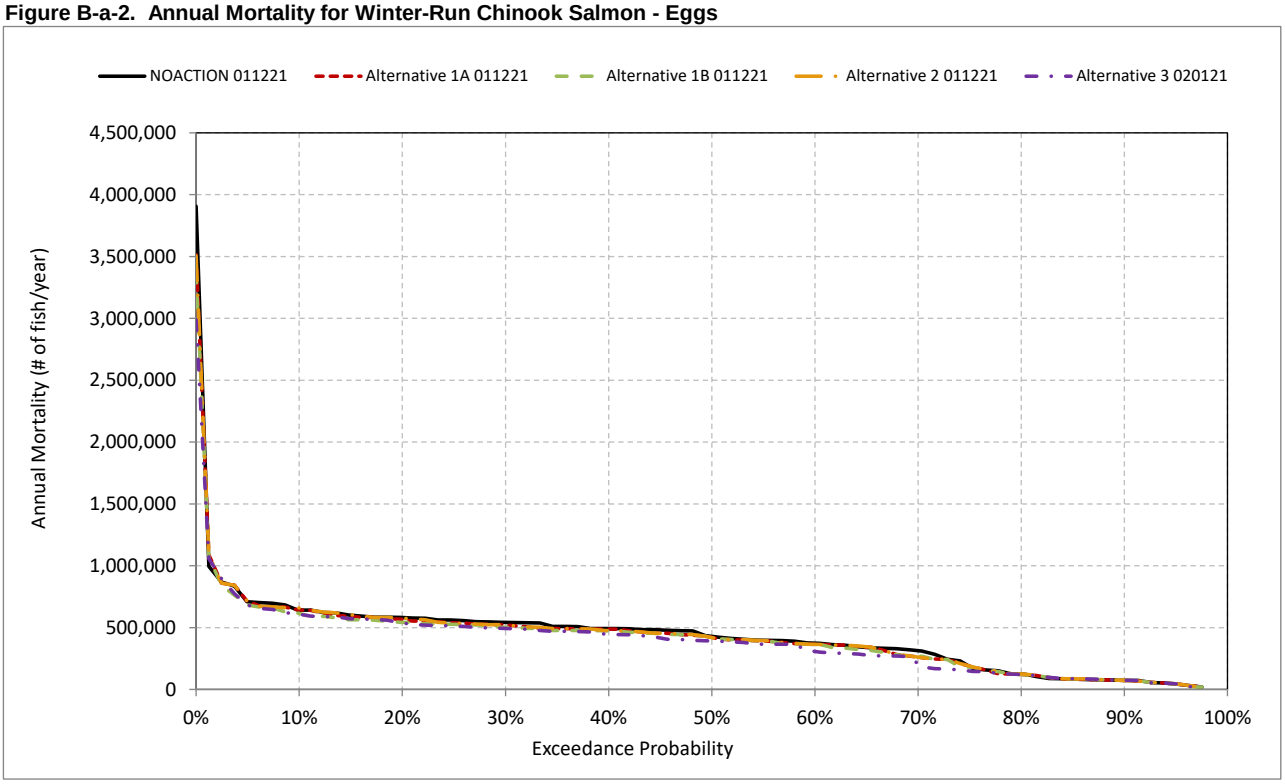


Figure B-a-3. Annual Mortality for Winter-Run Chinook Salmon - Fry

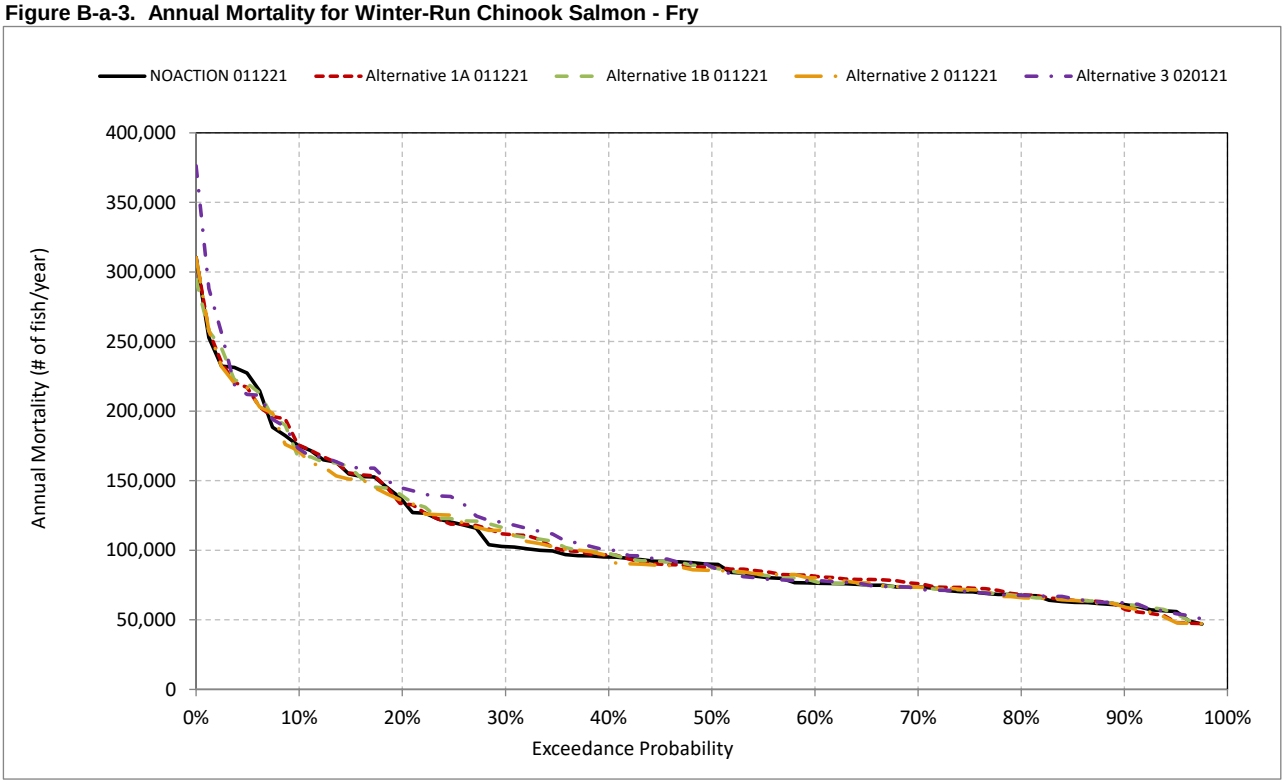


Figure B-a-4. Annual Mortality for Winter-Run Chinook Salmon - Pre-Smolt

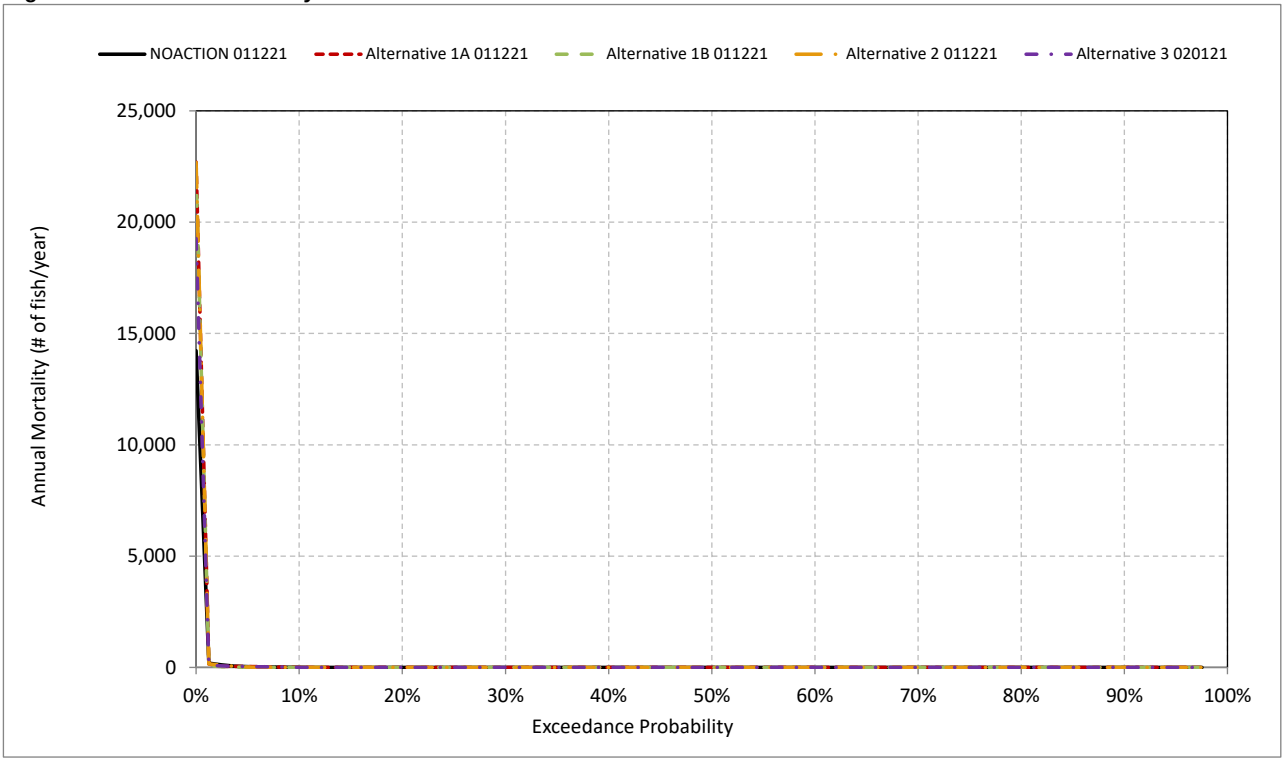


Figure B-a-5. Annual Mortality for Winter-Run Chinook Salmon - Immature Smolt

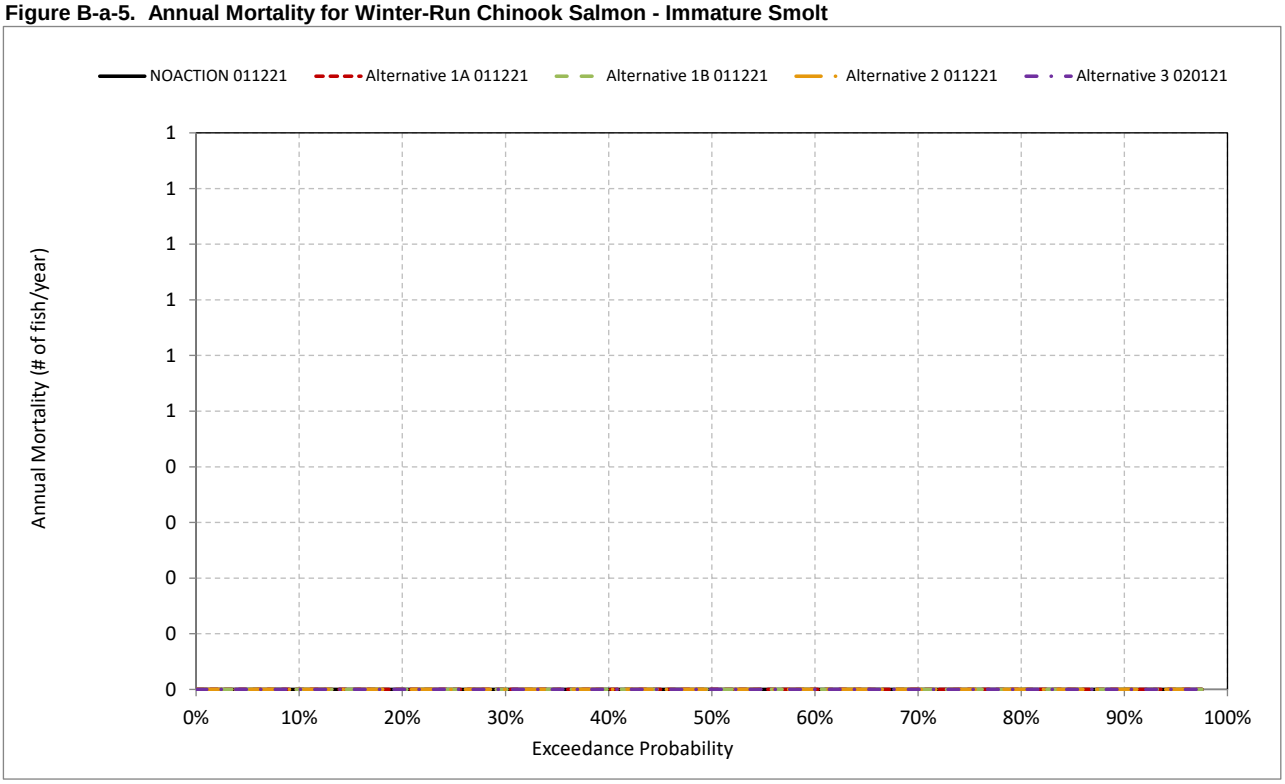


Figure B-a-6. Annual Mortality for Winter-Run Chinook Salmon - Pre- & Immature Smolts

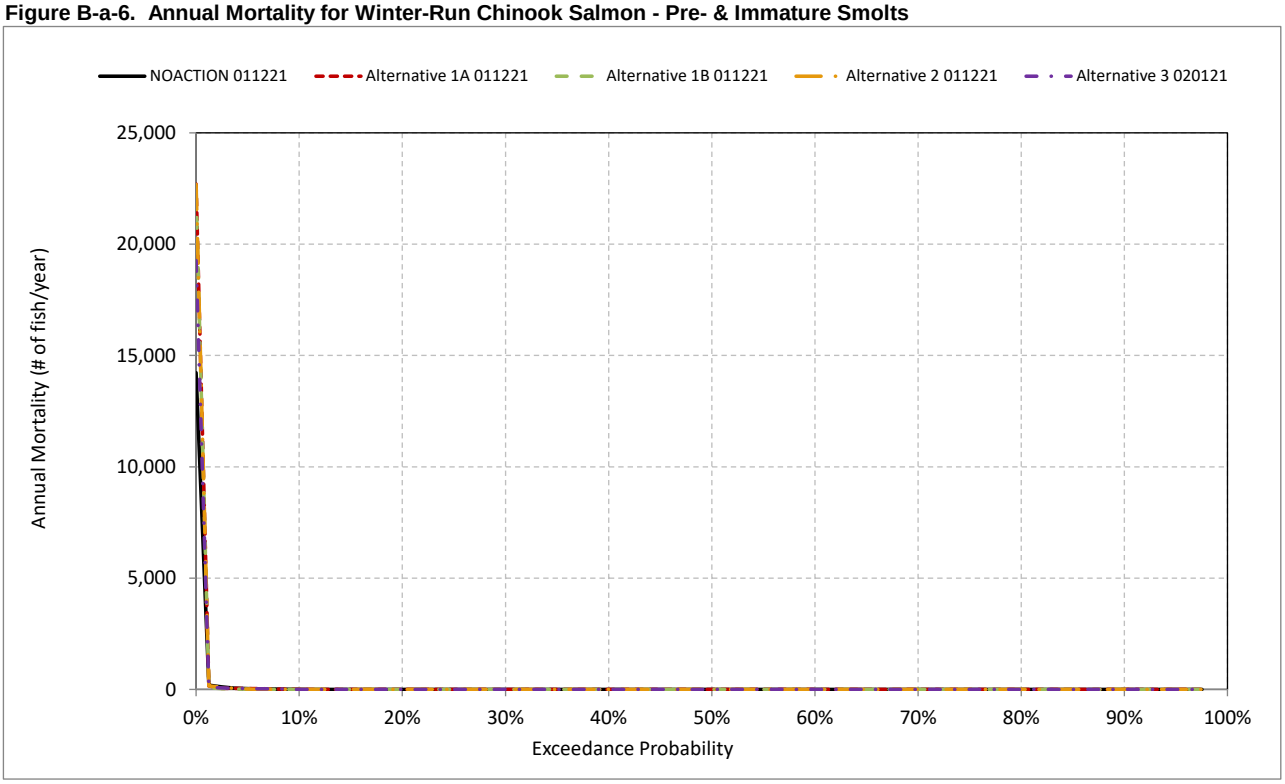


Figure B-a-7. Annual Mortality for Winter-Run Chinook Salmon - All Lifestages

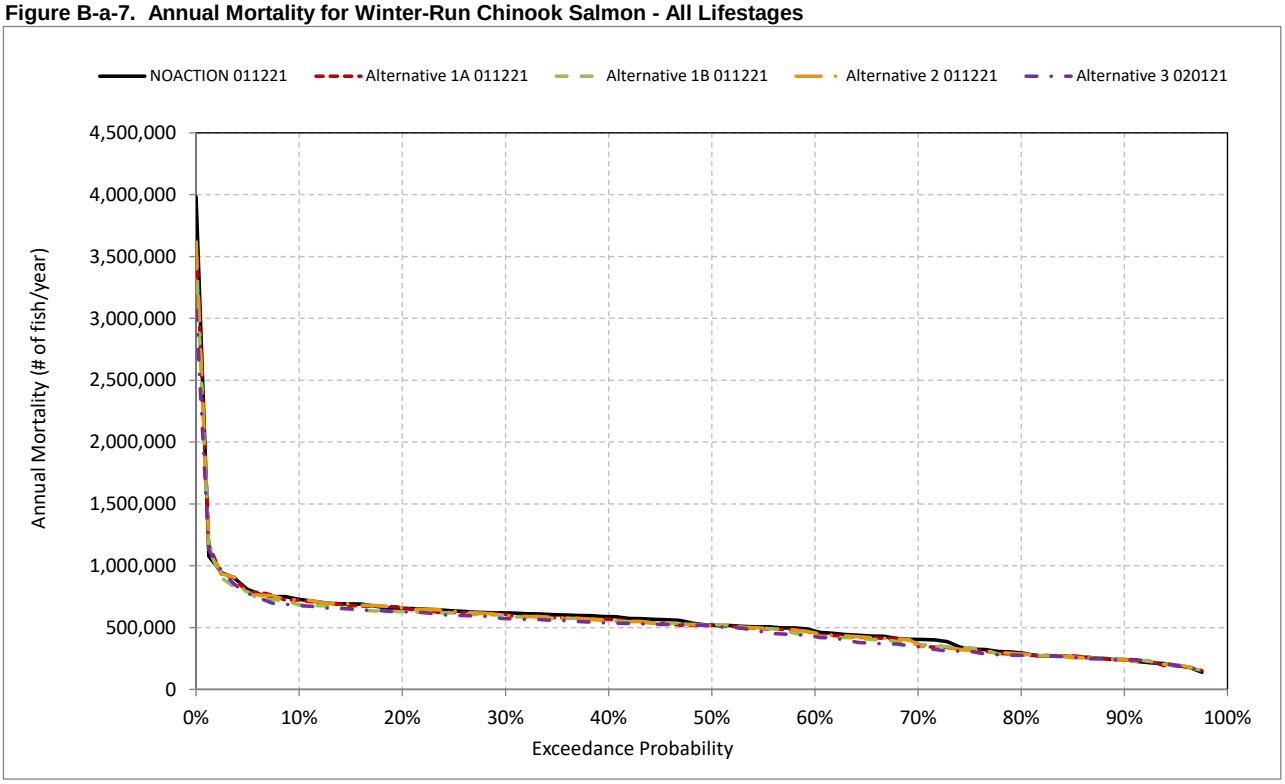


Figure B-a-8. Incubation - Habitat based Annual Mortality for Winter-Run Chinook Salmon

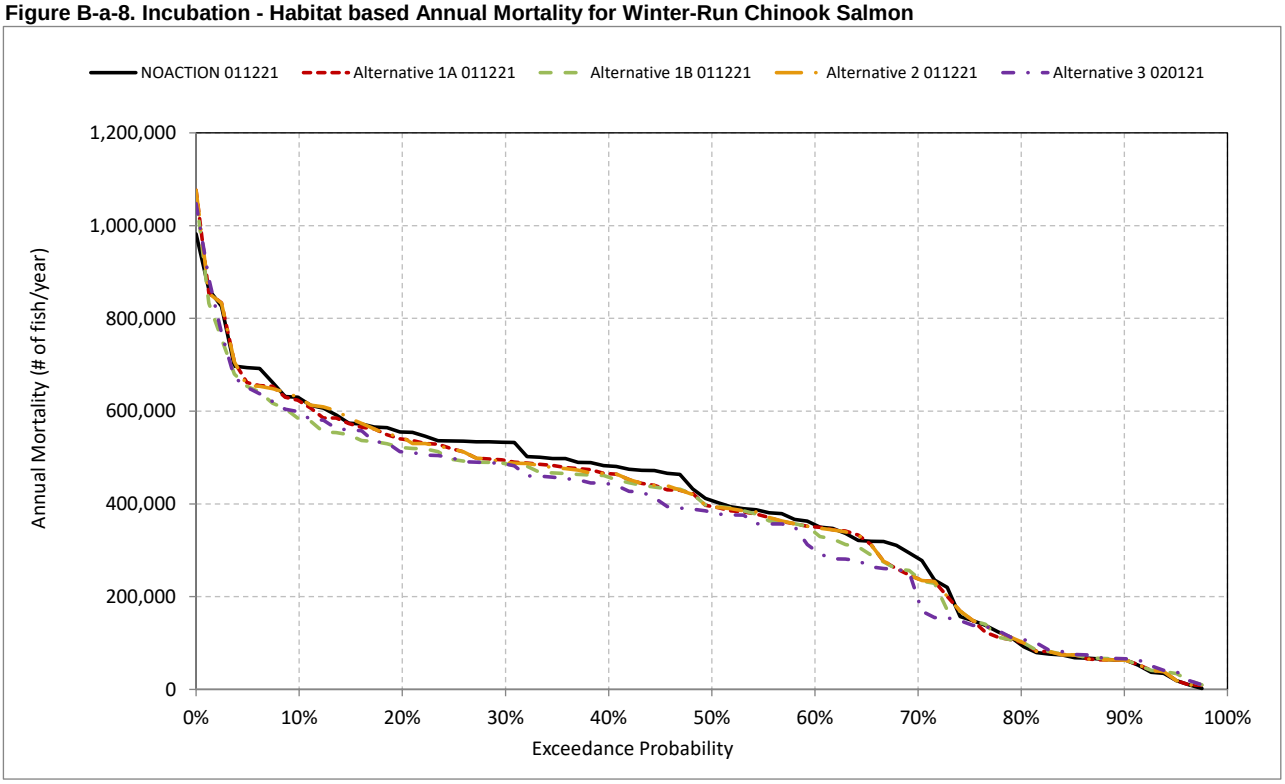


Figure B-a-9. Super-imposition - Habitat based Annual Mortality for Winter-Run Chinook Salmon

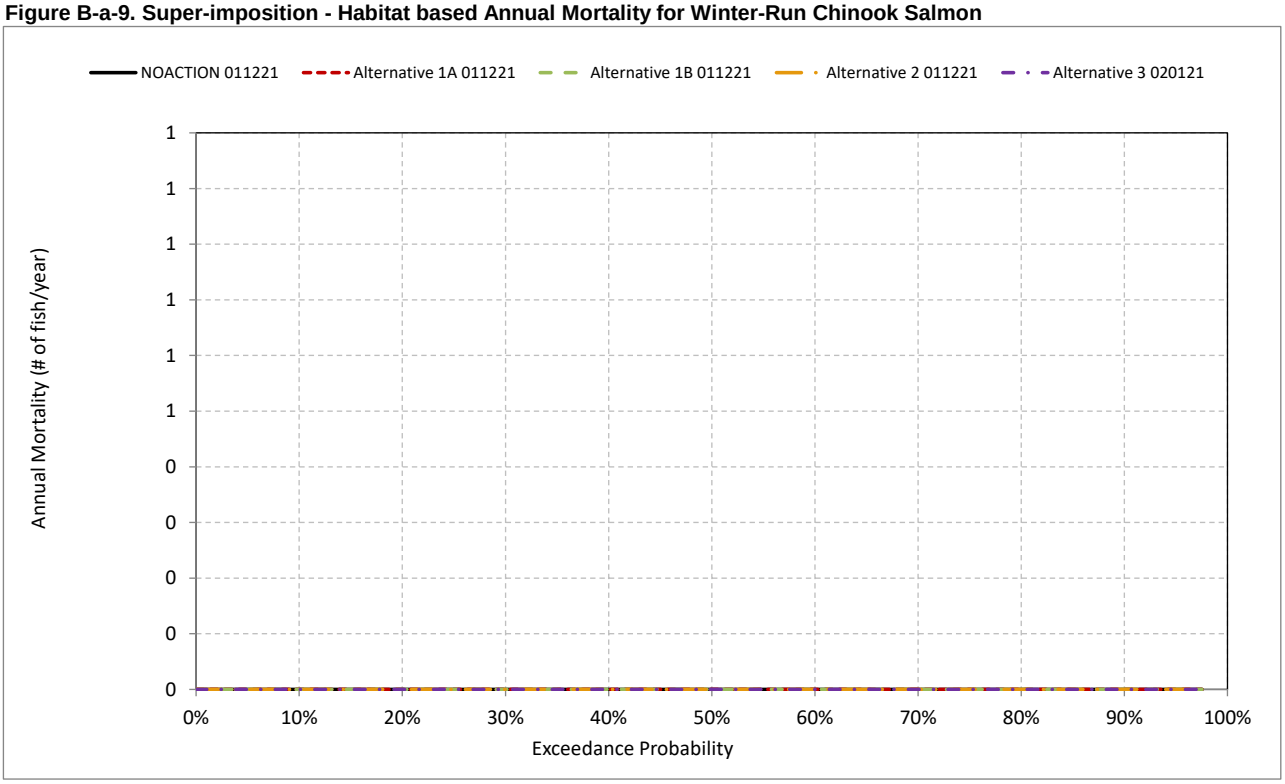


Figure B-a-10. Fry - Habitat based Annual Mortality for Winter-Run Chinook Salmon

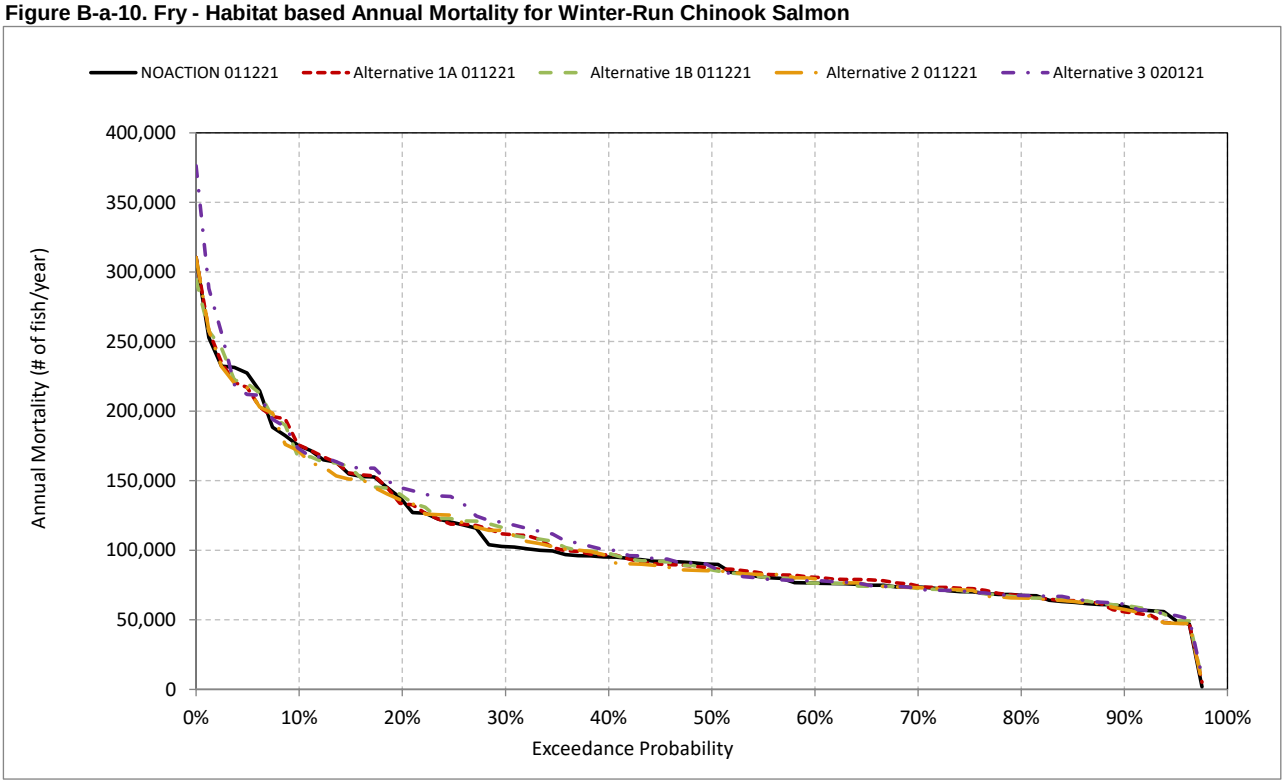


Figure B-a-11. Pre-smolt - Habitat based Annual Mortality for Winter-Run Chinook Salmon

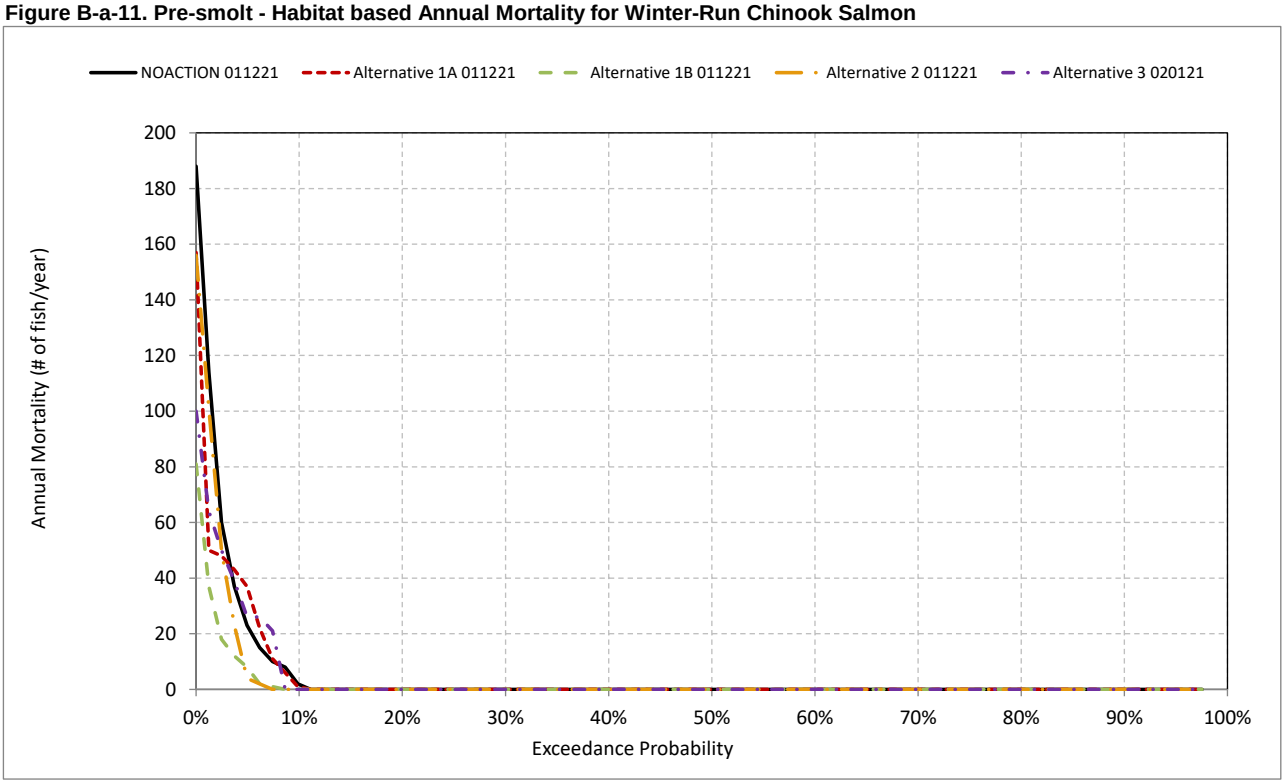


Figure B-a-12. Immature Smolt - Habitat based Annual Mortality for Winter-Run Chinook Salmon

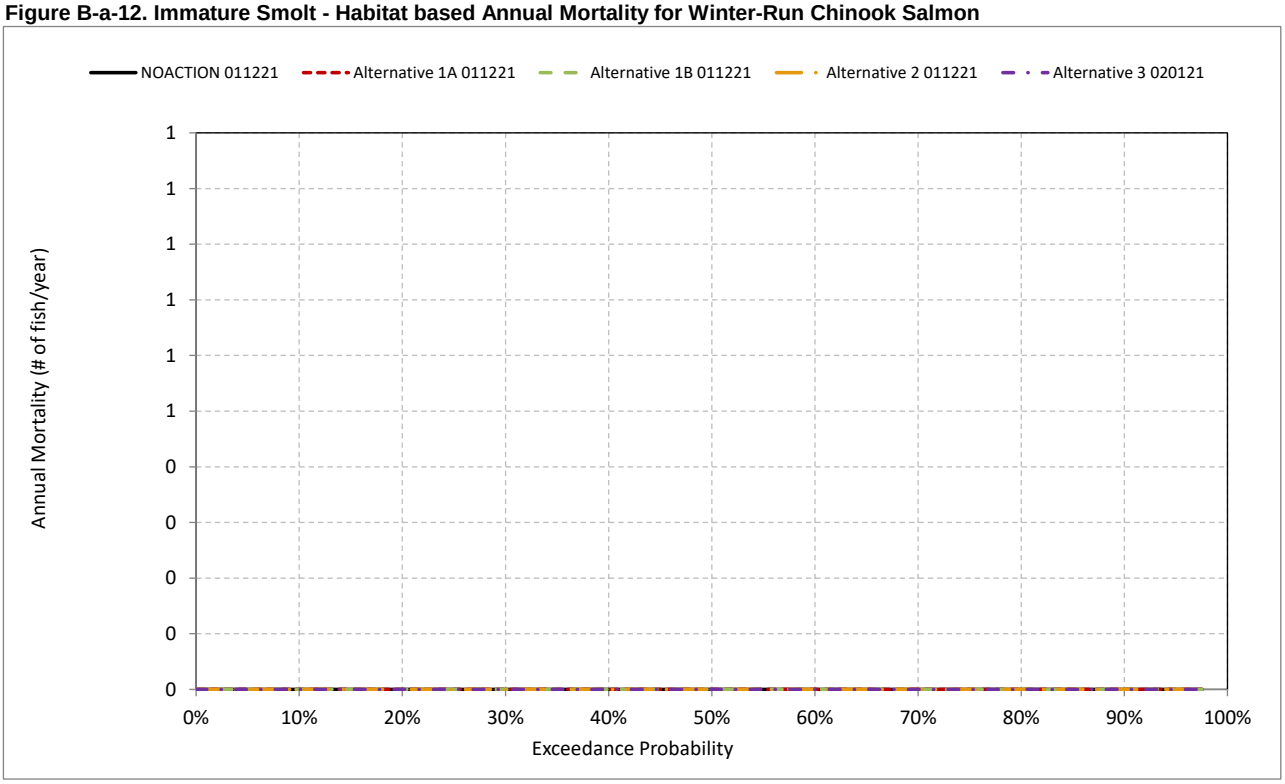


Figure B-a-13. Total Habitat based Annual Mortality for Winter-Run Chinook Salmon

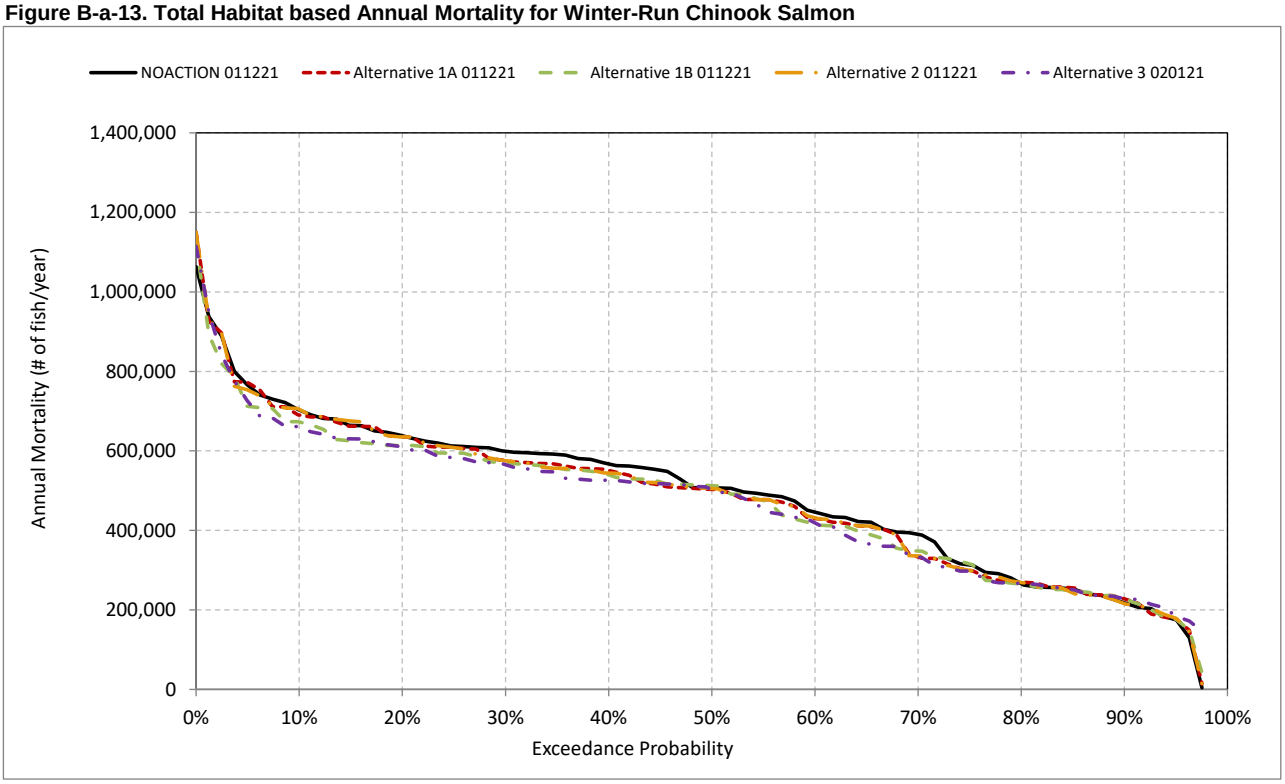


Figure B-a-14. Pre-Spawn Mortality - Temperature based Annual Mortality for Winter-Run Chinook Salmon

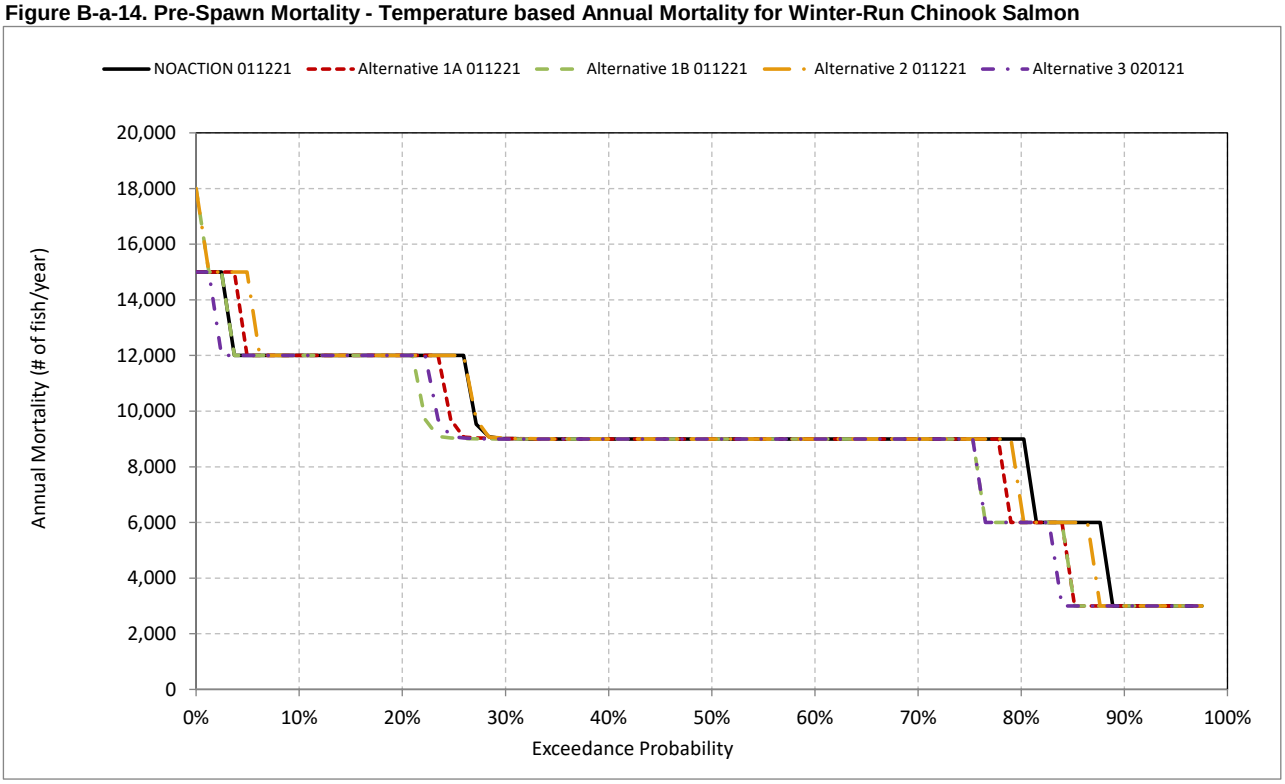


Figure B-a-15. Eggs - Temperature based Annual Mortality for Winter-Run Chinook Salmon

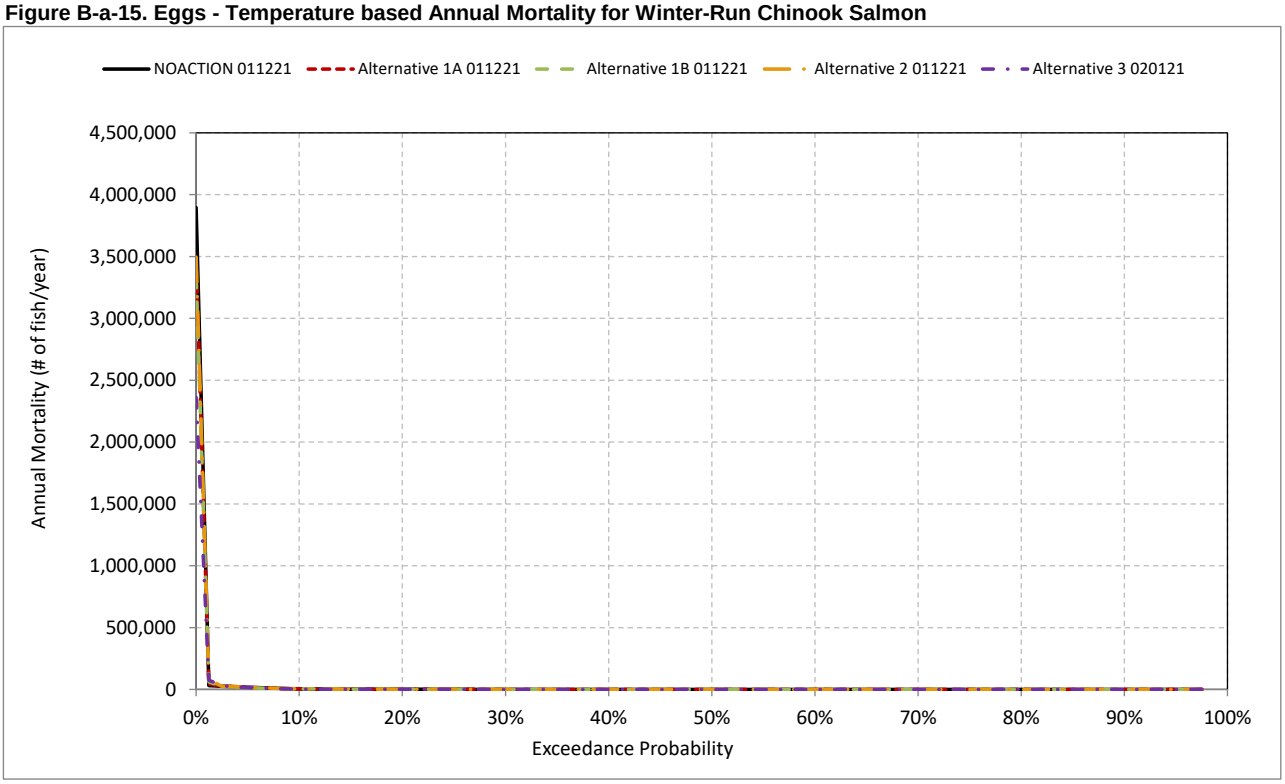


Figure B-a-16. Fry - Temperature based Annual Mortality for Winter-Run Chinook Salmon

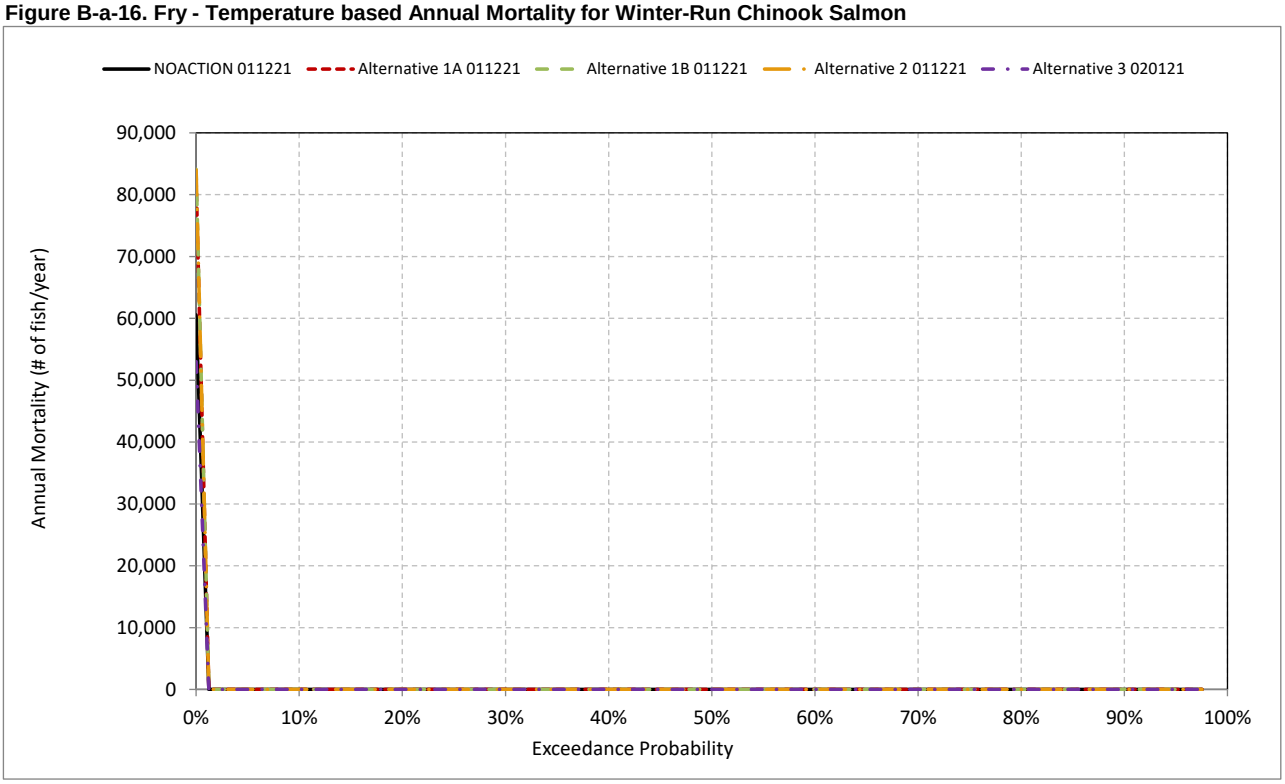


Figure B-a-17. Pre-smolt - Temperature based Annual Mortality for Winter-Run Chinook Salmon

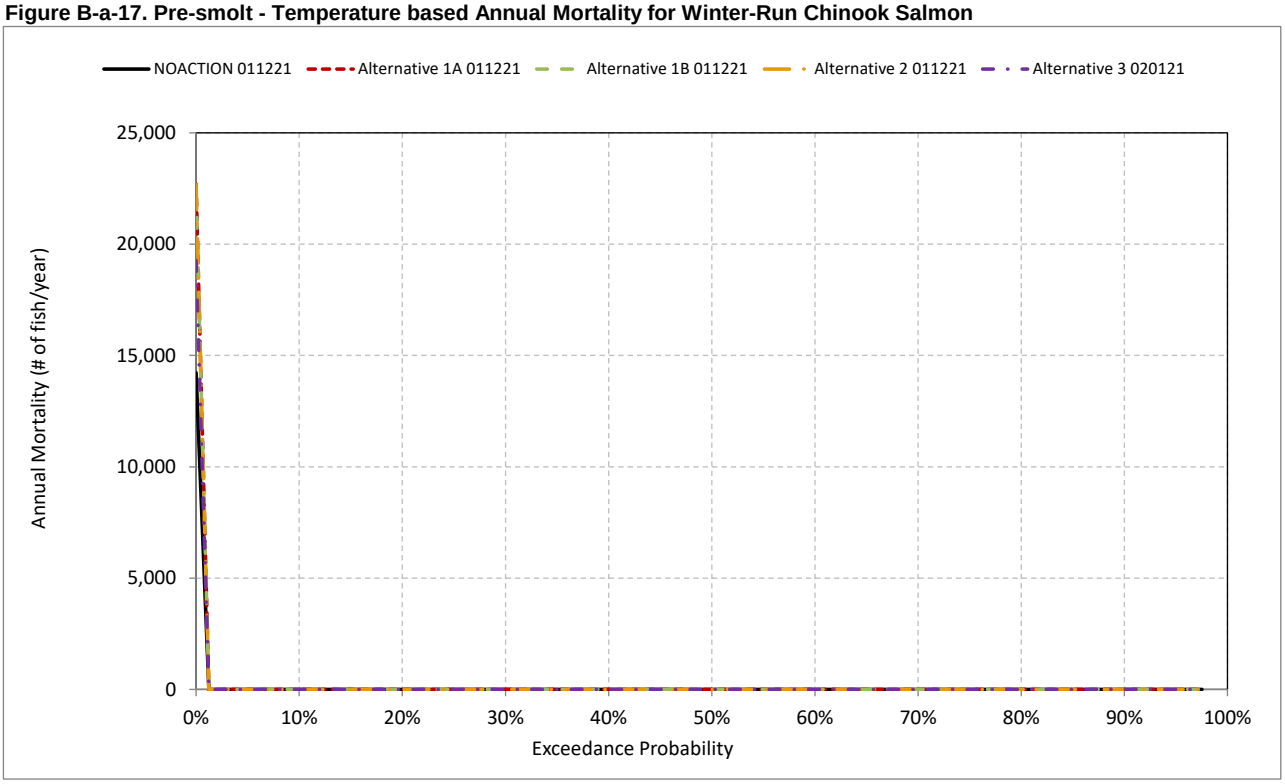


Figure B-a-18. Immature Smolt - Temperature based Annual Mortality for Winter-Run Chinook Salmon

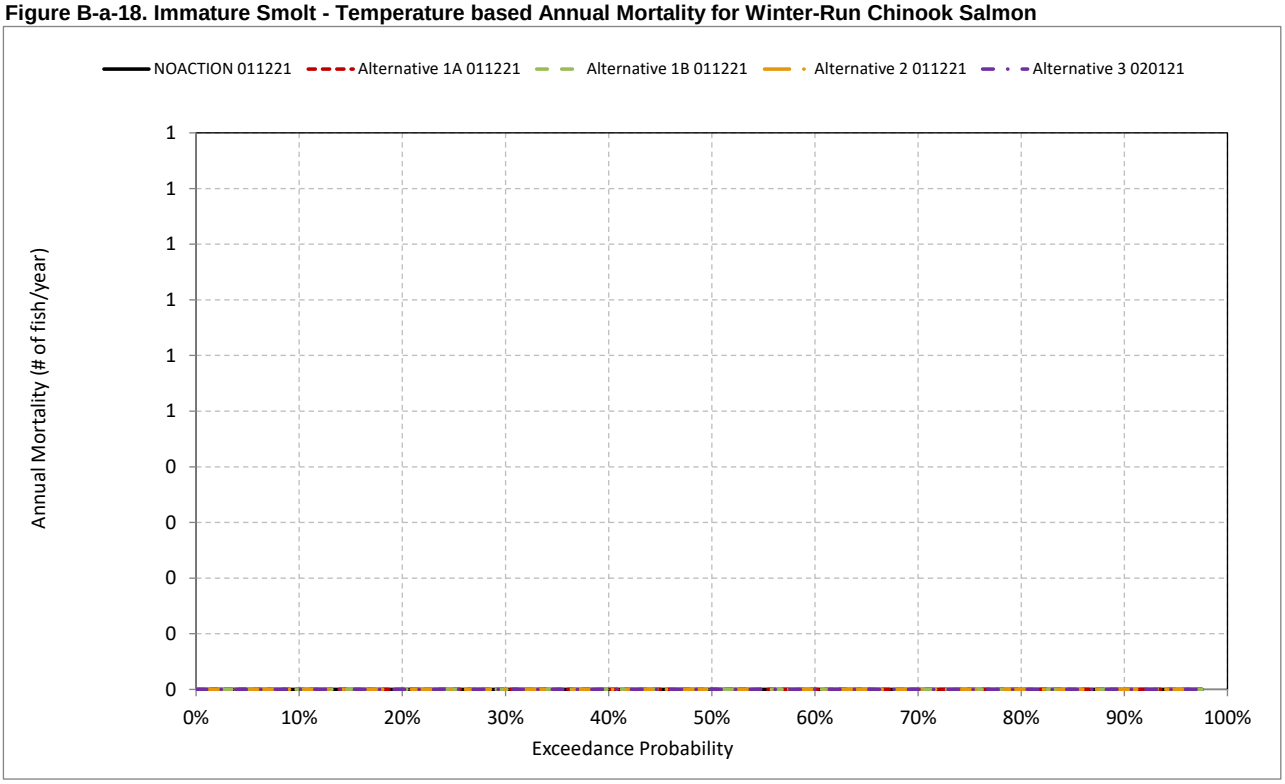


Figure B-a-19. Total Temperature based Annual Mortality for Winter-Run Chinook Salmon

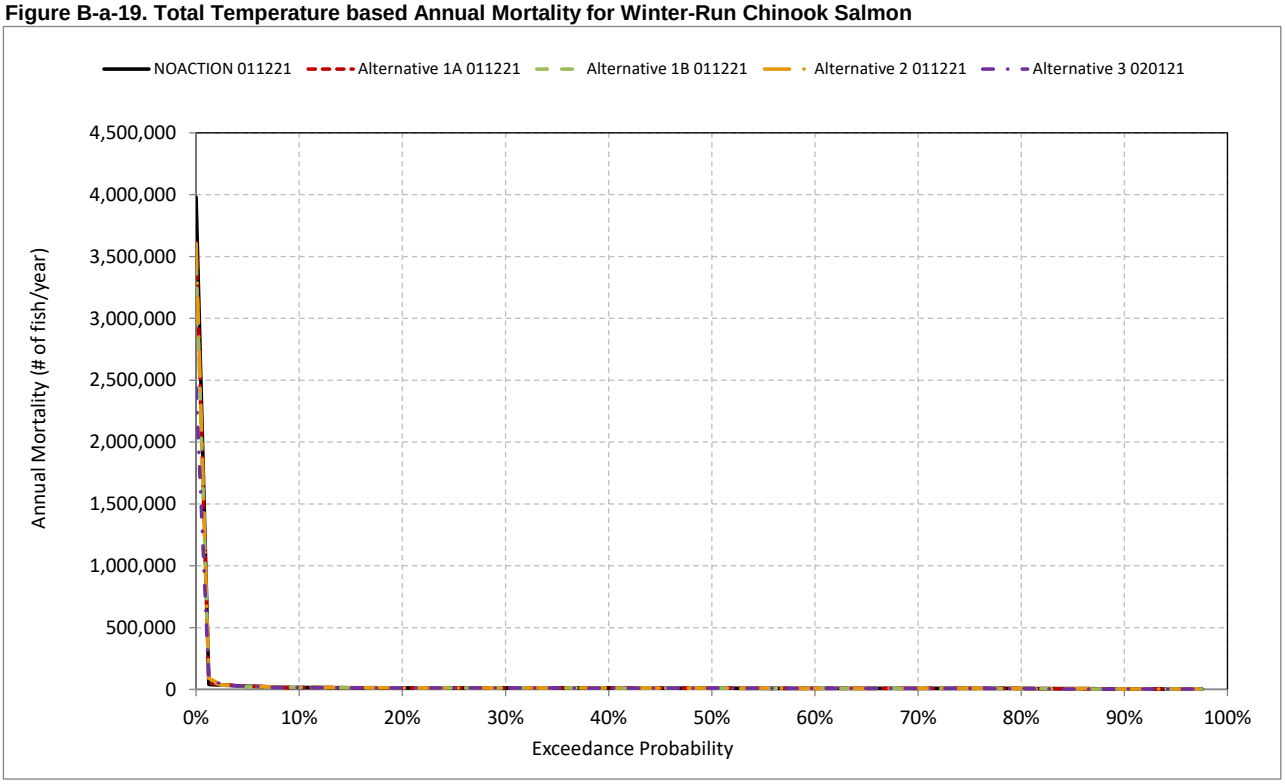


Figure B-b-1. Annual Potential Production for Spring-Run Chinook Salmon

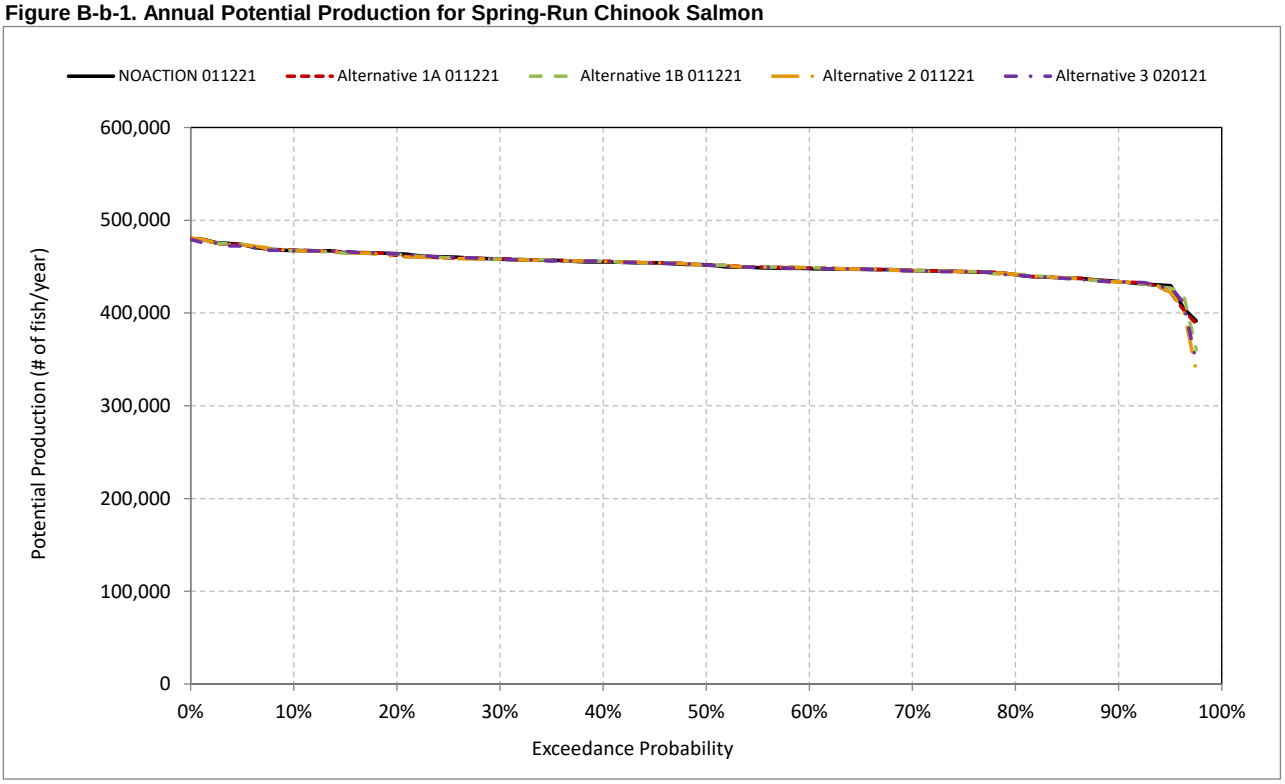


Figure B-b-2. Annual Mortality for Spring-Run Chinook Salmon - Eggs

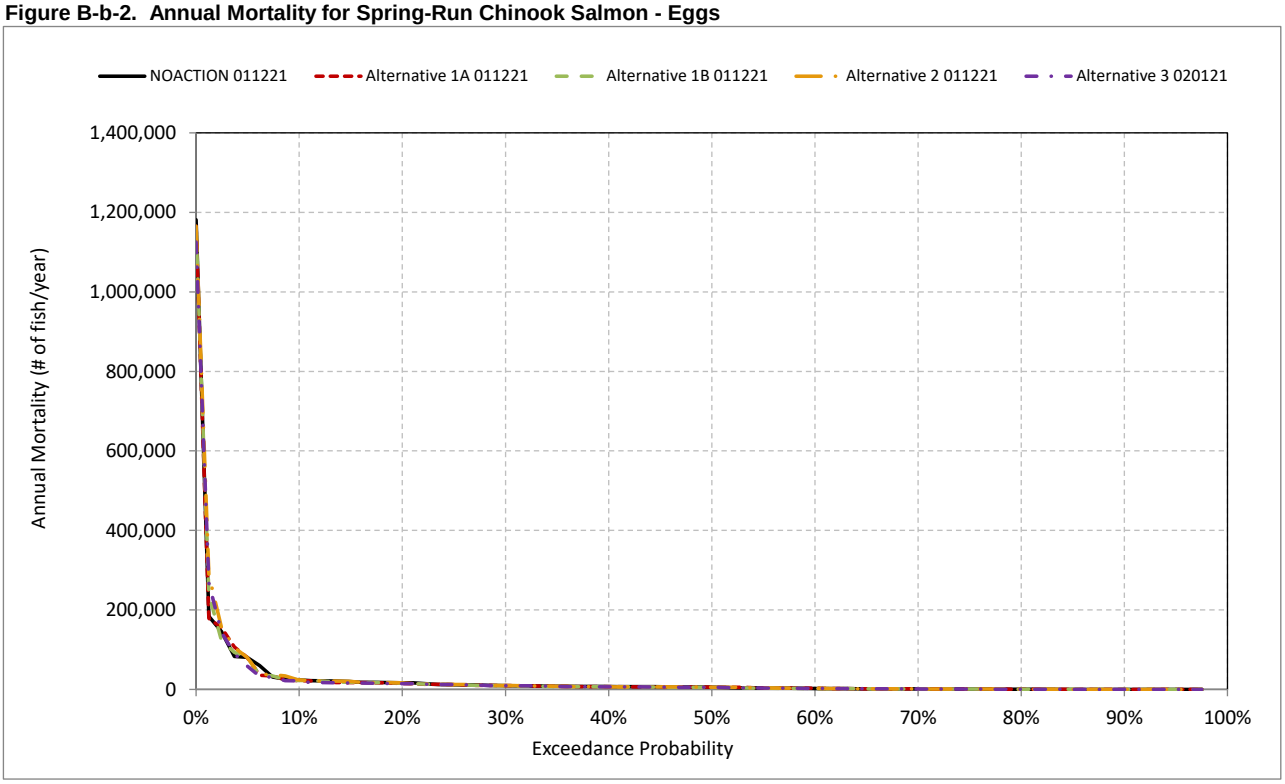


Figure B-b-3. Annual Mortality for Spring-Run Chinook Salmon - Fry

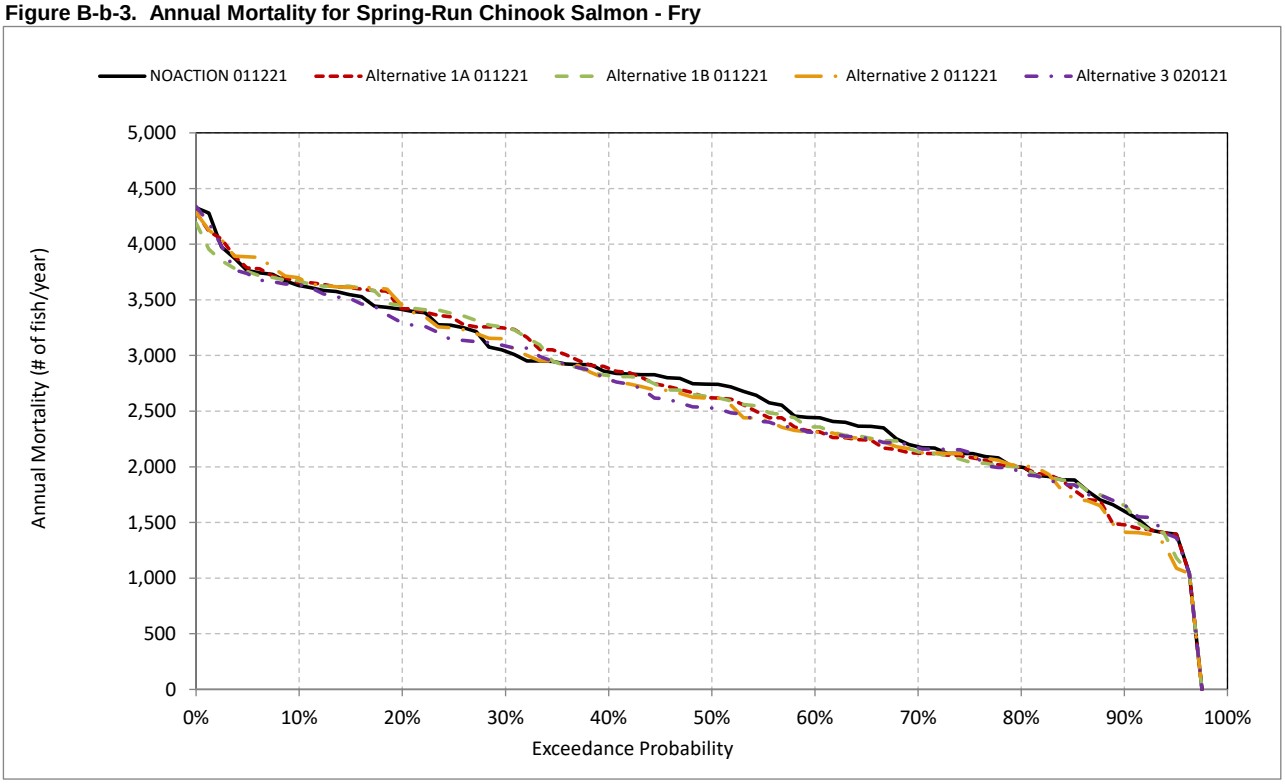


Figure B-b-4. Annual Mortality for Spring-Run Chinook Salmon - Pre-Smolt

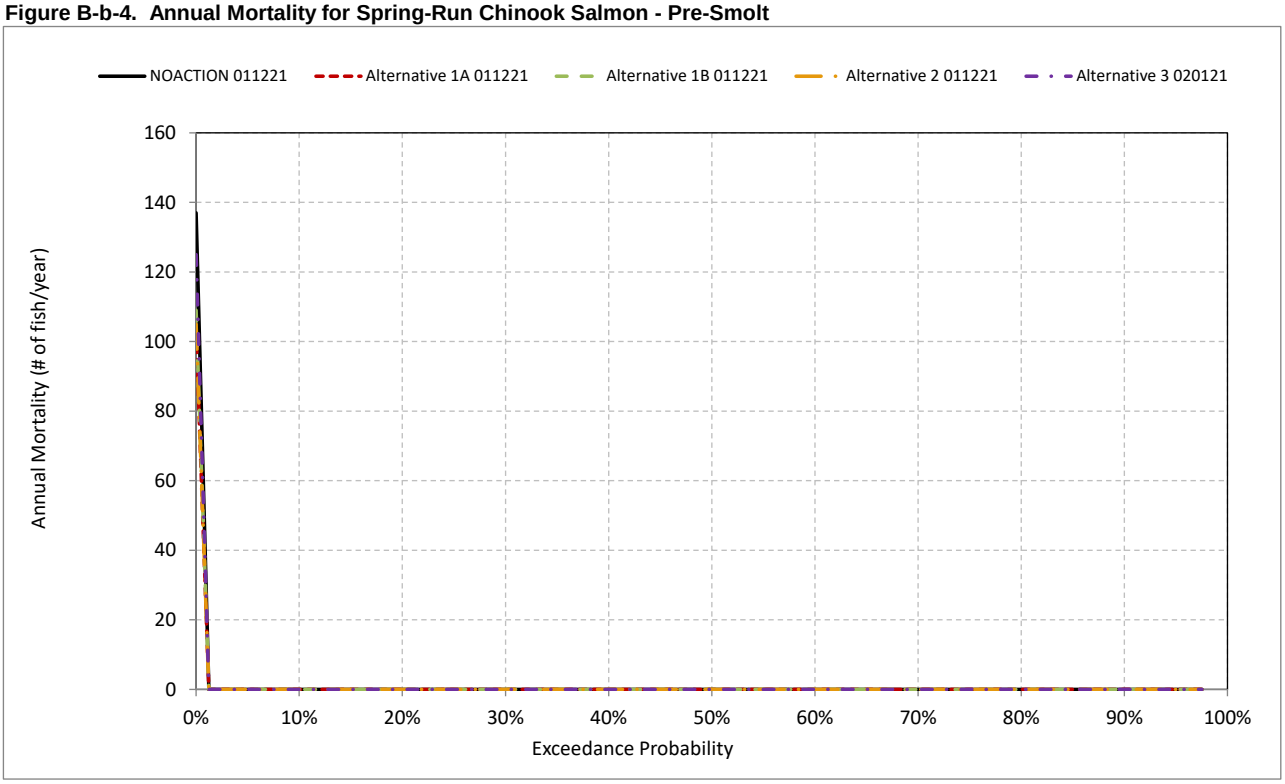


Figure B-b-5. Annual Mortality for Spring-Run Chinook Salmon - Immature Smolt

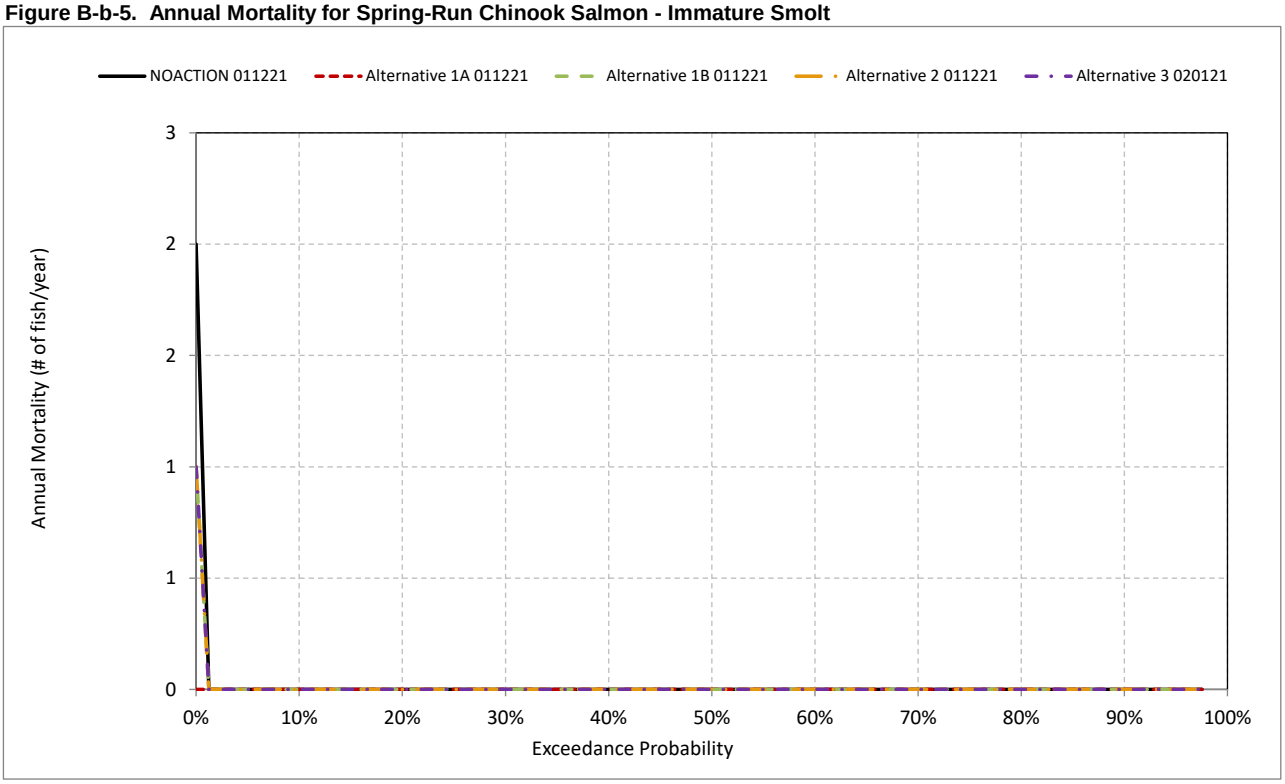


Figure B-b-6. Annual Mortality for Spring-Run Chinook Salmon - Pre- & Immature Smolts

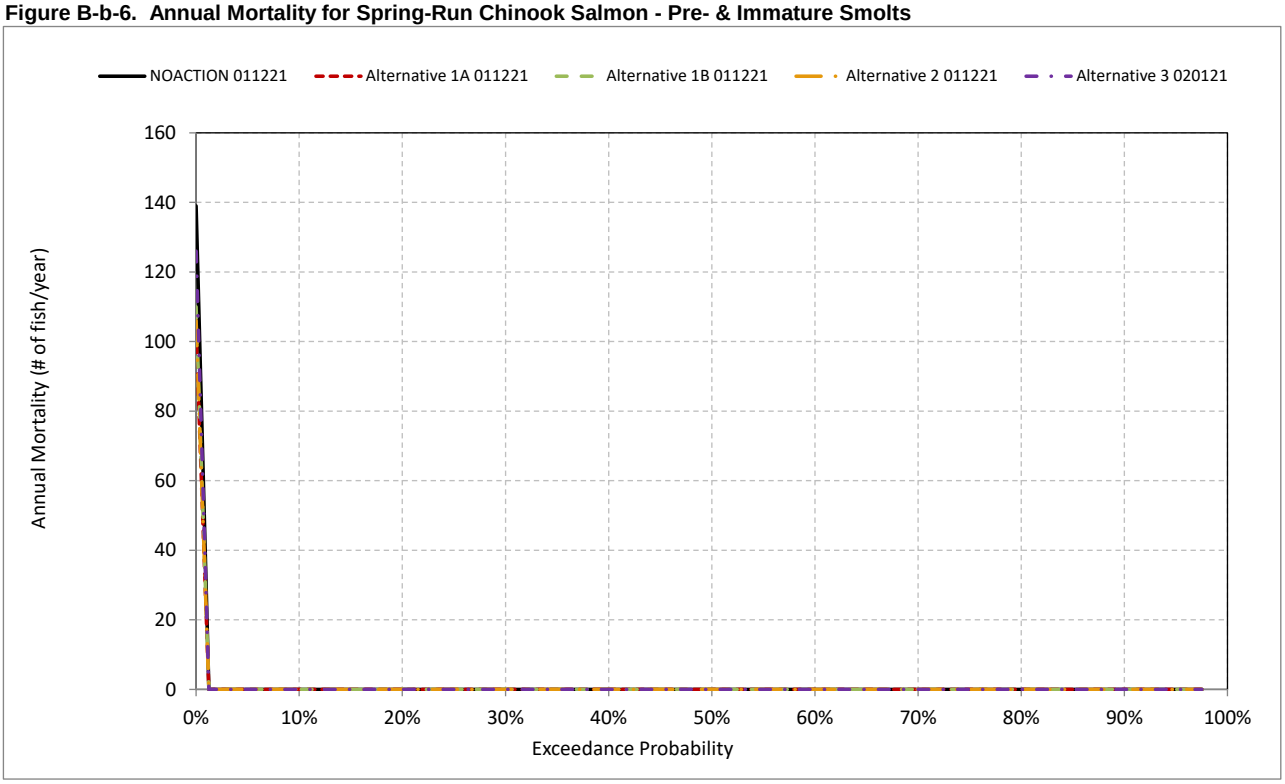


Figure B-b-7. Annual Mortality for Spring-Run Chinook Salmon - All Lifestages

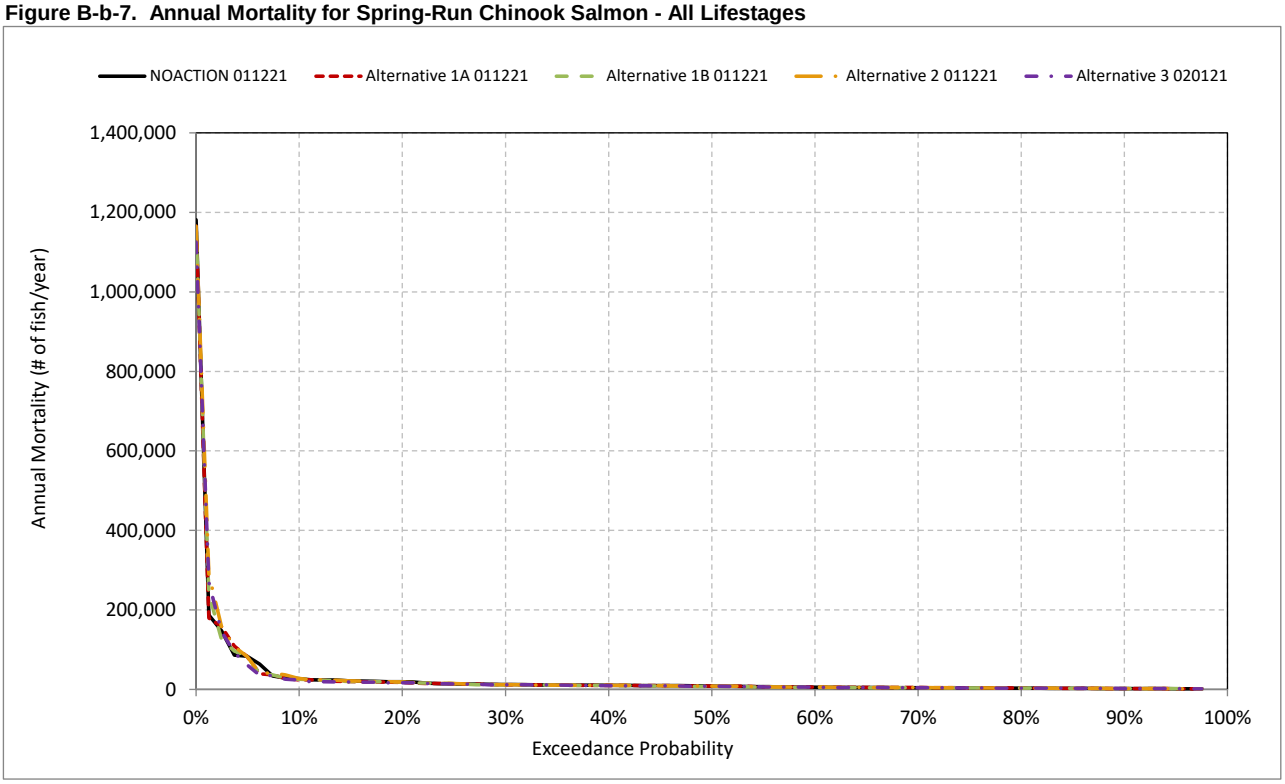


Figure B-b-8. Incubation - Habitat based Annual Mortality for Spring-Run Chinook Salmon

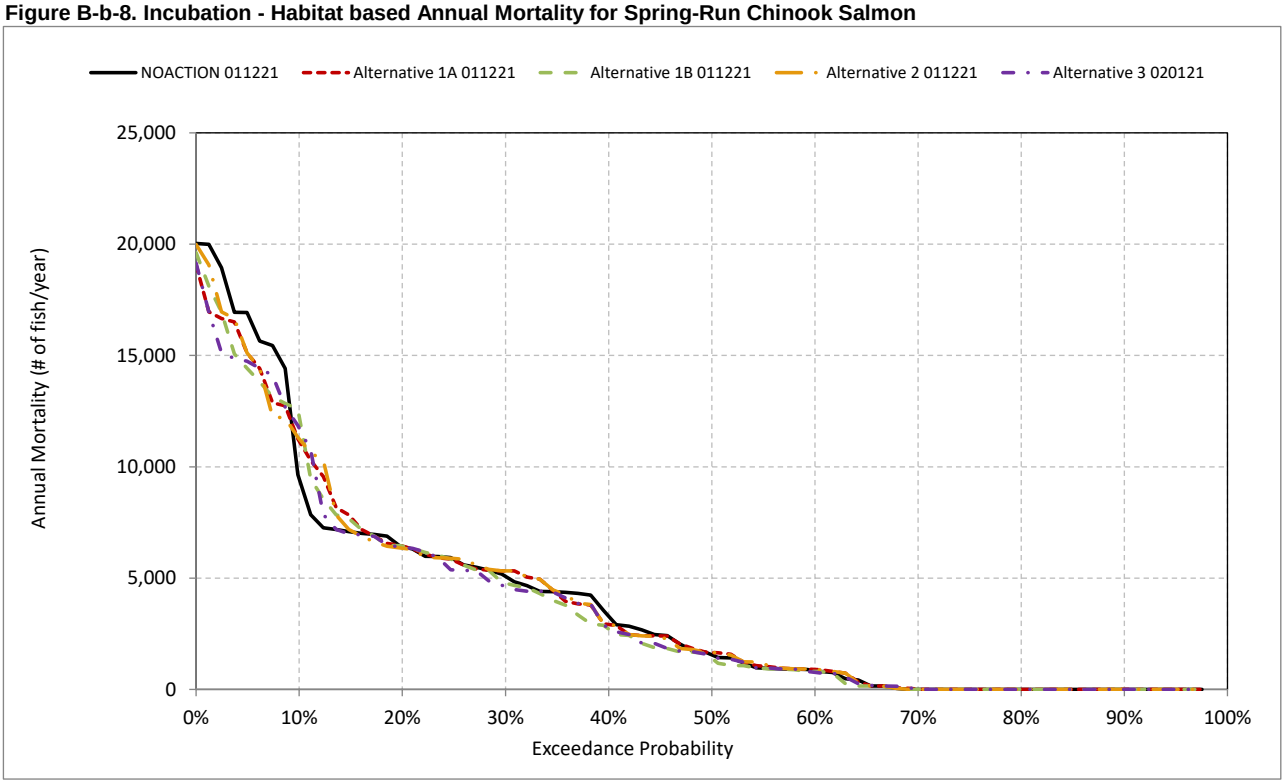


Figure B-b-9. Super-imposition - Habitat based Annual Mortality for Spring-Run Chinook Salmon

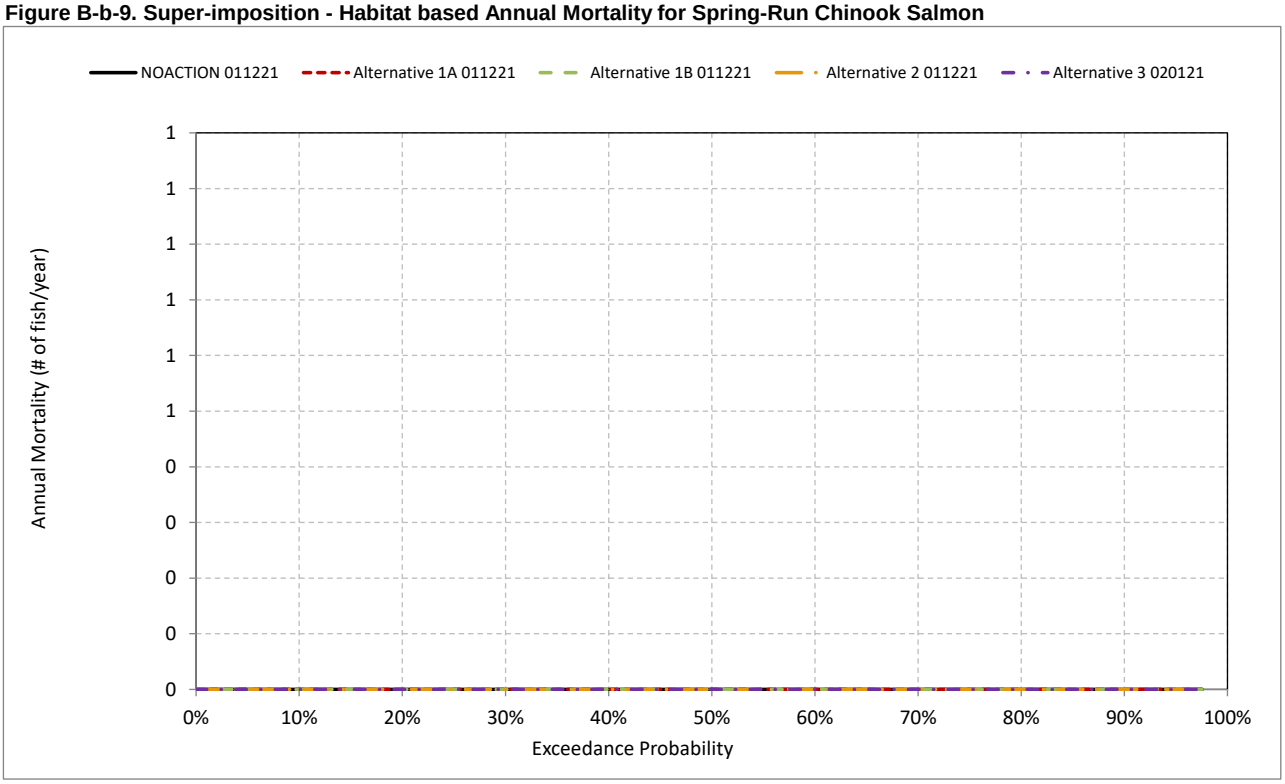


Figure B-b-10. Fry - Habitat based Annual Mortality for Spring-Run Chinook Salmon

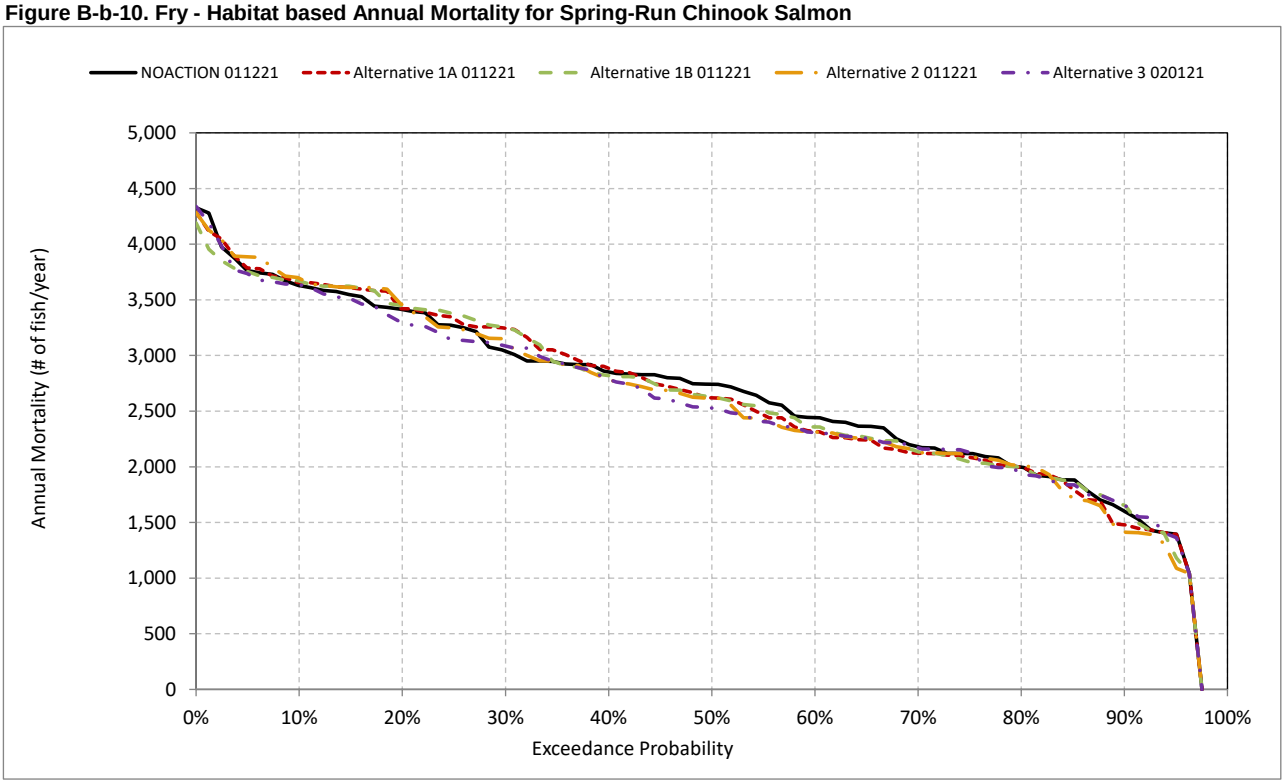


Figure B-b-11. Pre-smolt - Habitat based Annual Mortality for Spring-Run Chinook Salmon

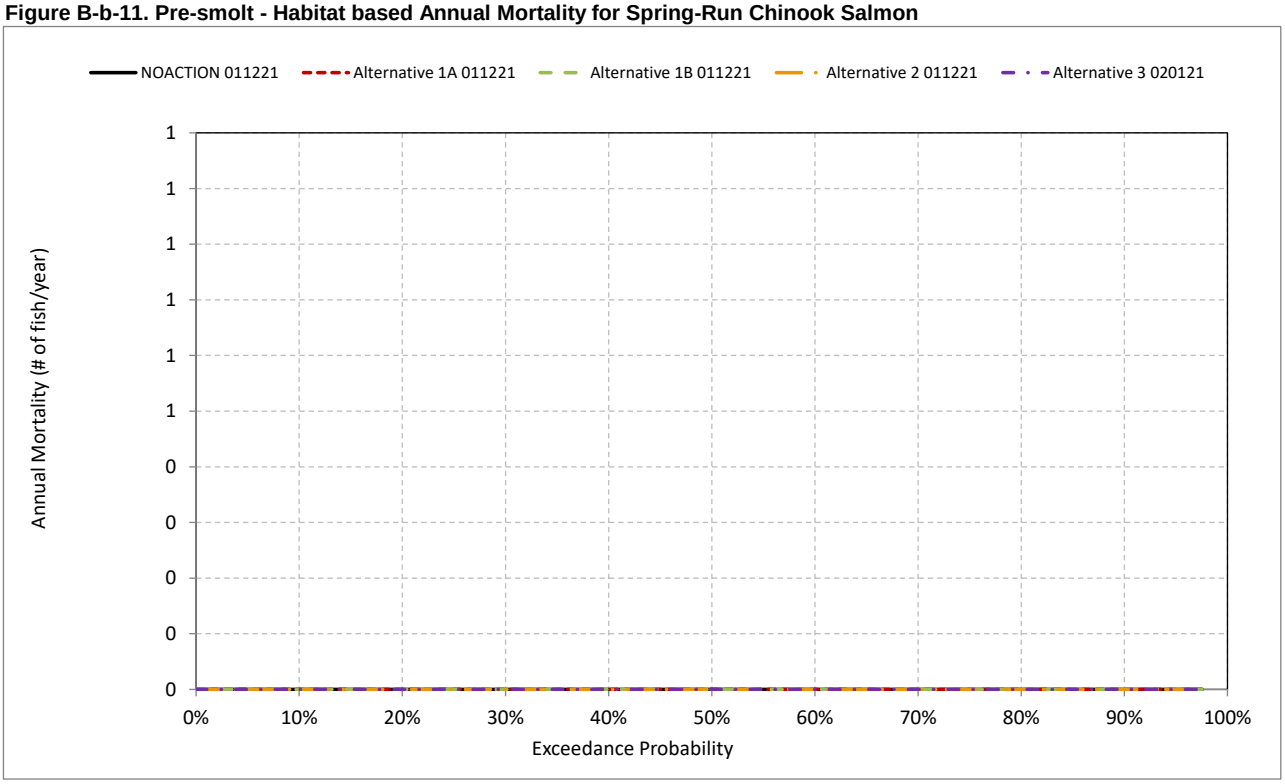


Figure B-b-12. Immature Smolt - Habitat based Annual Mortality for Spring-Run Chinook Salmon

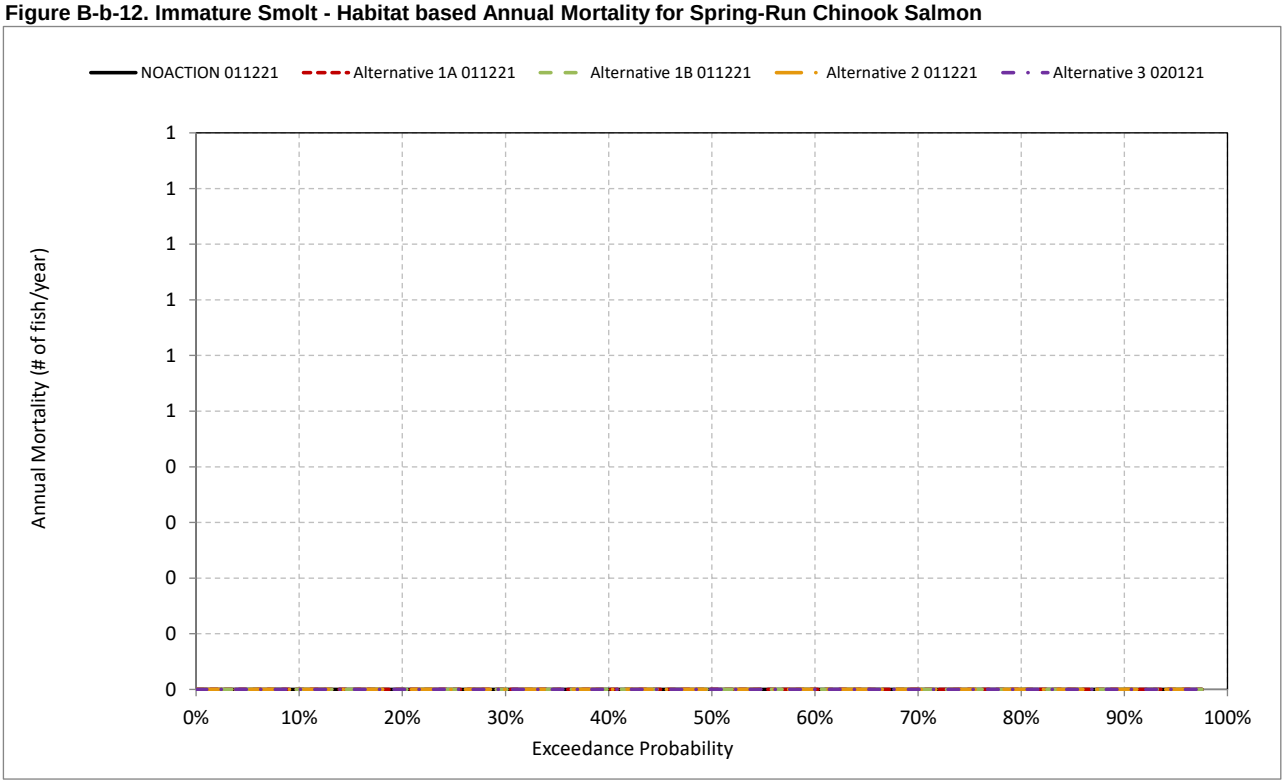


Figure B-b-13. Total Habitat based Annual Mortality for Spring-Run Chinook Salmon

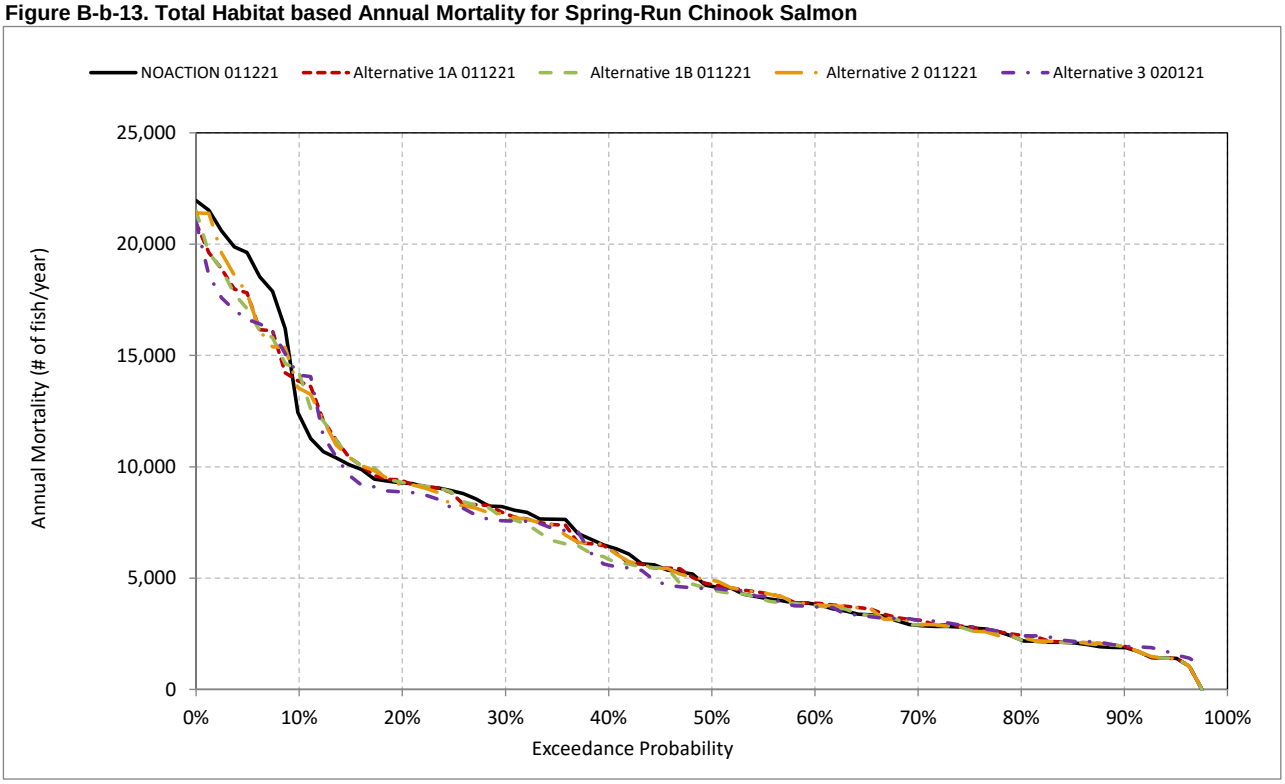


Figure B-b-14. Pre-Spawn Mortality - Temperature based Annual Mortality for Spring-Run Chinook Salmon

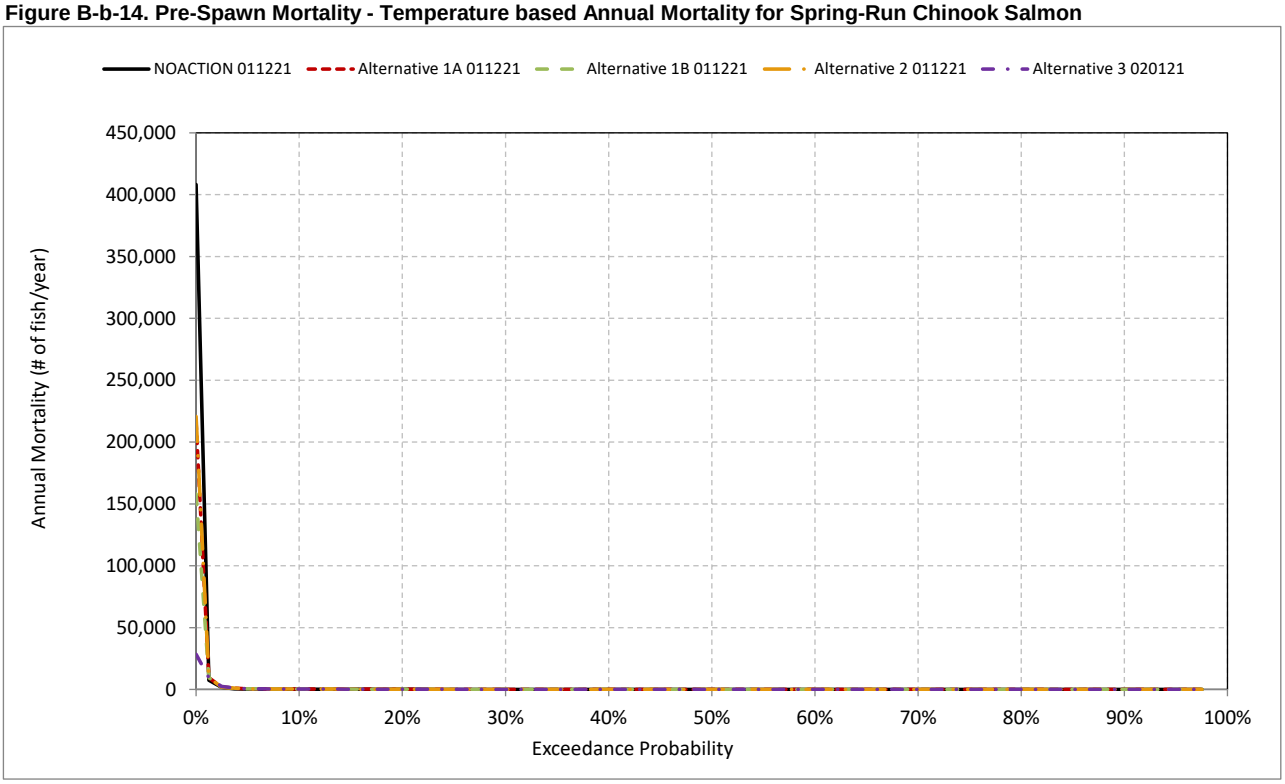


Figure B-b-15. Eggs - Temperature based Annual Mortality for Spring-Run Chinook Salmon

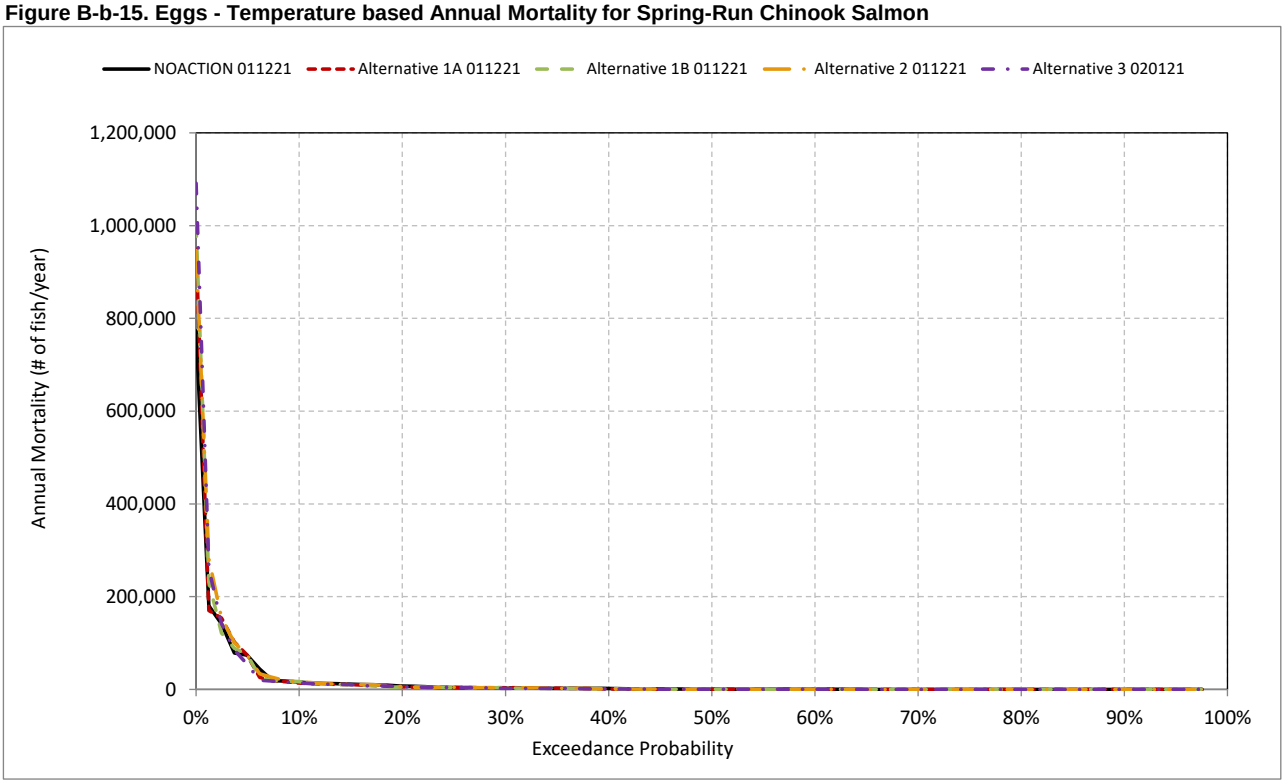


Figure B-b-16. Fry - Temperature based Annual Mortality for Spring-Run Chinook Salmon

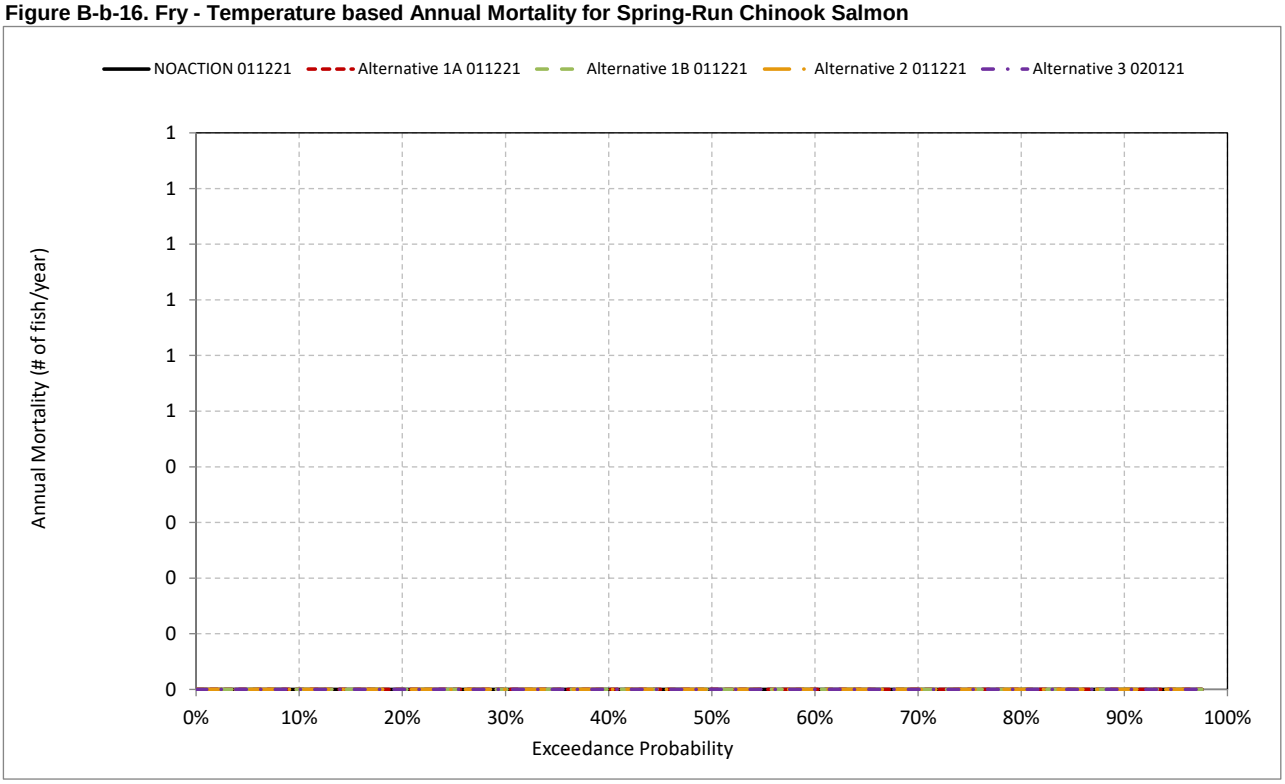


Figure B-b-17. Pre-smolt - Temperature based Annual Mortality for Spring-Run Chinook Salmon

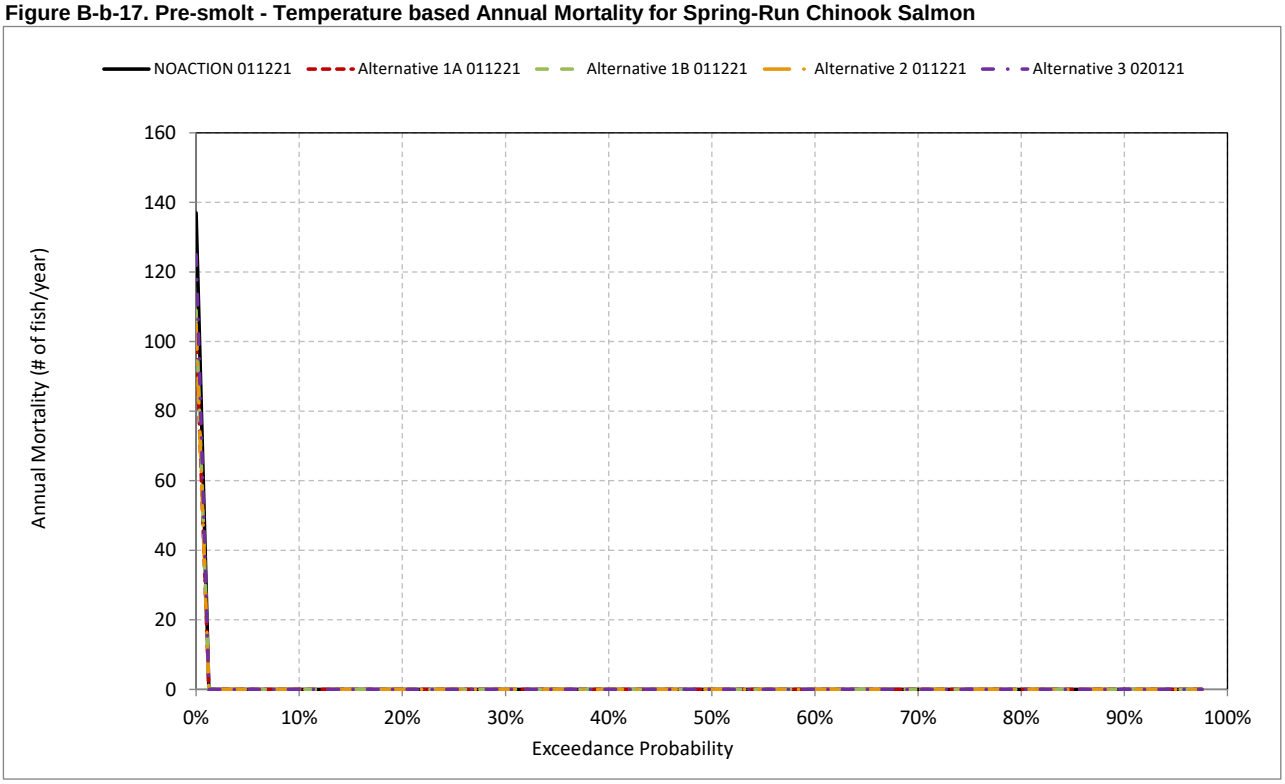


Figure B-b-18. Immature Smolt - Temperature based Annual Mortality for Spring-Run Chinook Salmon

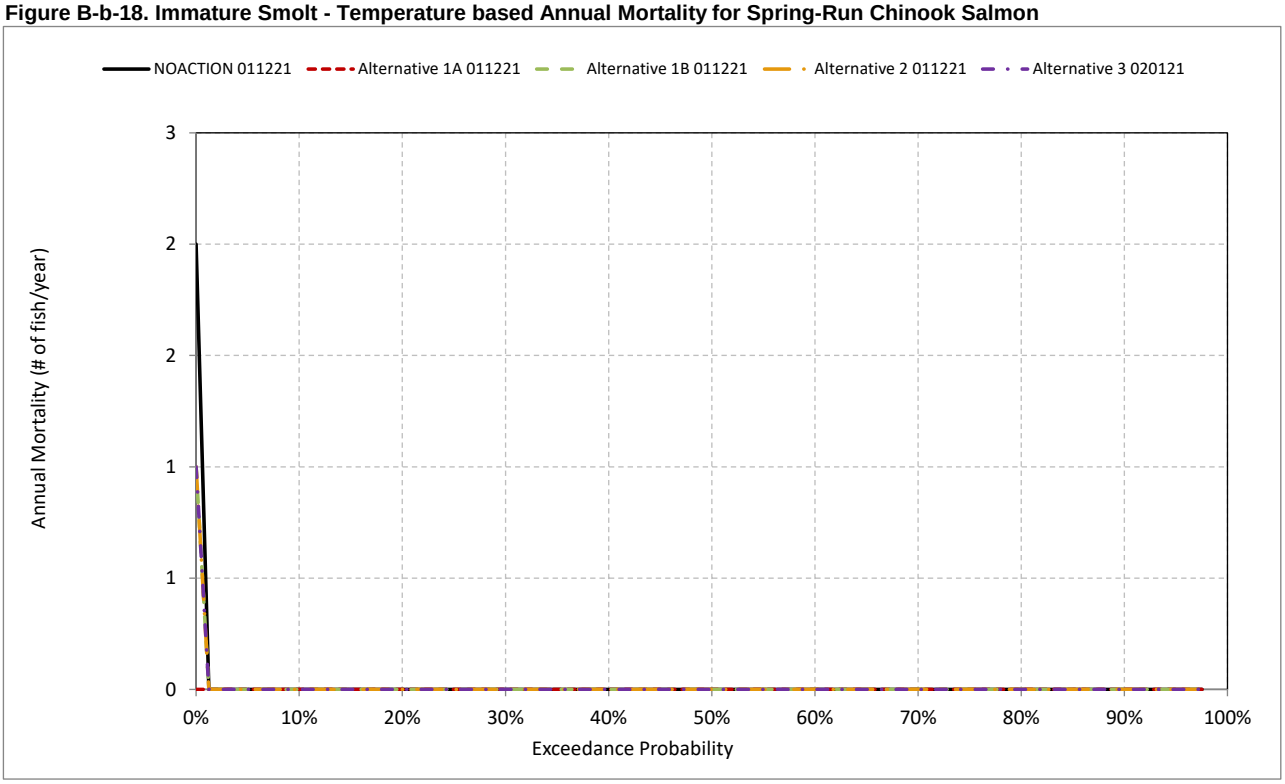


Figure B-b-19. Total Temperature based Annual Mortality for Spring-Run Chinook Salmon

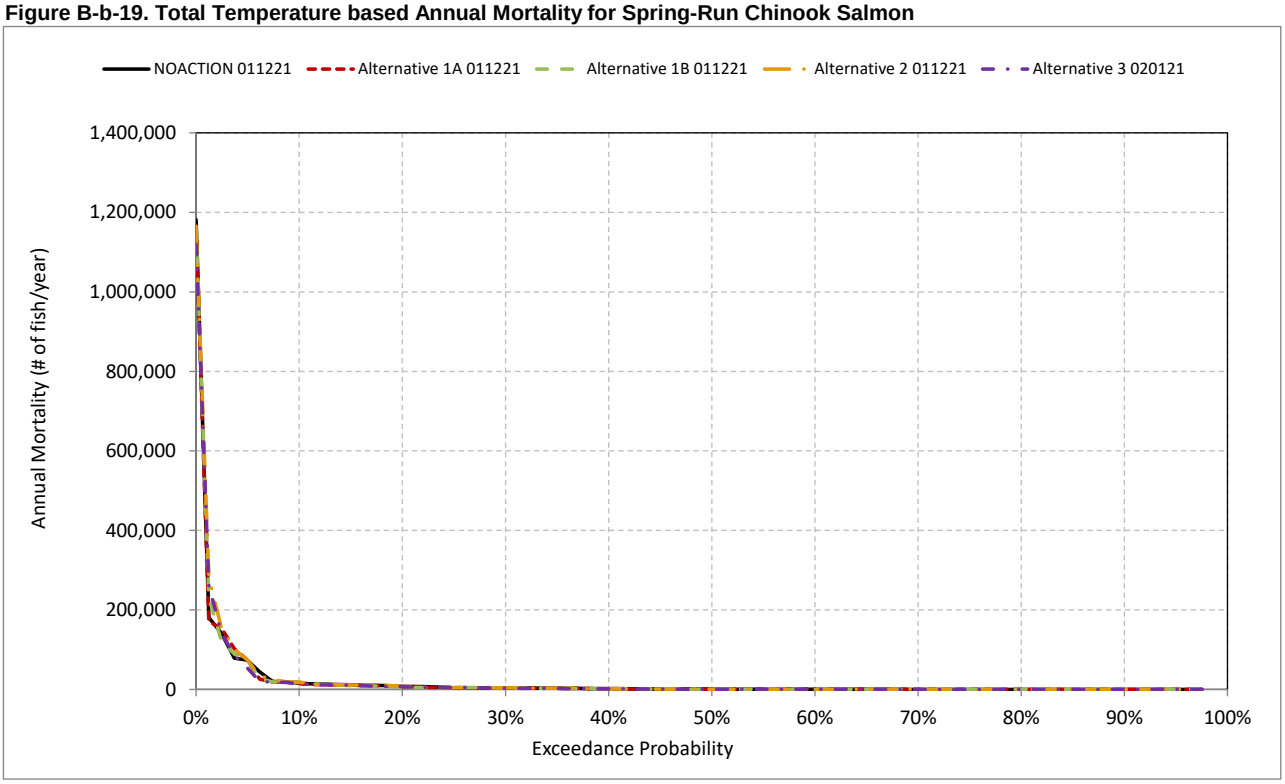


Figure B-c-1. Annual Potential Production for Fall-Run Chinook Salmon

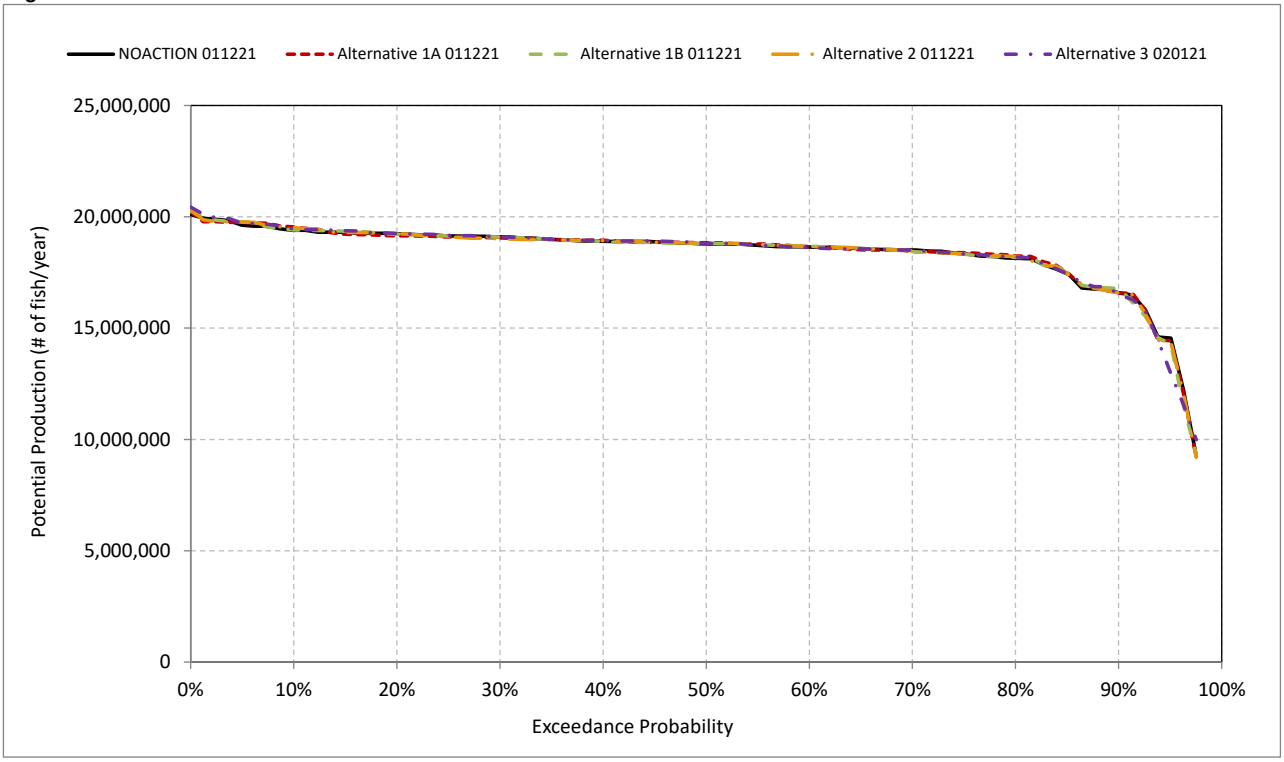


Figure B-c-2. Annual Mortality for Fall-Run Chinook Salmon - Eggs

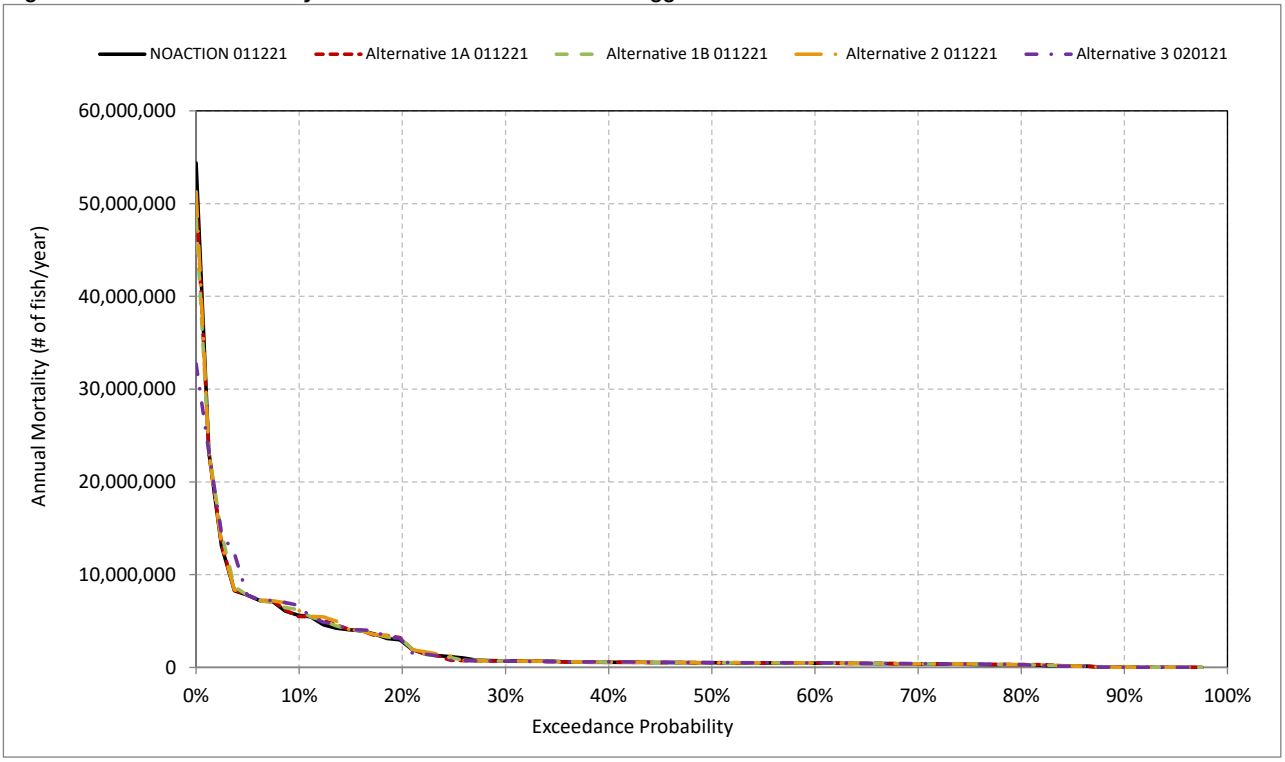


Figure B-c-3. Annual Mortality for Fall-Run Chinook Salmon - Fry

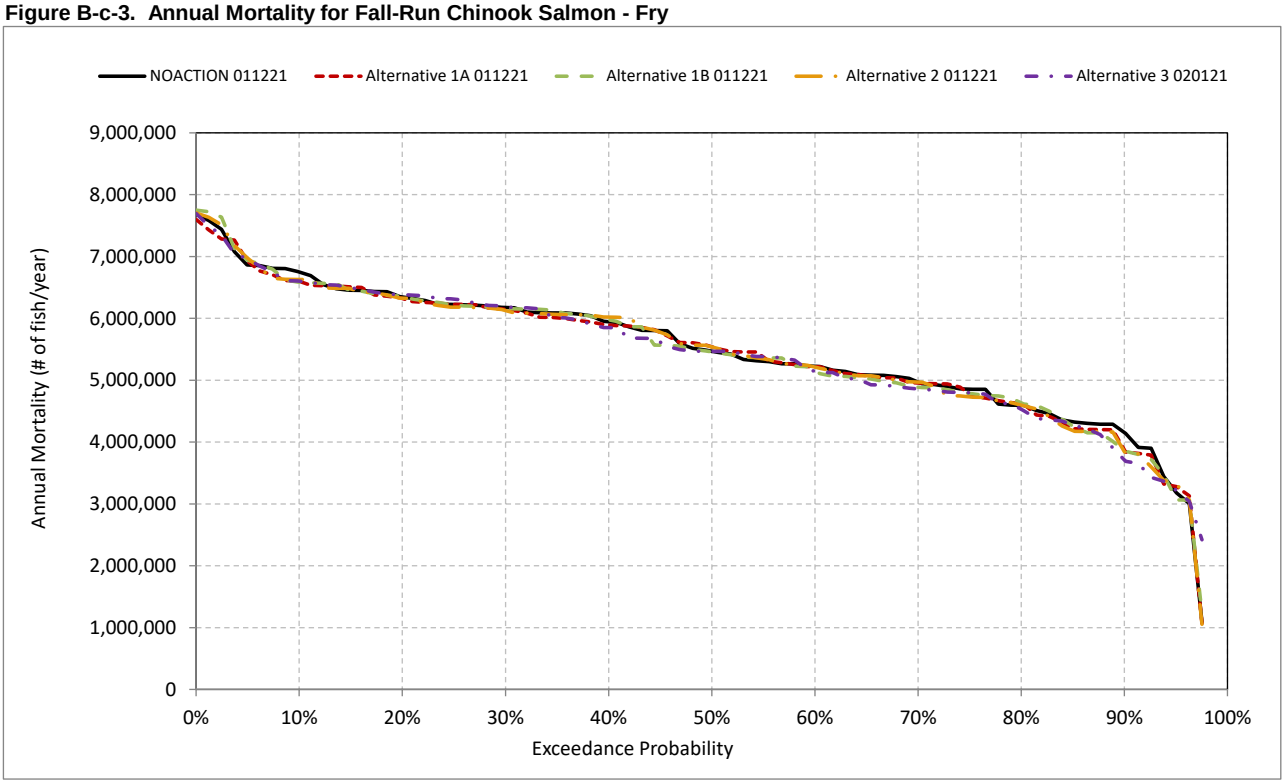


Figure B-c-4. Annual Mortality for Fall-Run Chinook Salmon - Pre-Smolt

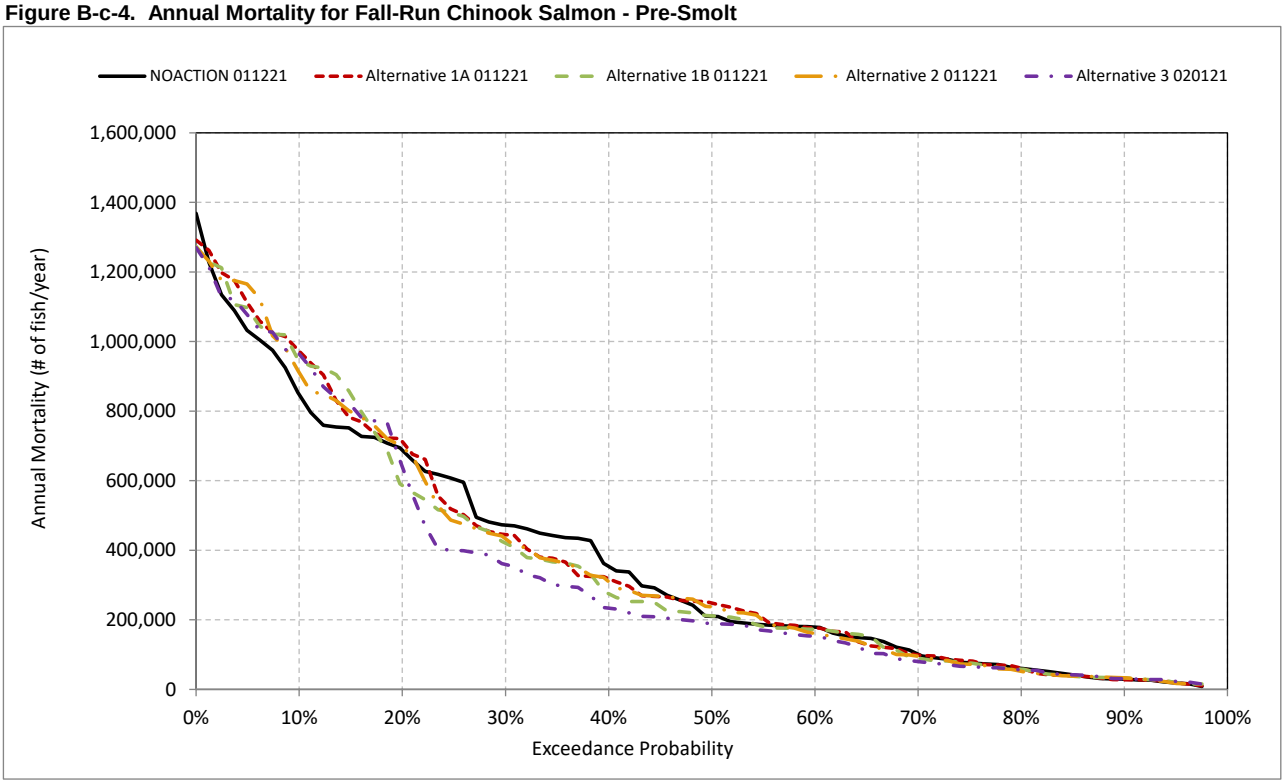


Figure B-c-5. Annual Mortality for Fall-Run Chinook Salmon - Immature Smolt

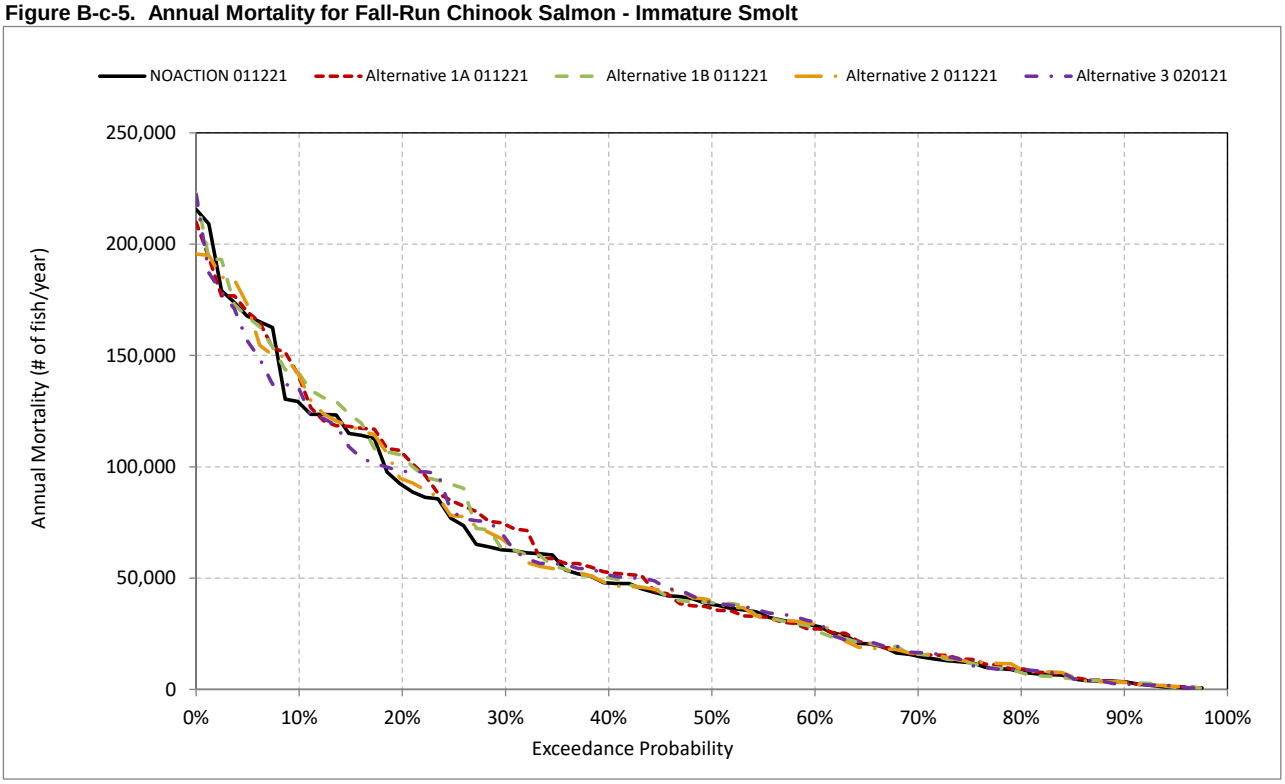


Figure B-c-6. Annual Mortality for Fall-Run Chinook Salmon - Pre- & Immature Smolts

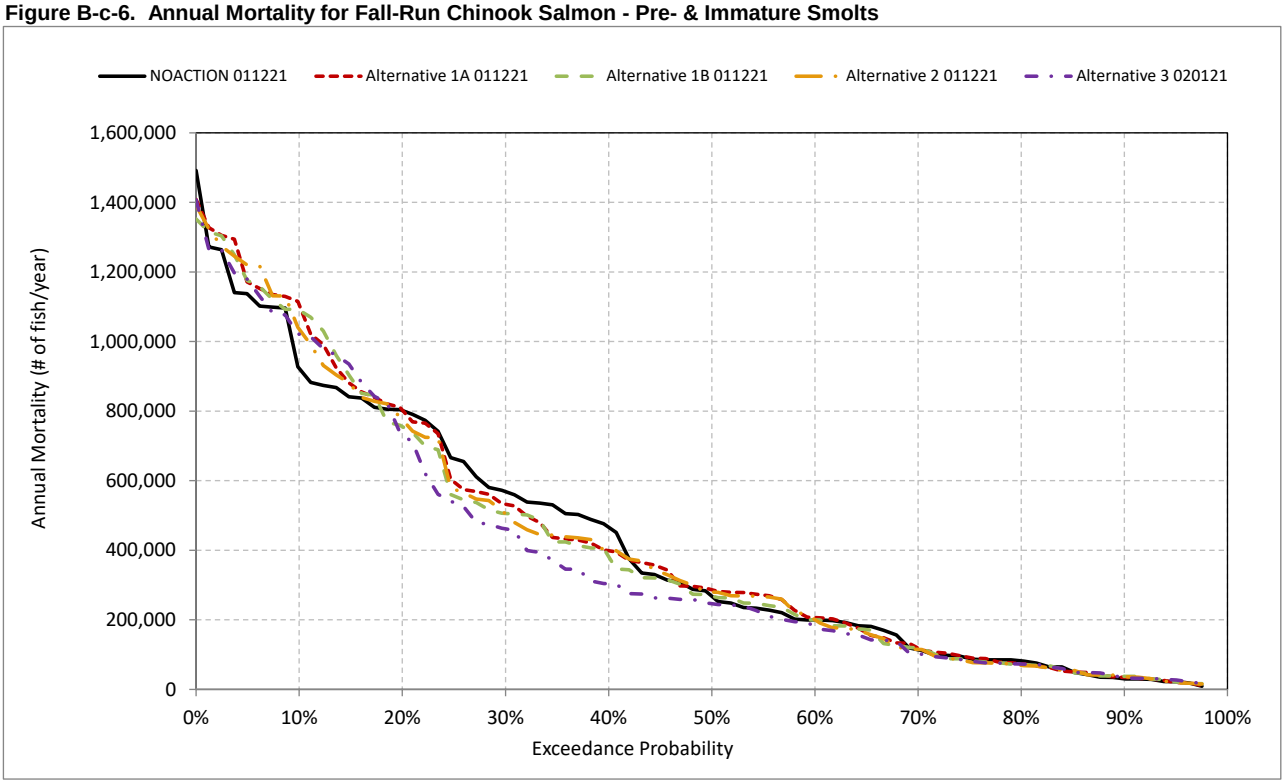


Figure B-c-7. Annual Mortality for Fall-Run Chinook Salmon - All Lifestages

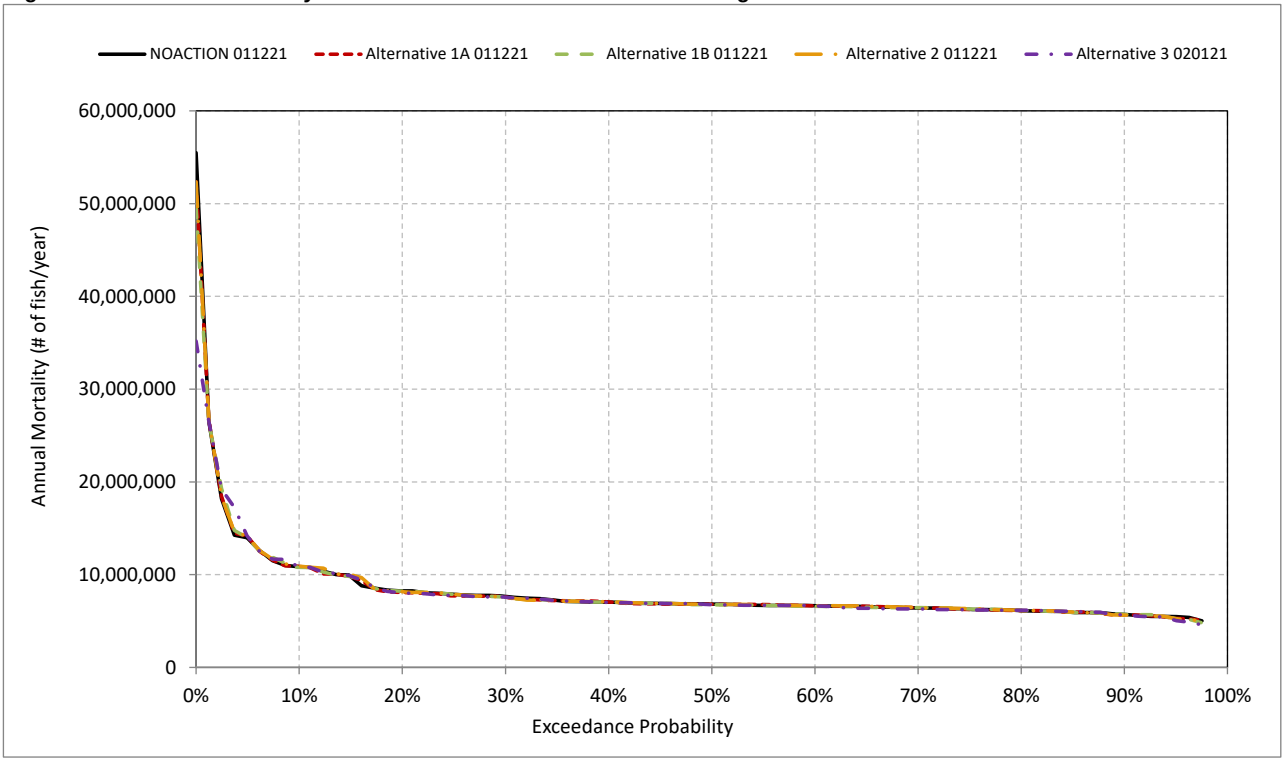


Figure B-c-8. Incubation - Habitat based Annual Mortality for Fall-Run Chinook Salmon

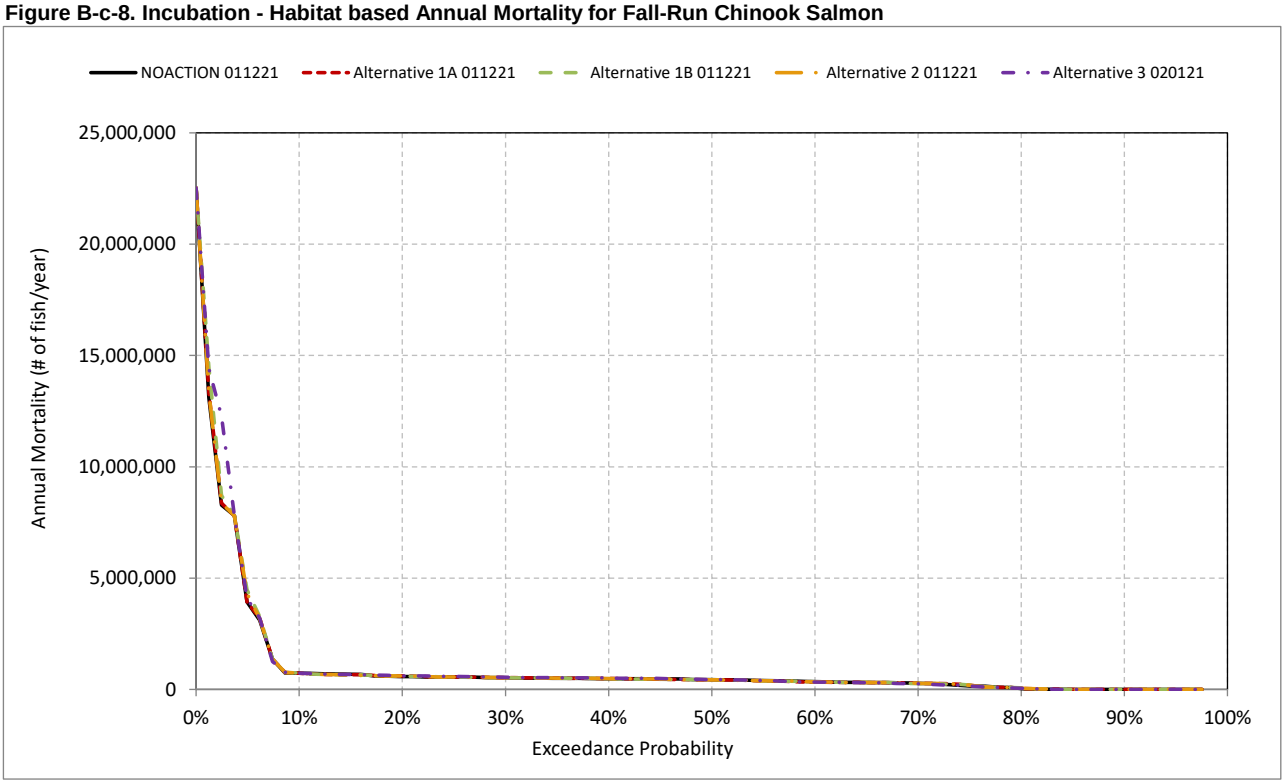


Figure B-c-9. Super-imposition - Habitat based Annual Mortality for Fall-Run Chinook Salmon

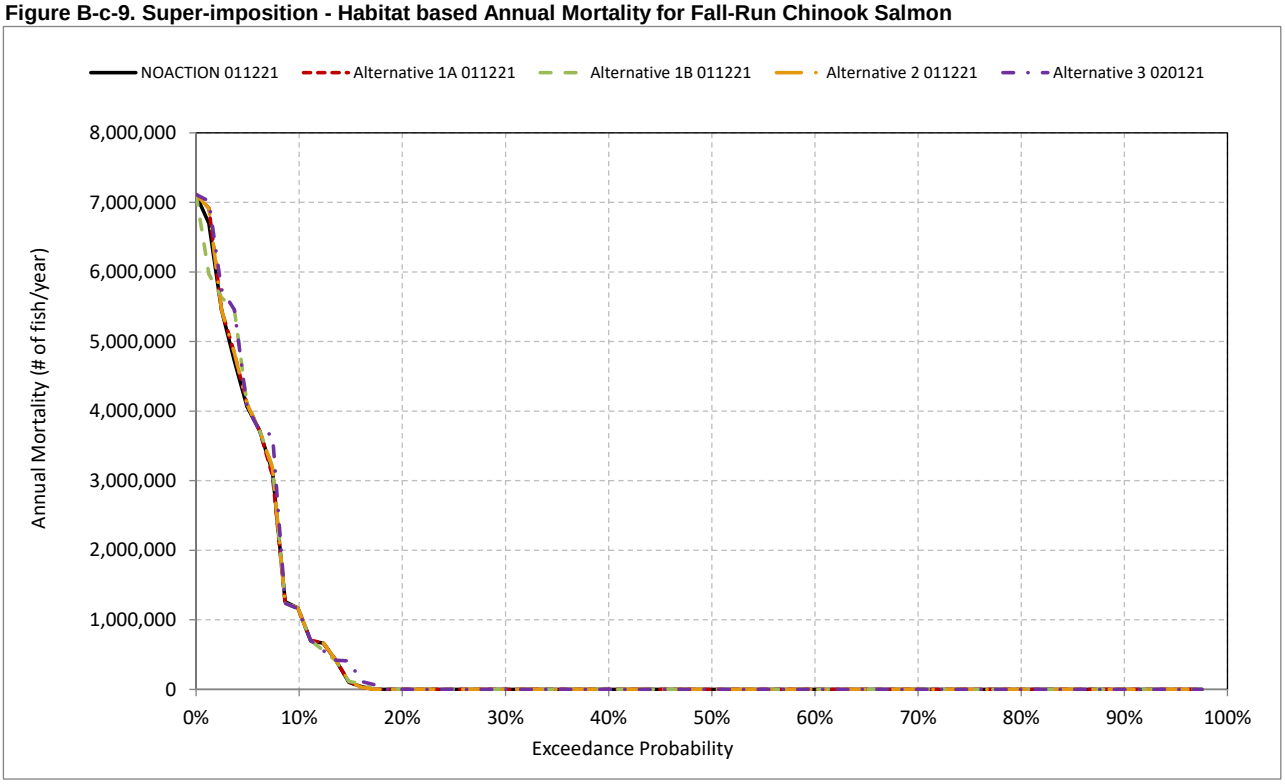


Figure B-c-10. Fry - Habitat based Annual Mortality for Fall-Run Chinook Salmon

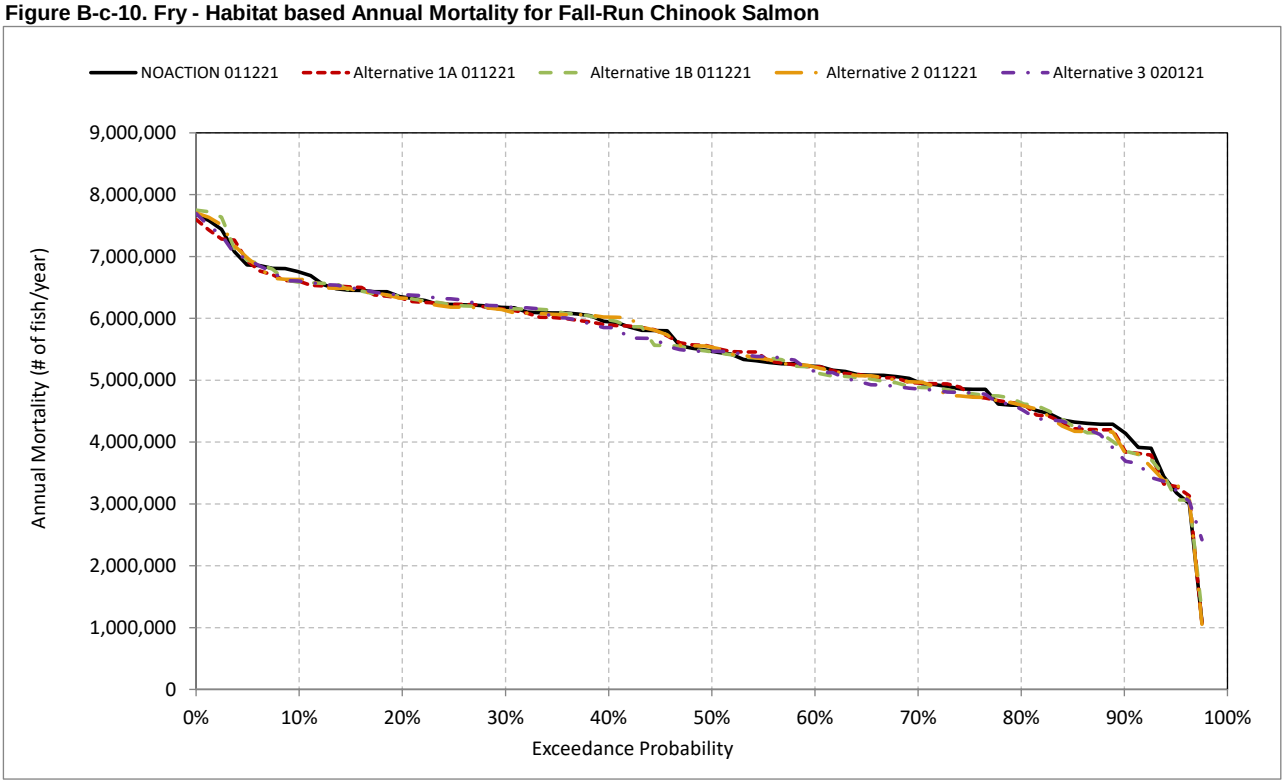


Figure B-c-11. Pre-smolt - Habitat based Annual Mortality for Fall-Run Chinook Salmon

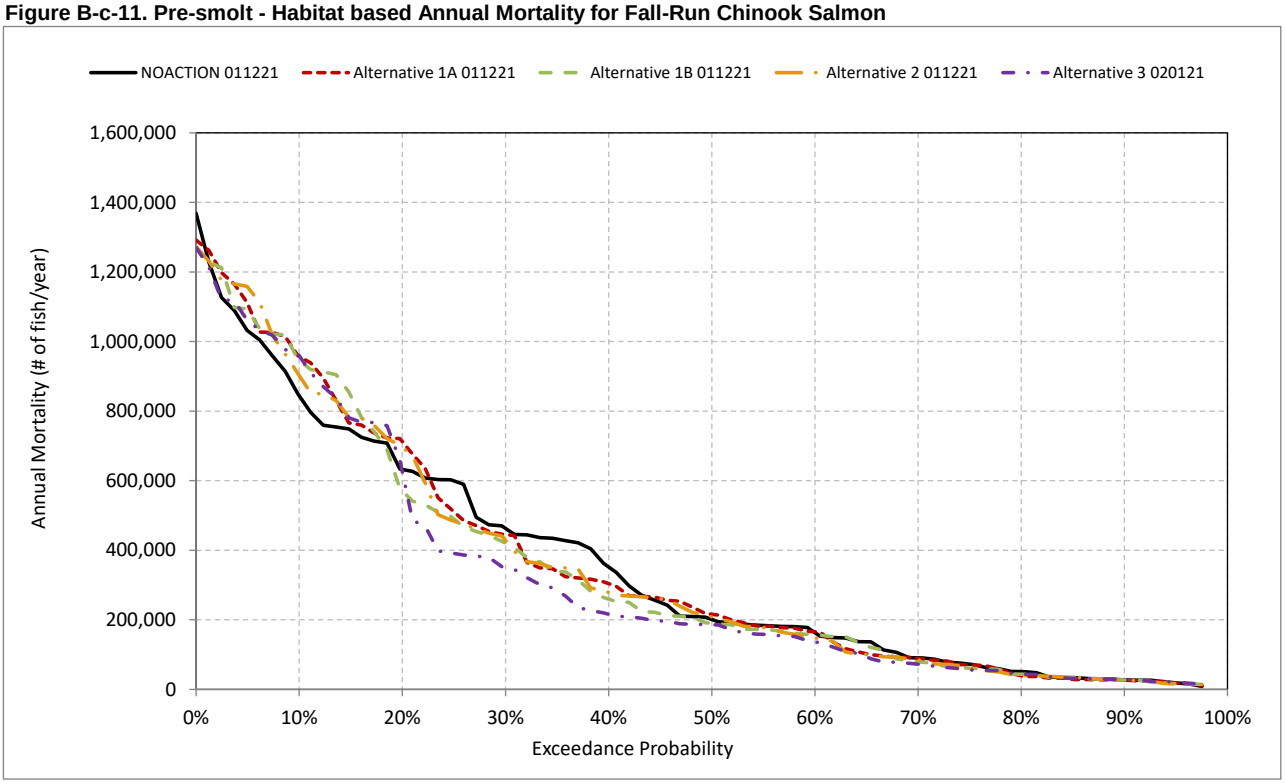


Figure B-c-12. Immature Smolt - Habitat based Annual Mortality for Fall-Run Chinook Salmon

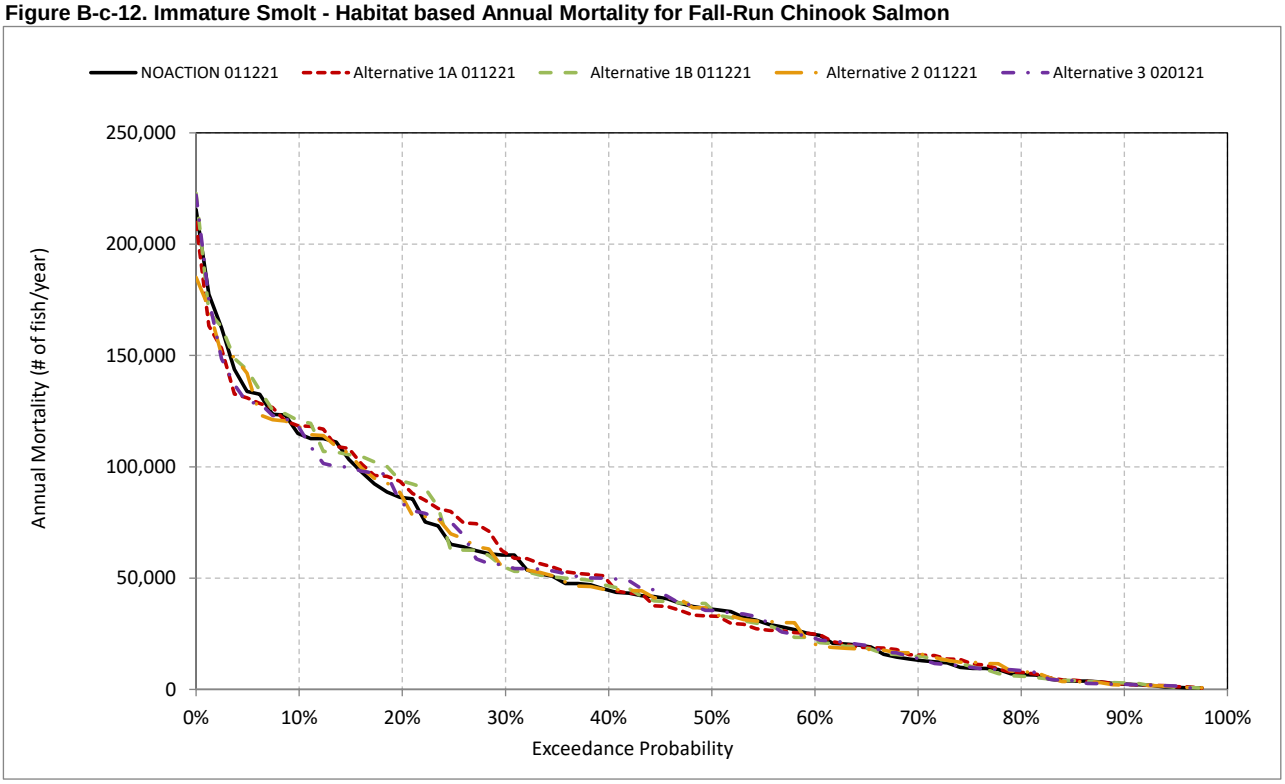


Figure B-c-13. Total Habitat based Annual Mortality for Fall-Run Chinook Salmon

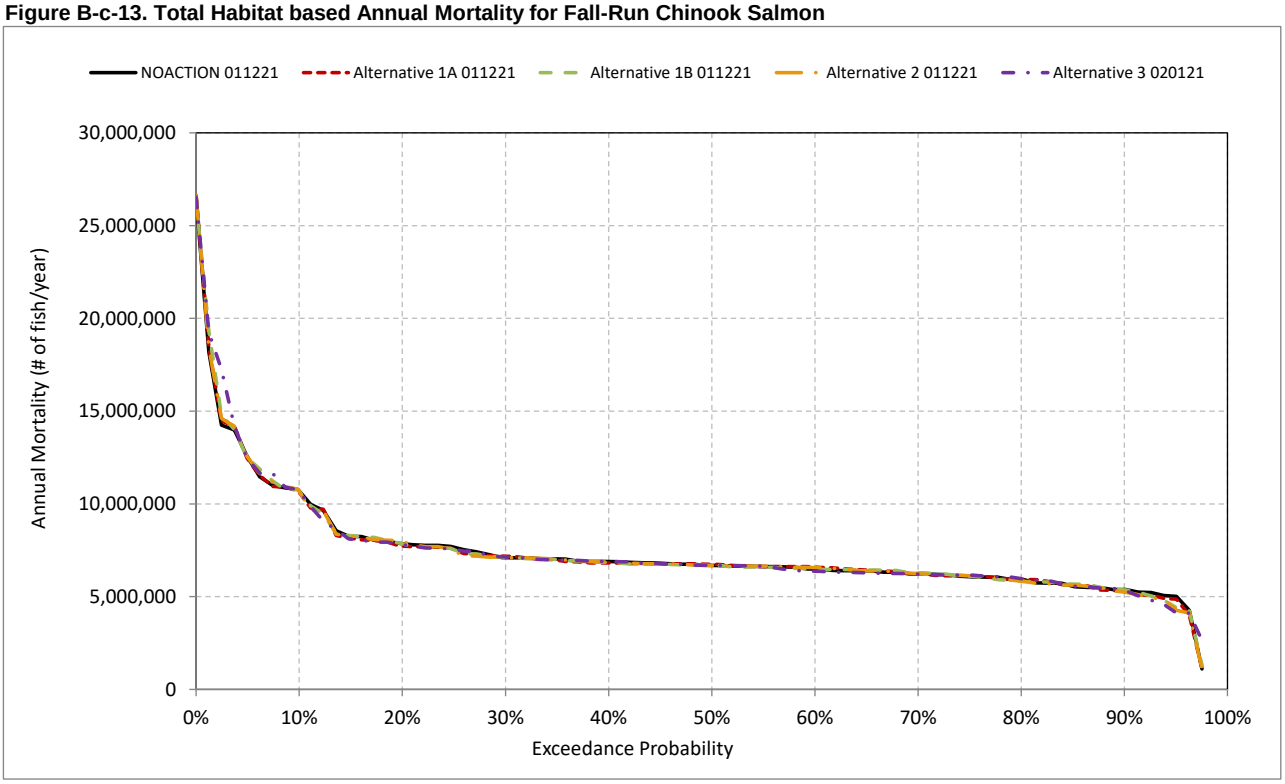


Figure B-c-14. Pre-Spawn Mortality - Temperature based Annual Mortality for Fall-Run Chinook Salmon

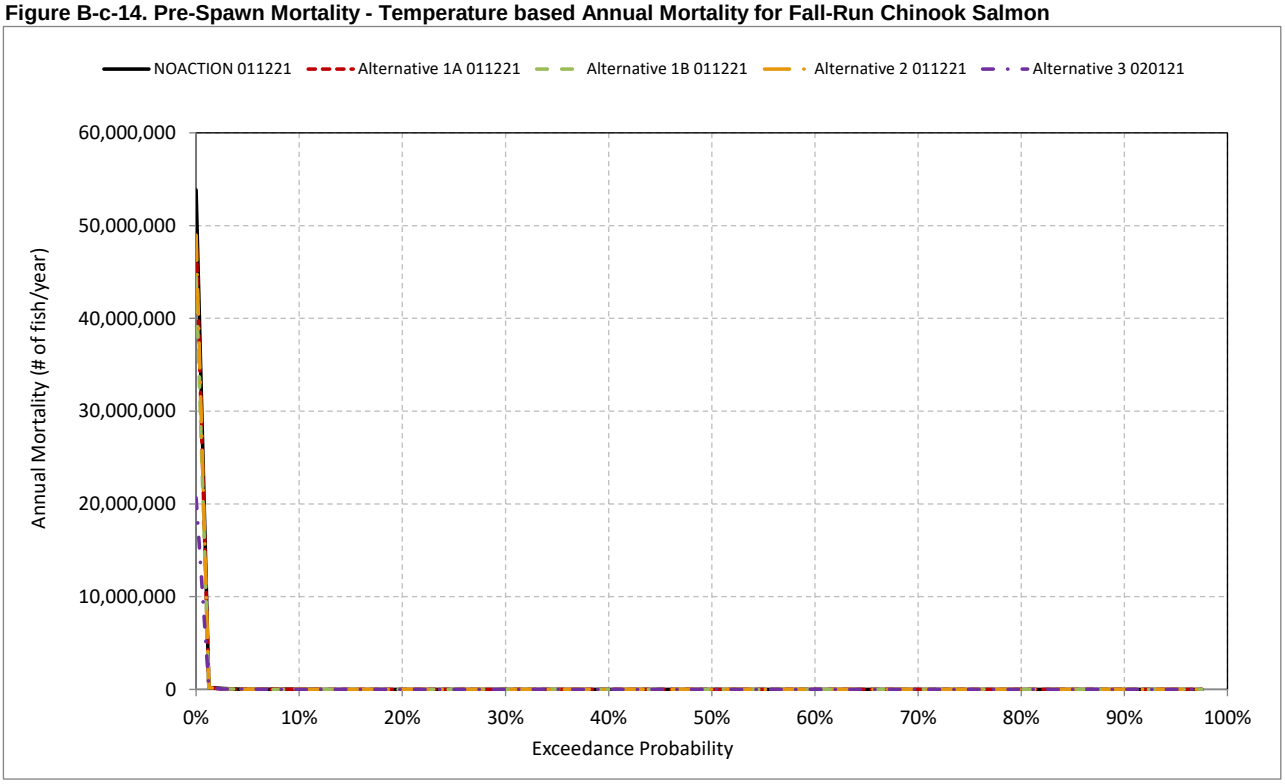


Figure B-c-15. Eggs - Temperature based Annual Mortality for Fall-Run Chinook Salmon

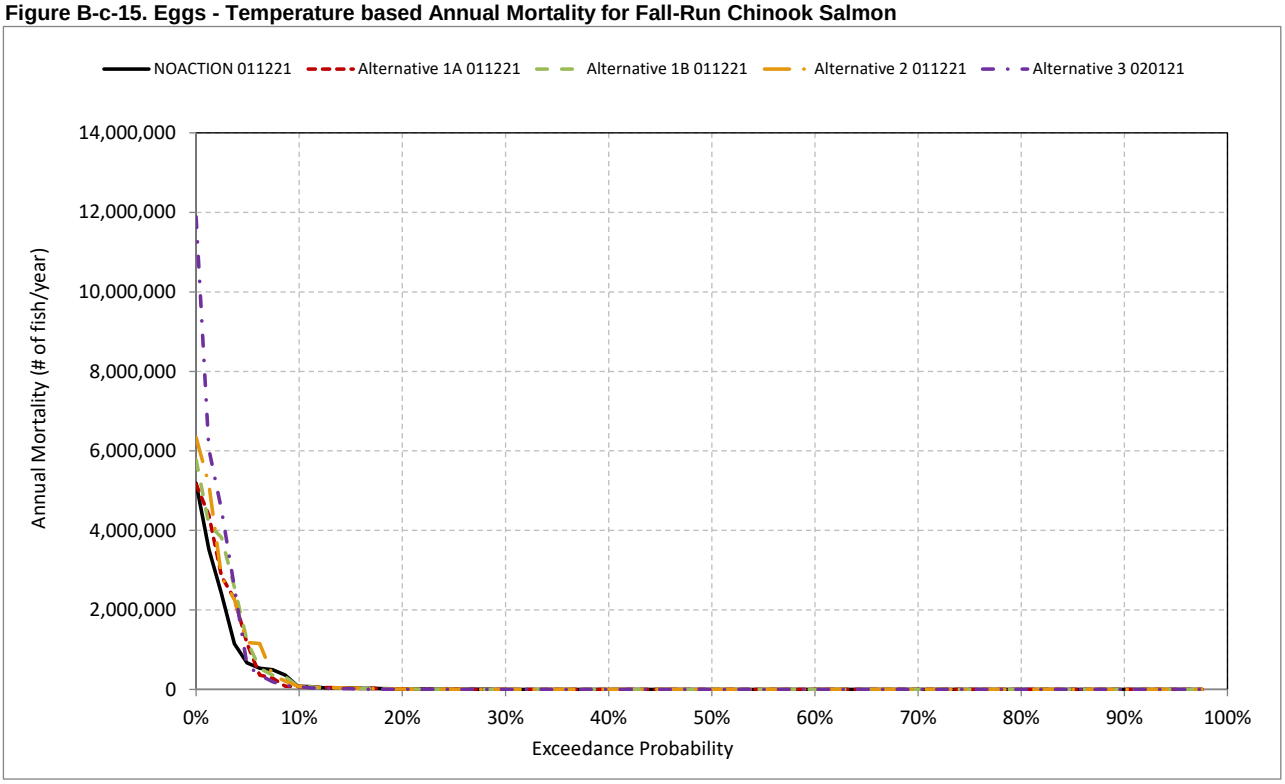


Figure B-c-16. Fry - Temperature based Annual Mortality for Fall-Run Chinook Salmon

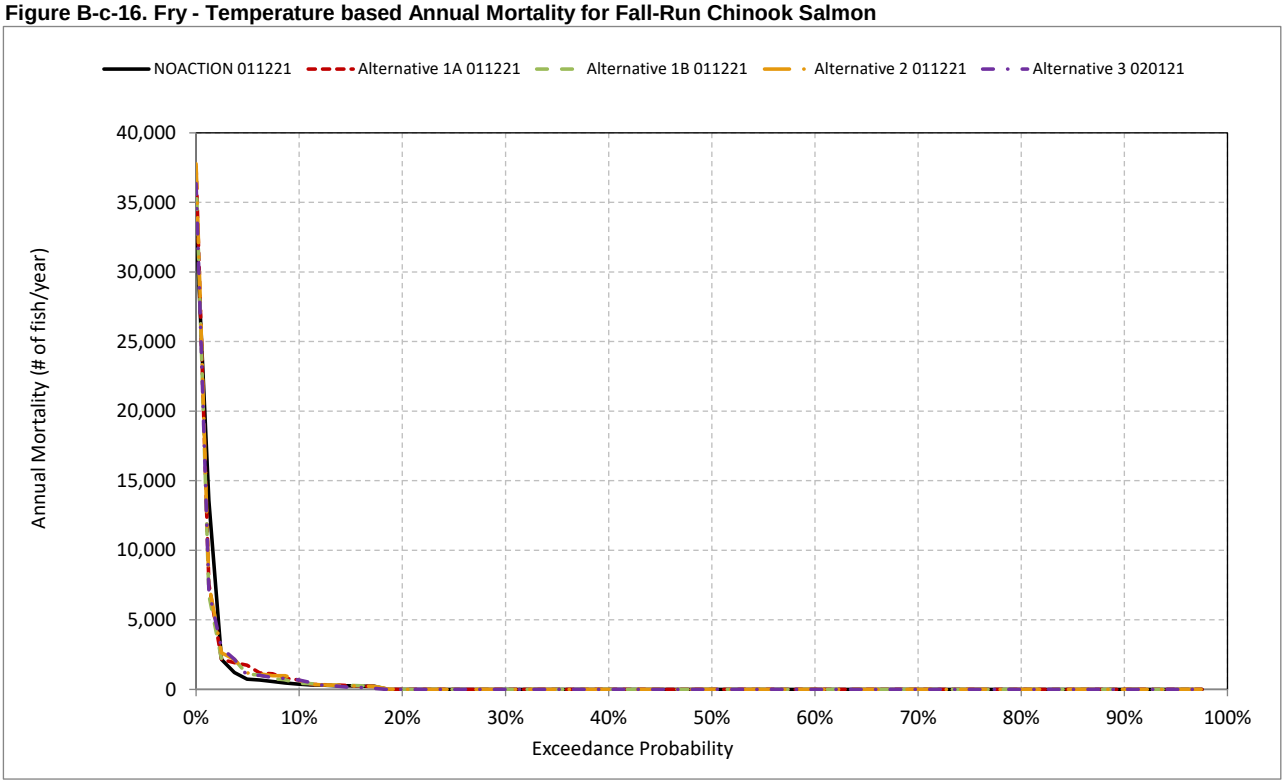


Figure B-c-17. Pre-smolt - Temperature based Annual Mortality for Fall-Run Chinook Salmon

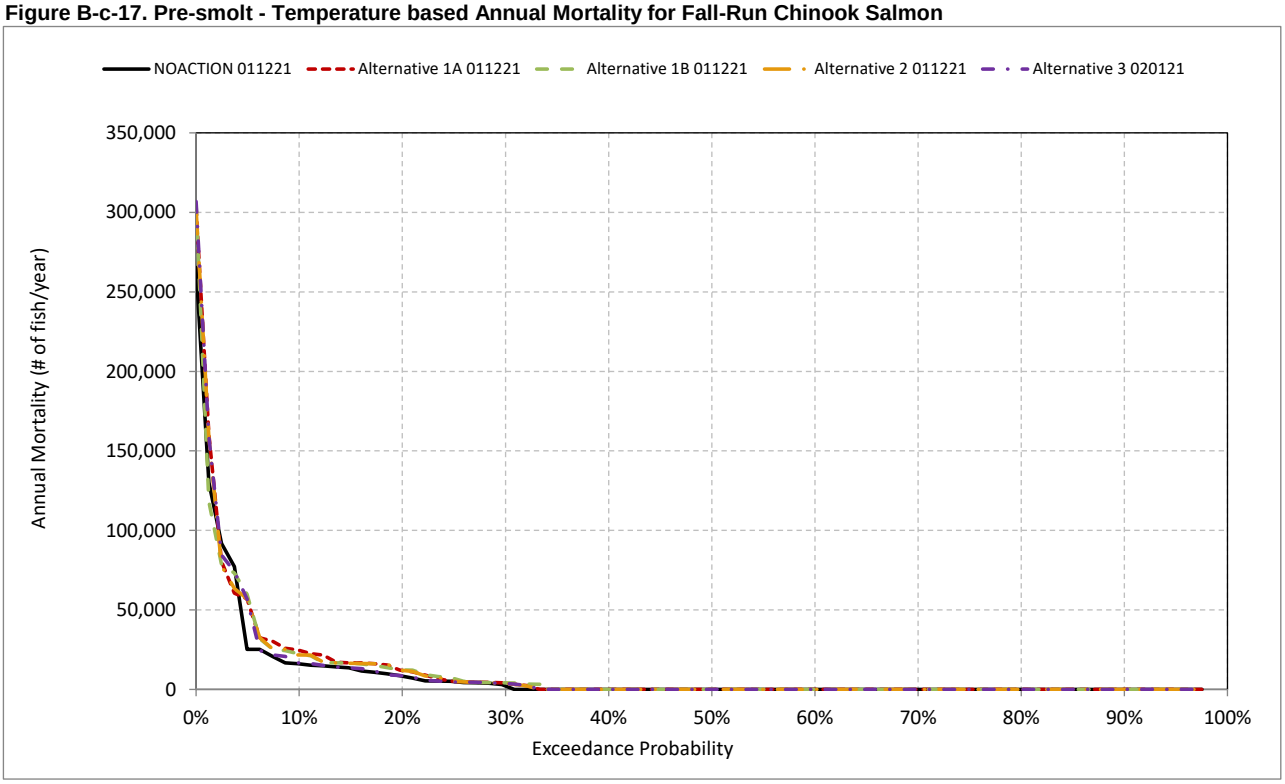


Figure B-c-18. Immature Smolt - Temperature based Annual Mortality for Fall-Run Chinook Salmon

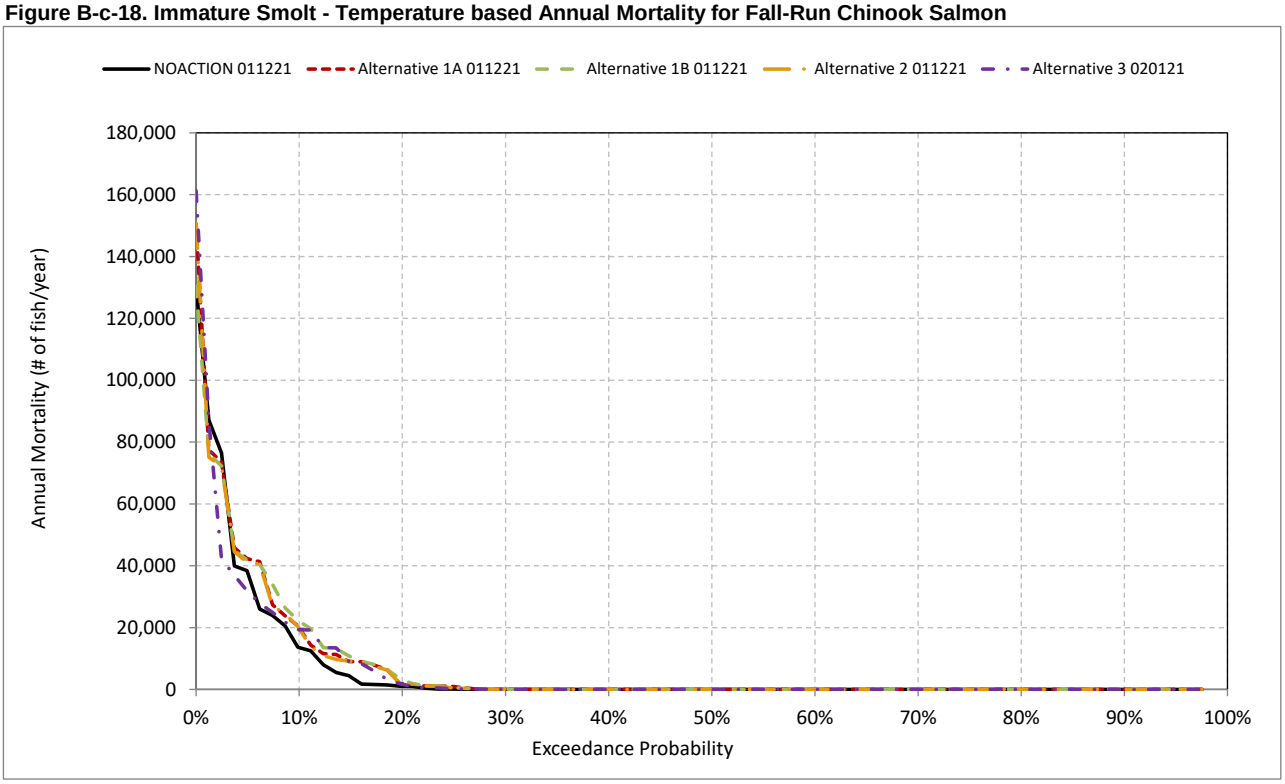


Figure B-c-19. Total Temperature based Annual Mortality for Fall-Run Chinook Salmon

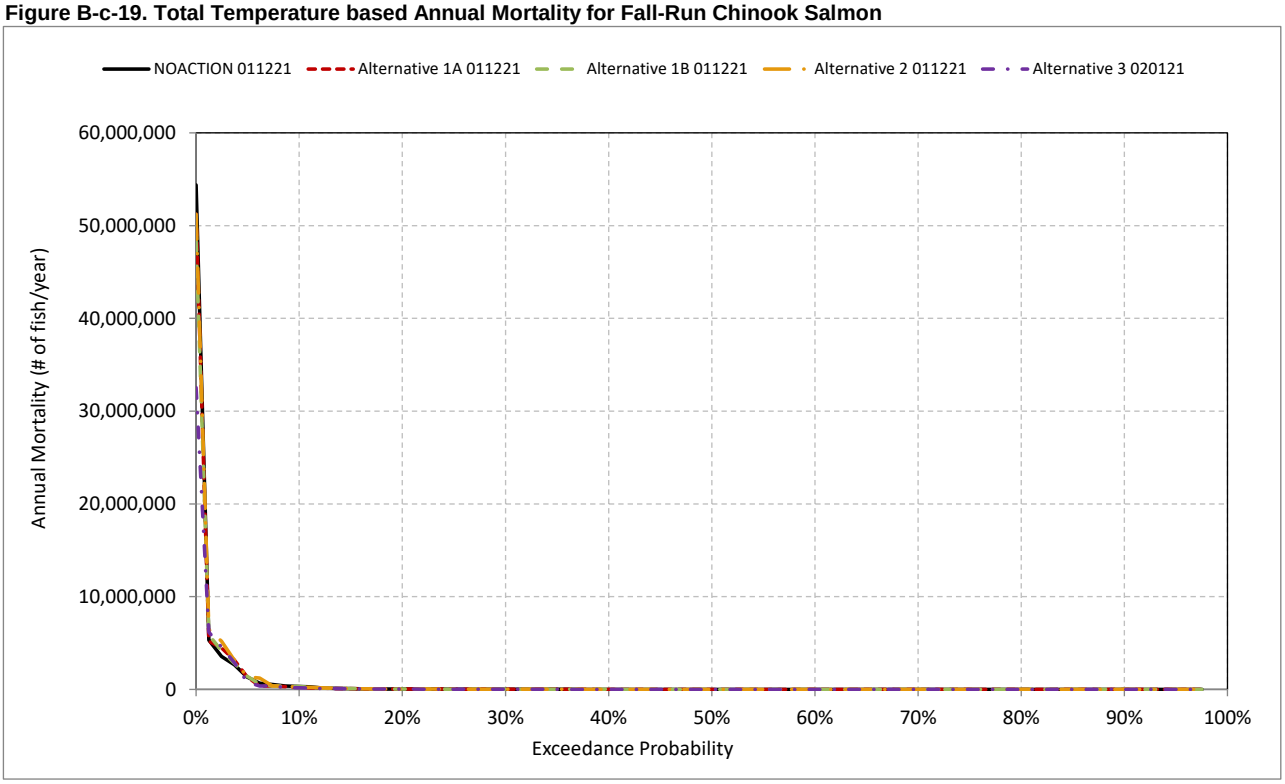


Figure B-d-1. Annual Potential Production for Late Fall-Run Chinook Salmon

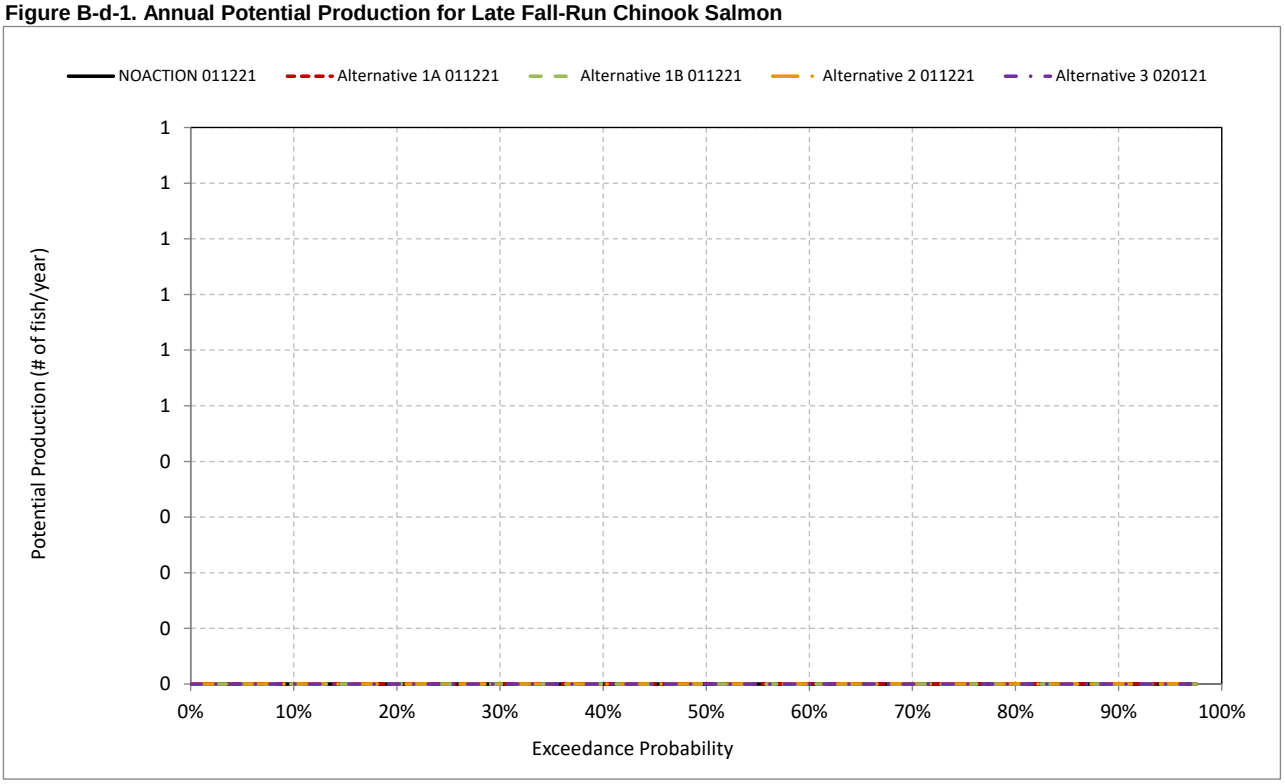


Figure B-d-2. Annual Mortality for Late Fall-Run Chinook Salmon - Eggs

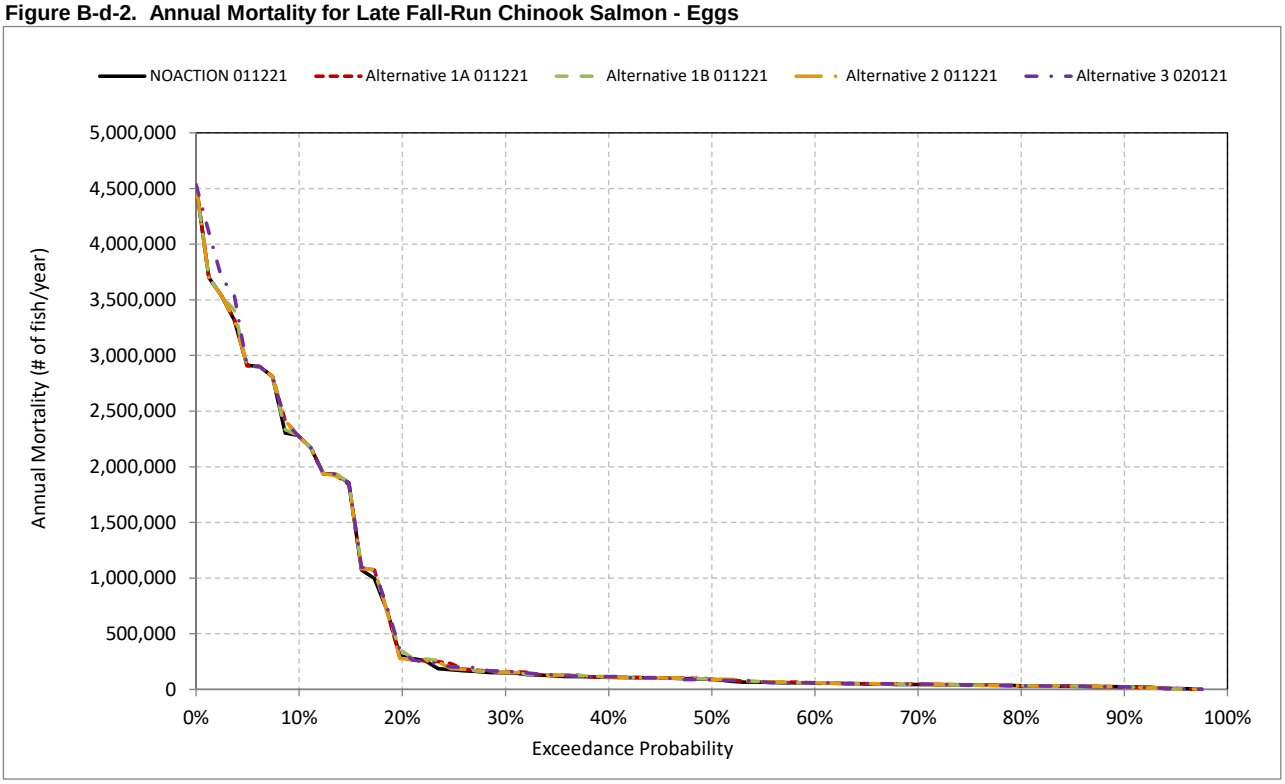


Figure B-d-3. Annual Mortality for Late Fall-Run Chinook Salmon - Fry

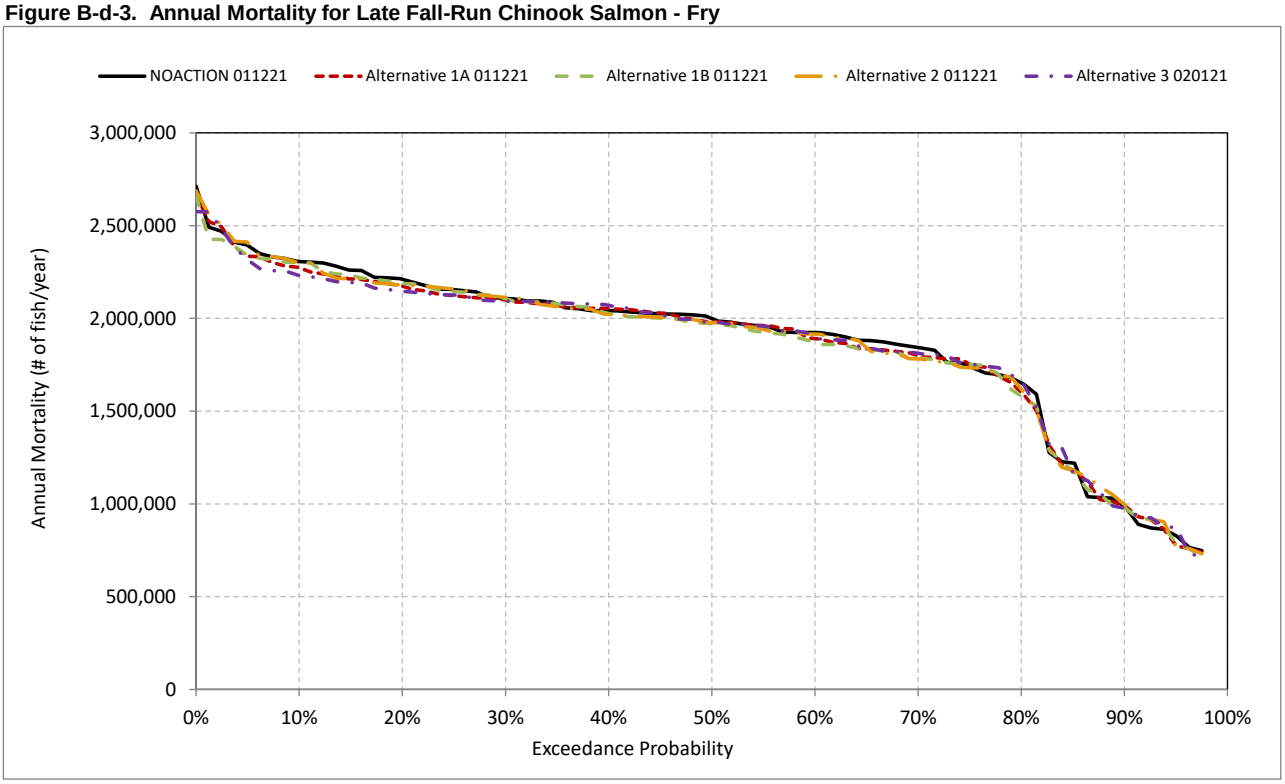


Figure B-d-4. Annual Mortality for Late Fall-Run Chinook Salmon - Pre-Smolt

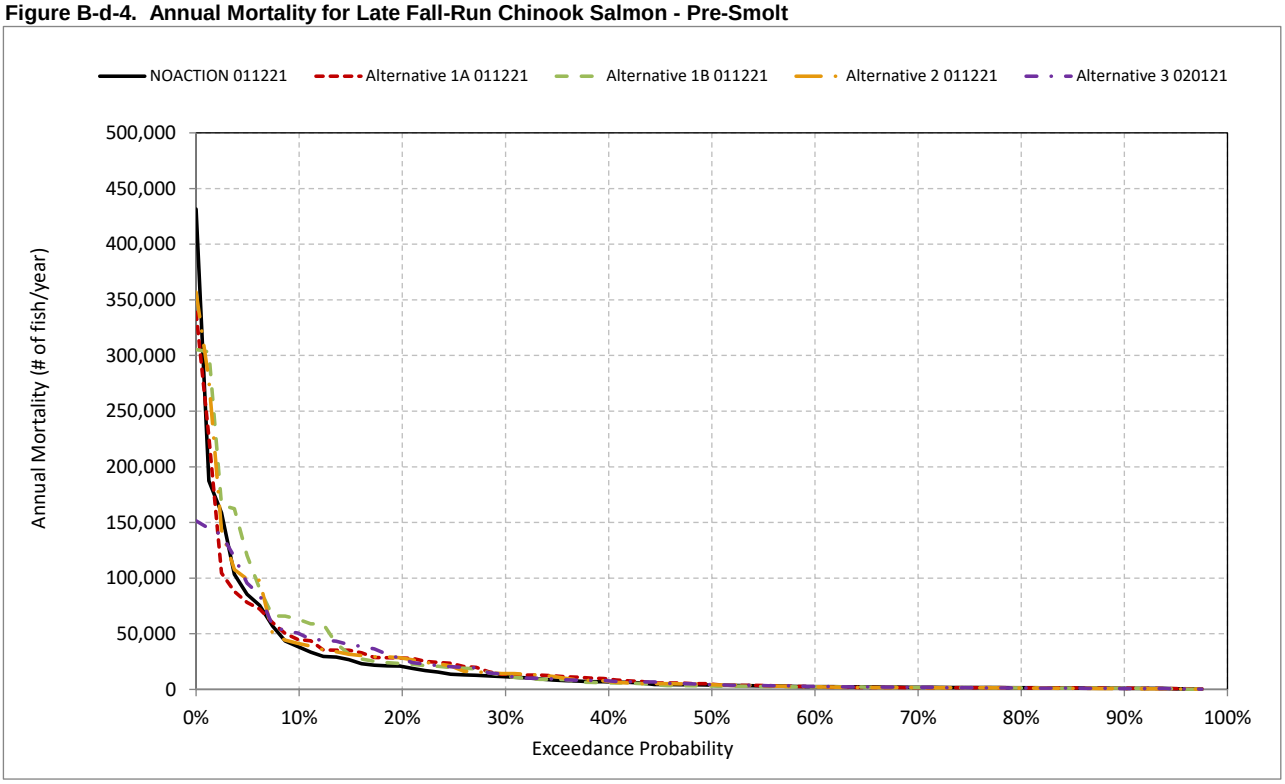


Figure B-d-5. Annual Mortality for Late Fall-Run Chinook Salmon - Immature Smolt

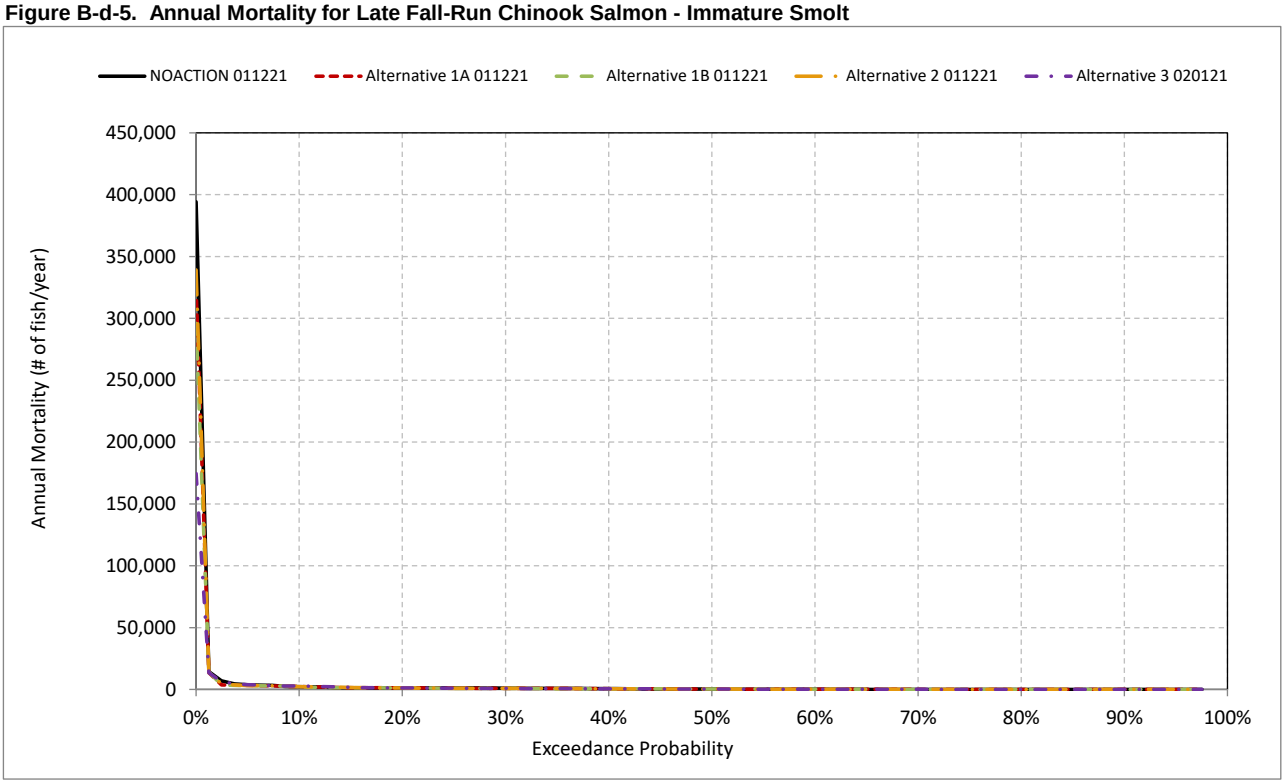


Figure B-d-6. Annual Mortality for Late Fall-Run Chinook Salmon - Pre- & Immature Smolts

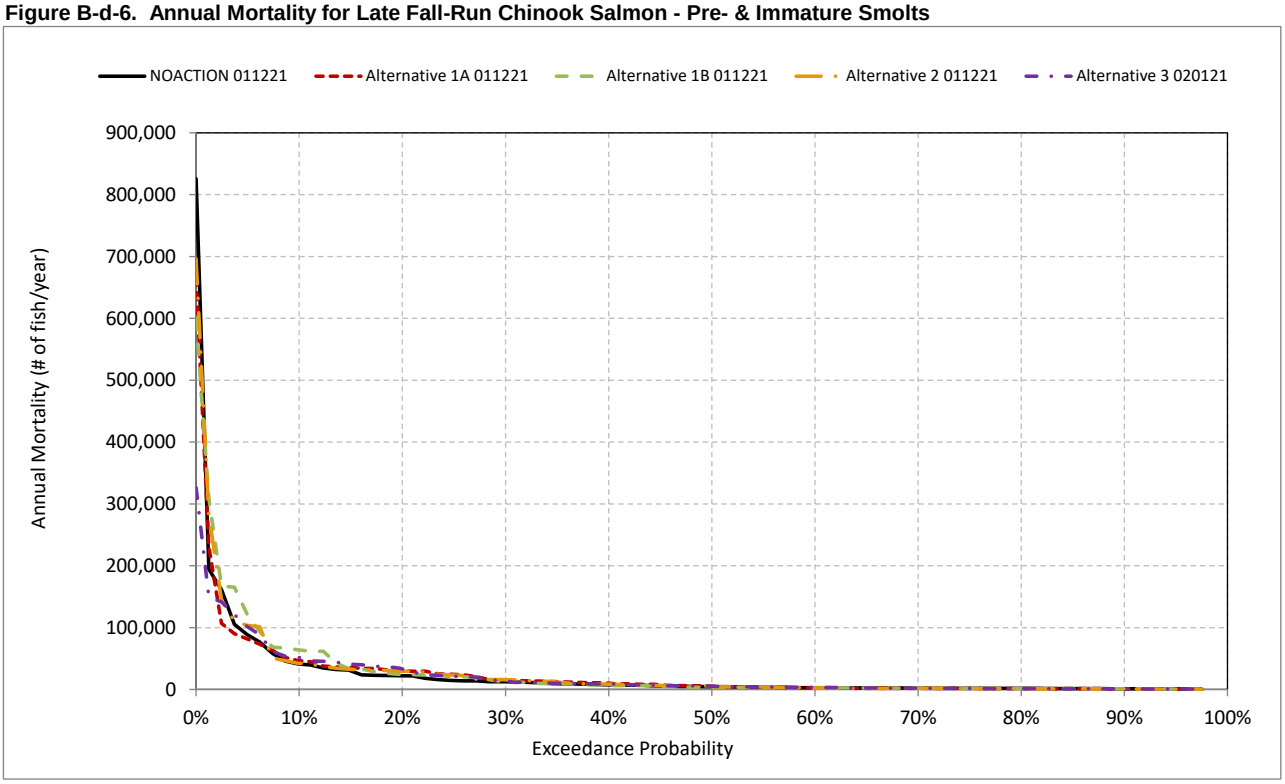


Figure B-d-7. Annual Mortality for Late Fall-Run Chinook Salmon - All Lifestages

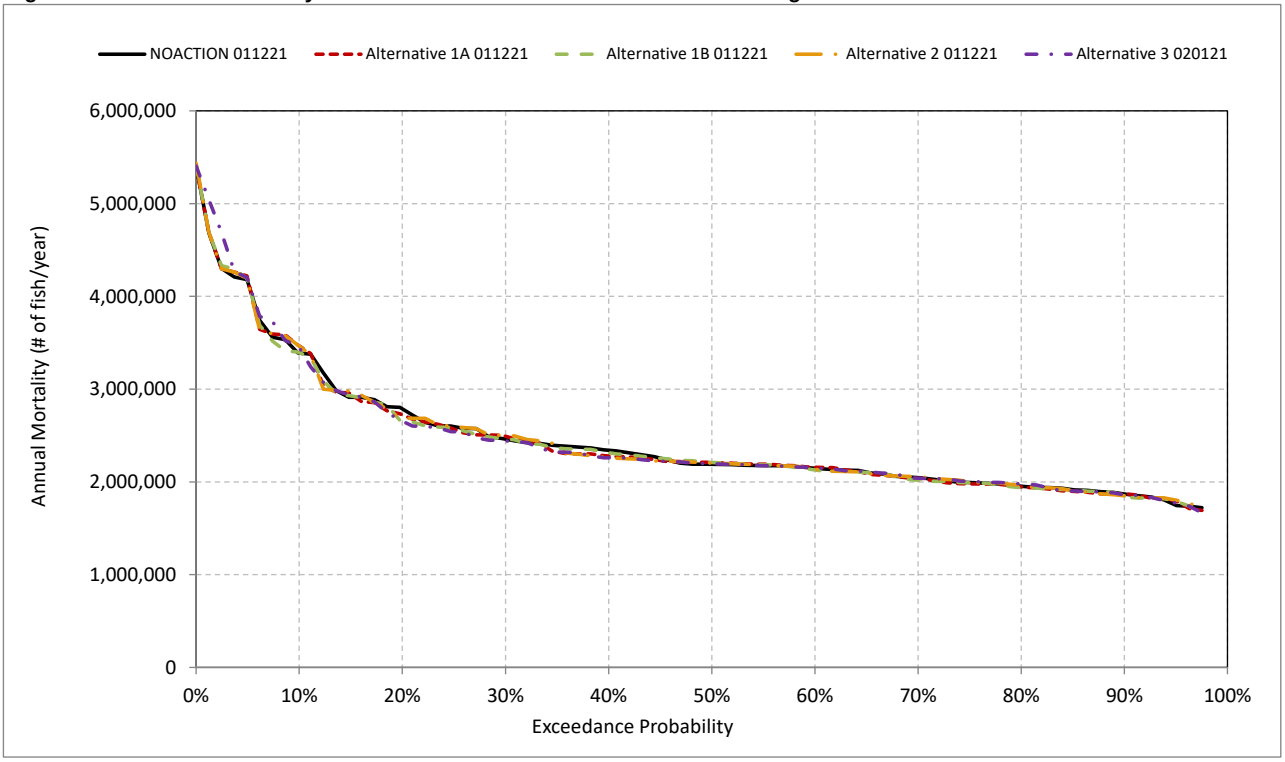


Figure B-d-8. Incubation - Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

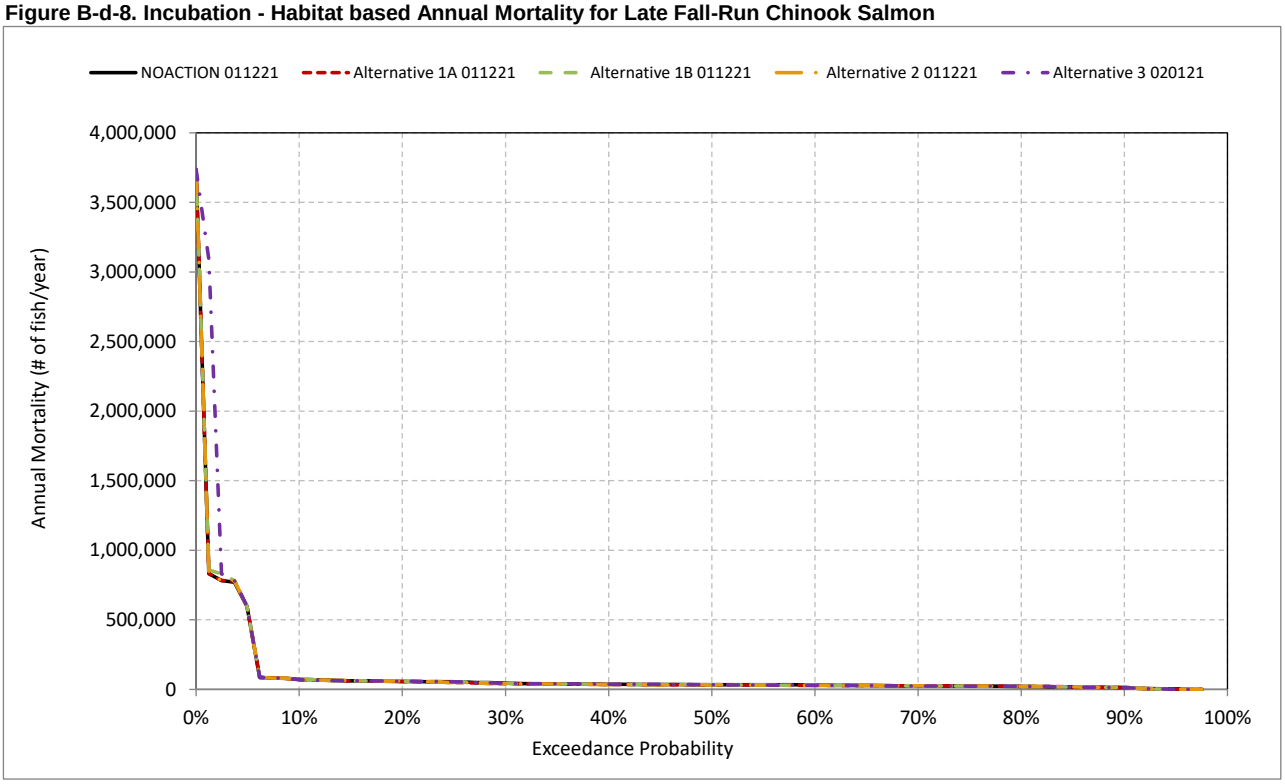


Figure B-d-9. Super-imposition - Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

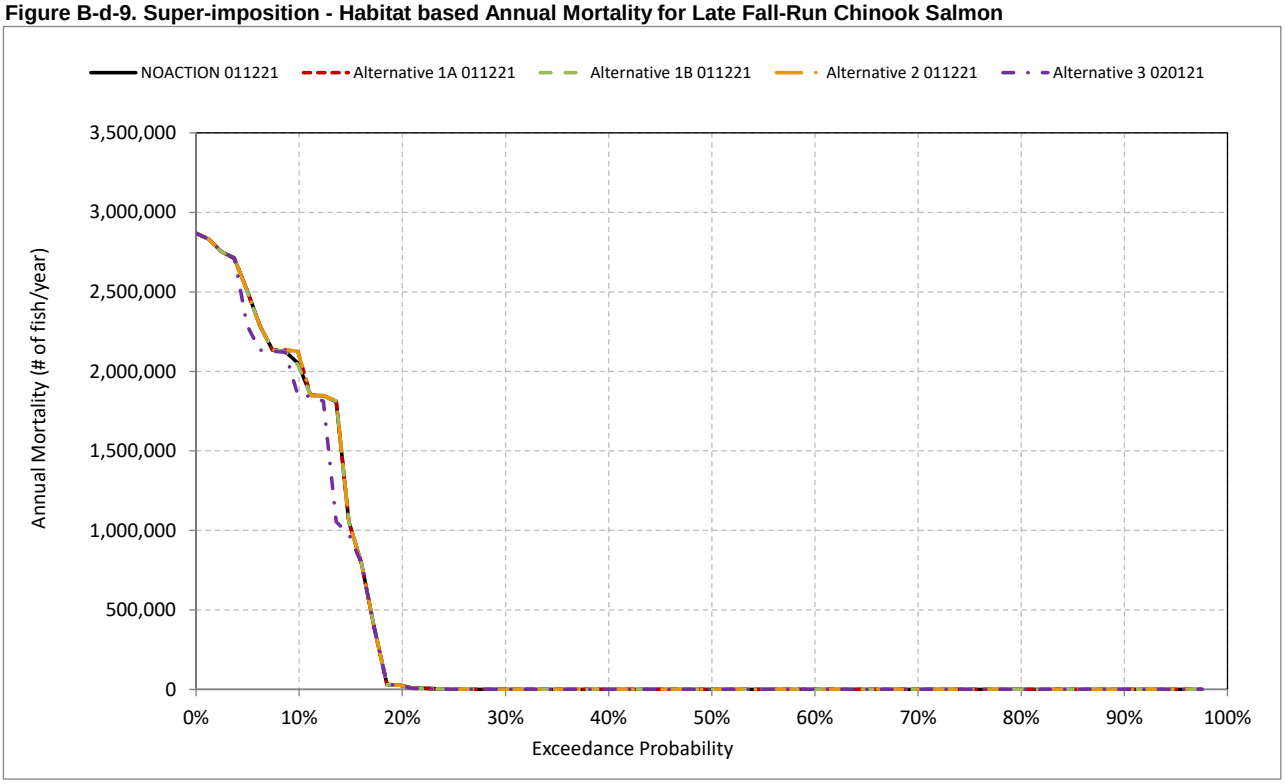


Figure B-d-10. Fry - Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

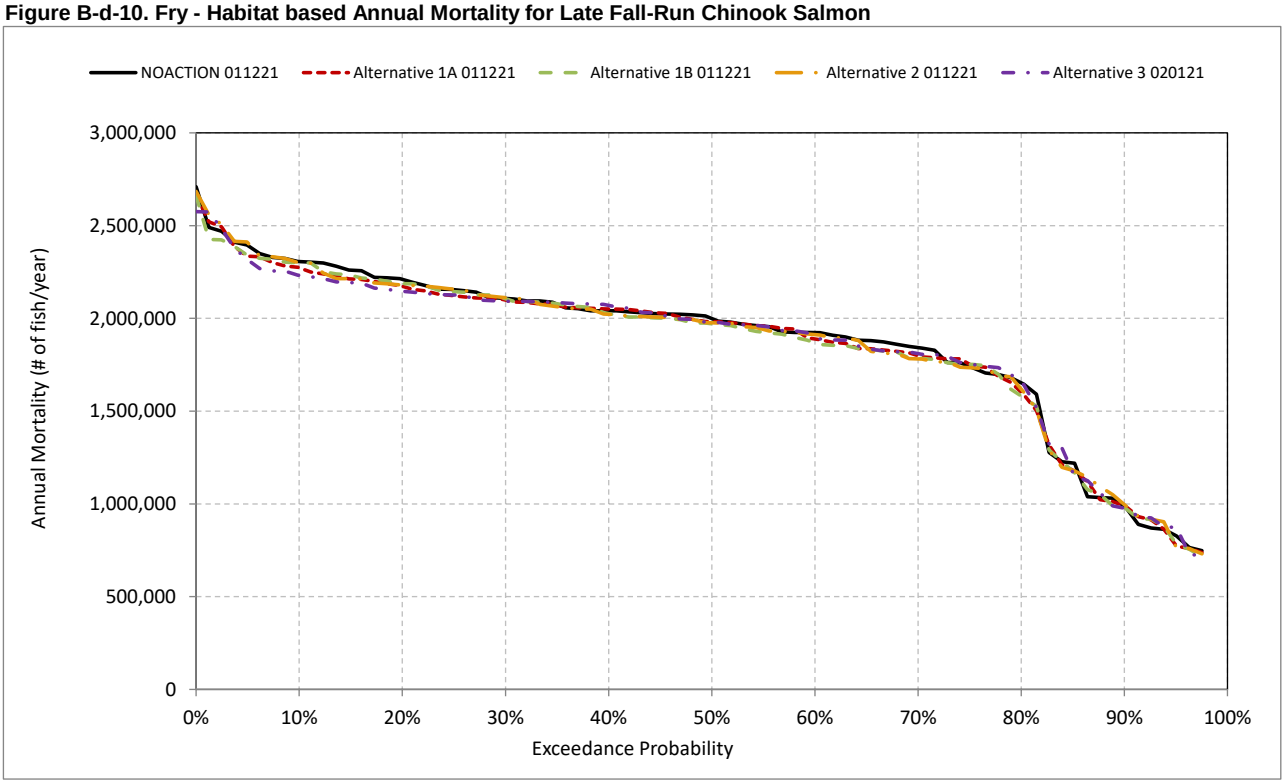


Figure B-d-11. Pre-smolt - Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

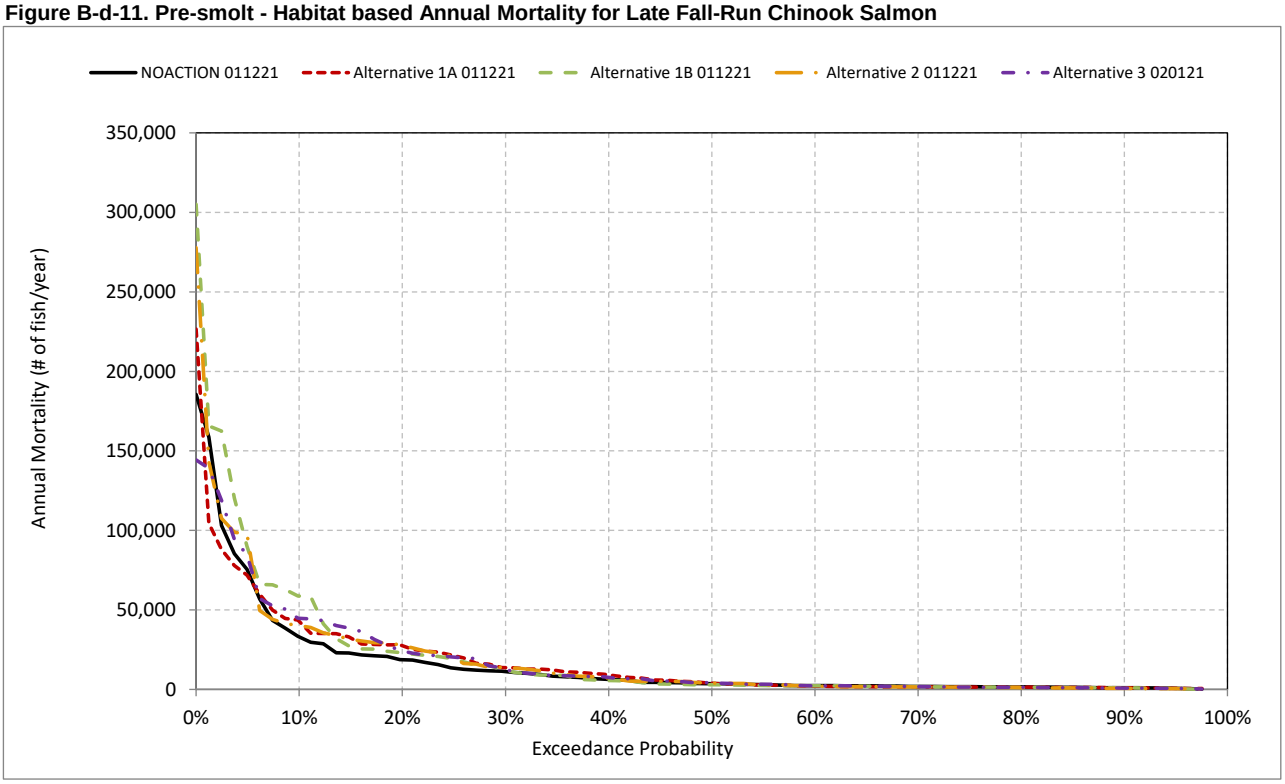


Figure B-d-12. Immature Smolt - Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

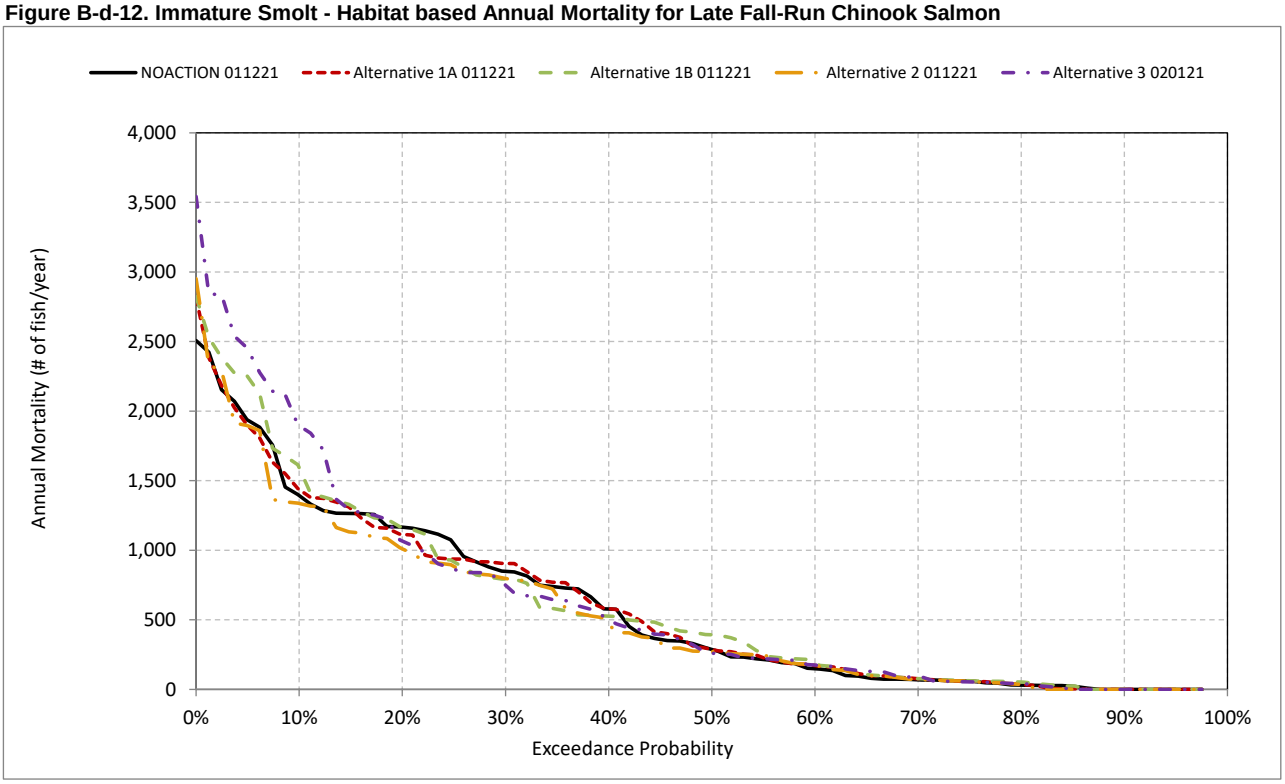


Figure B-d-13. Total Habitat based Annual Mortality for Late Fall-Run Chinook Salmon

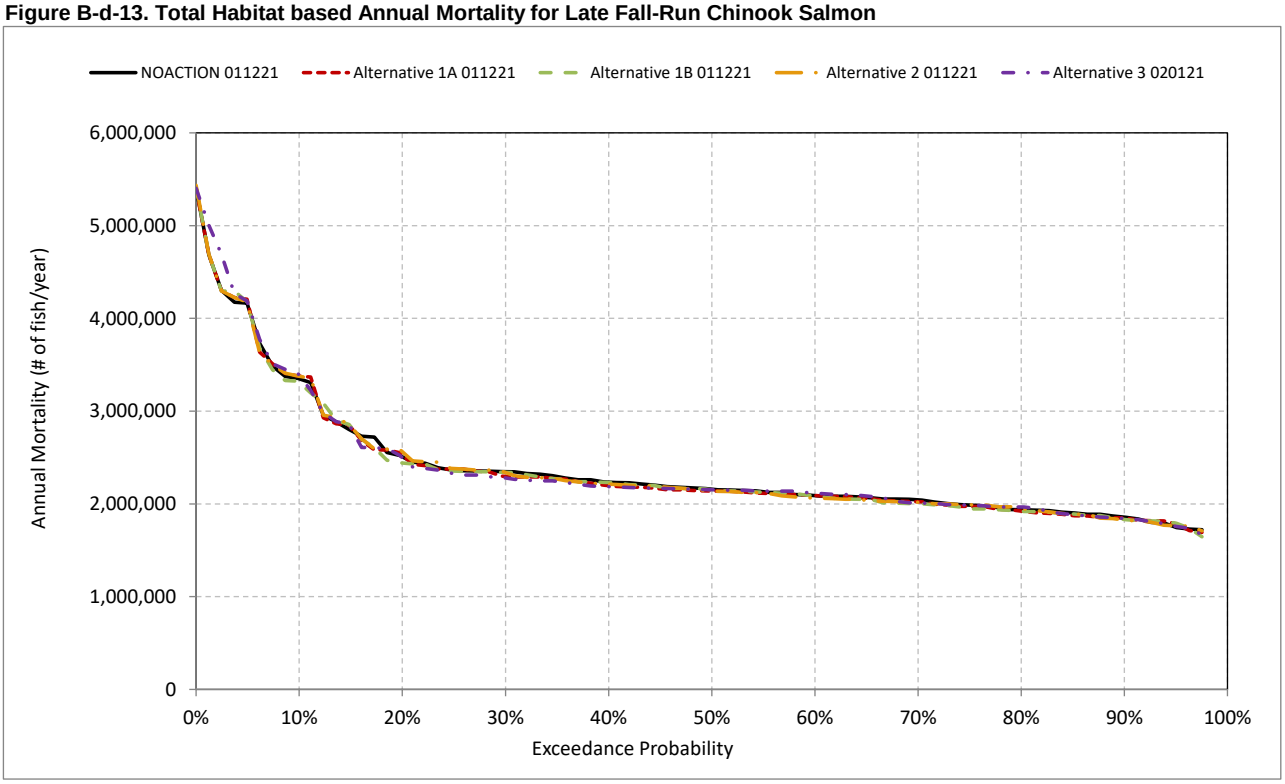


Figure B-d-14. Pre-Spawn Mortality - Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

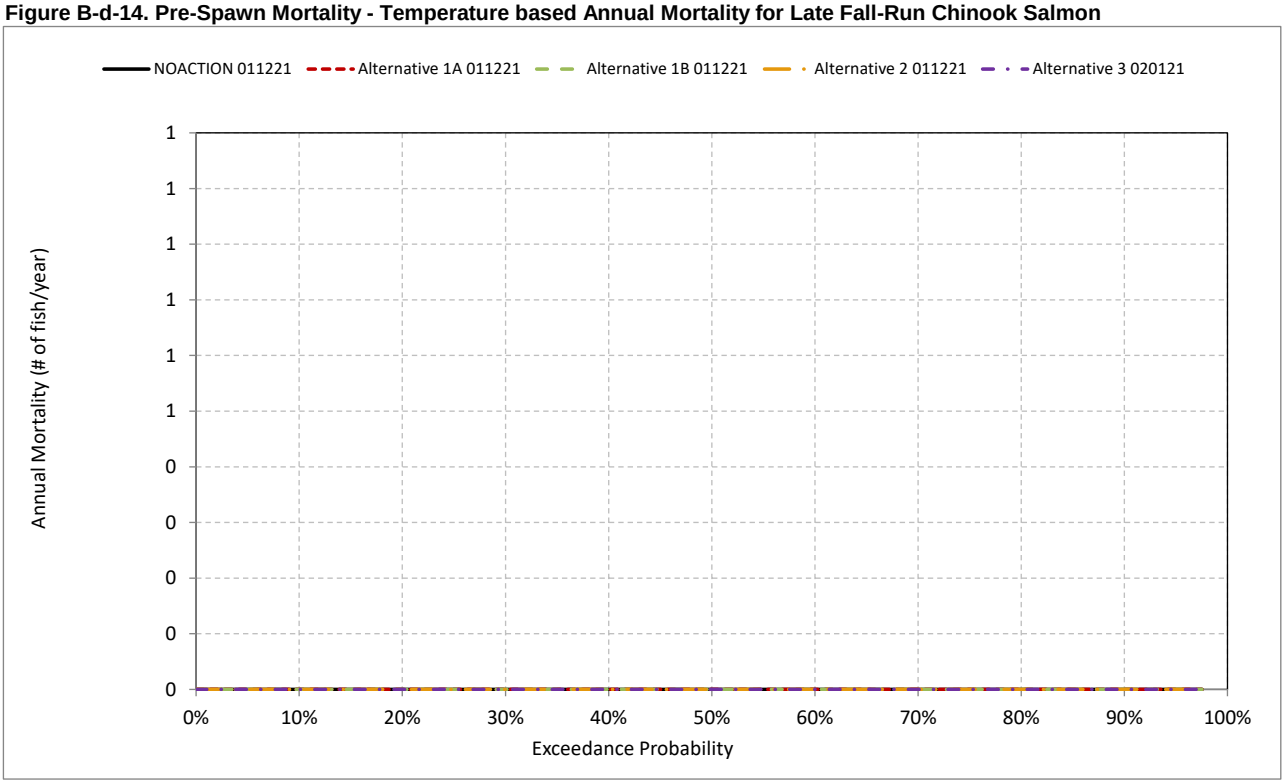


Figure B-d-15. Eggs - Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

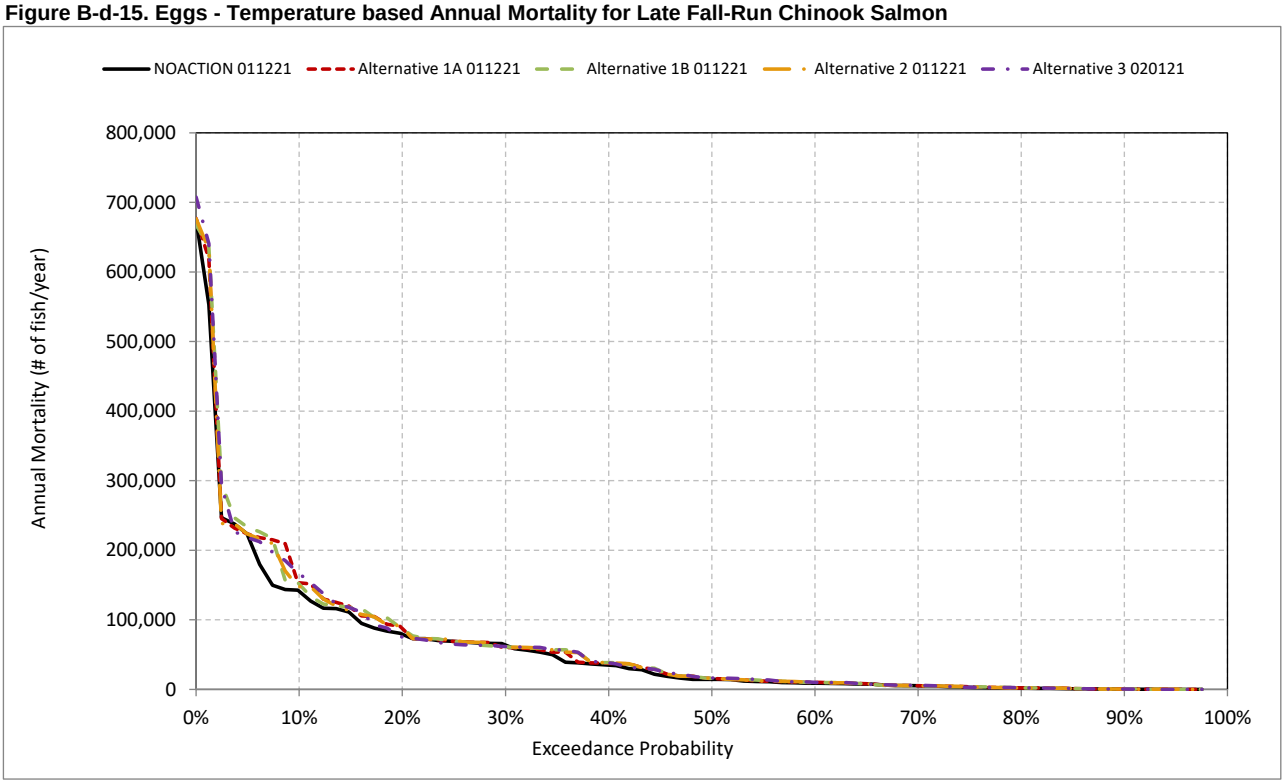


Figure B-d-16. Fry - Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

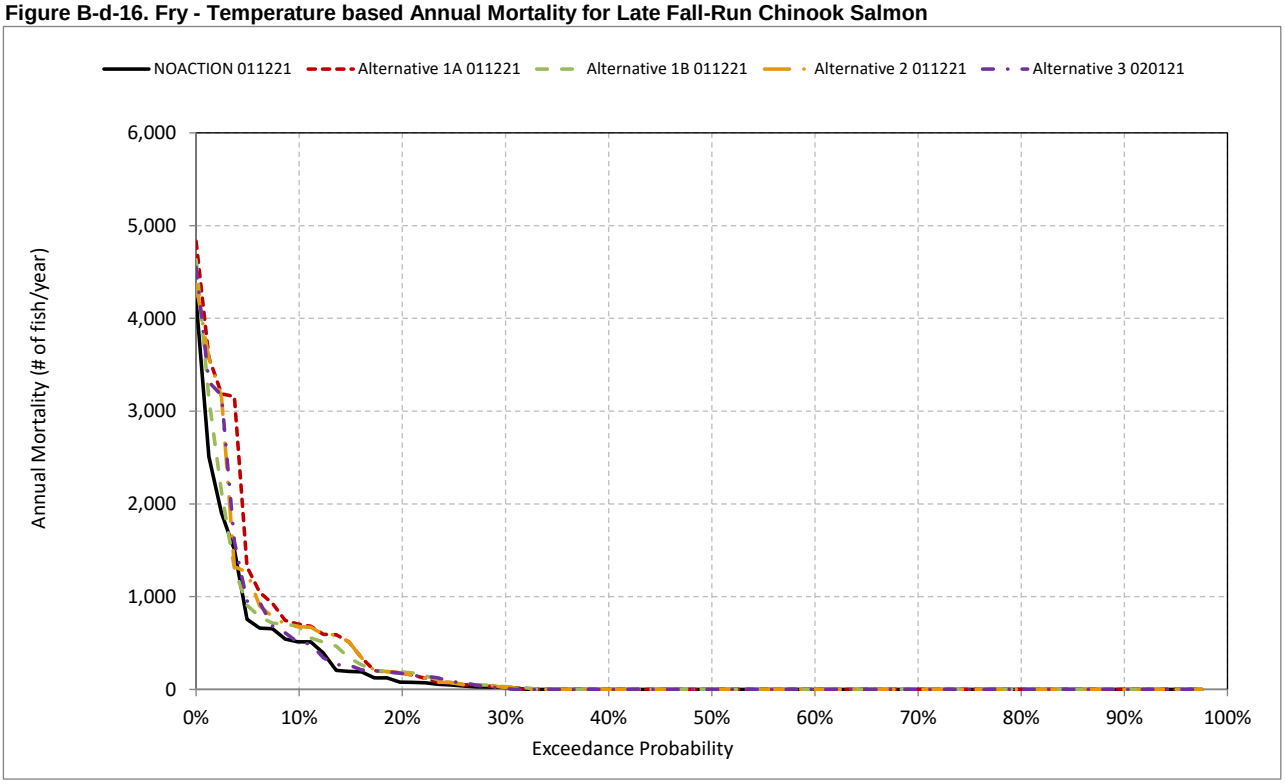


Figure B-d-17. Pre-smolt - Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

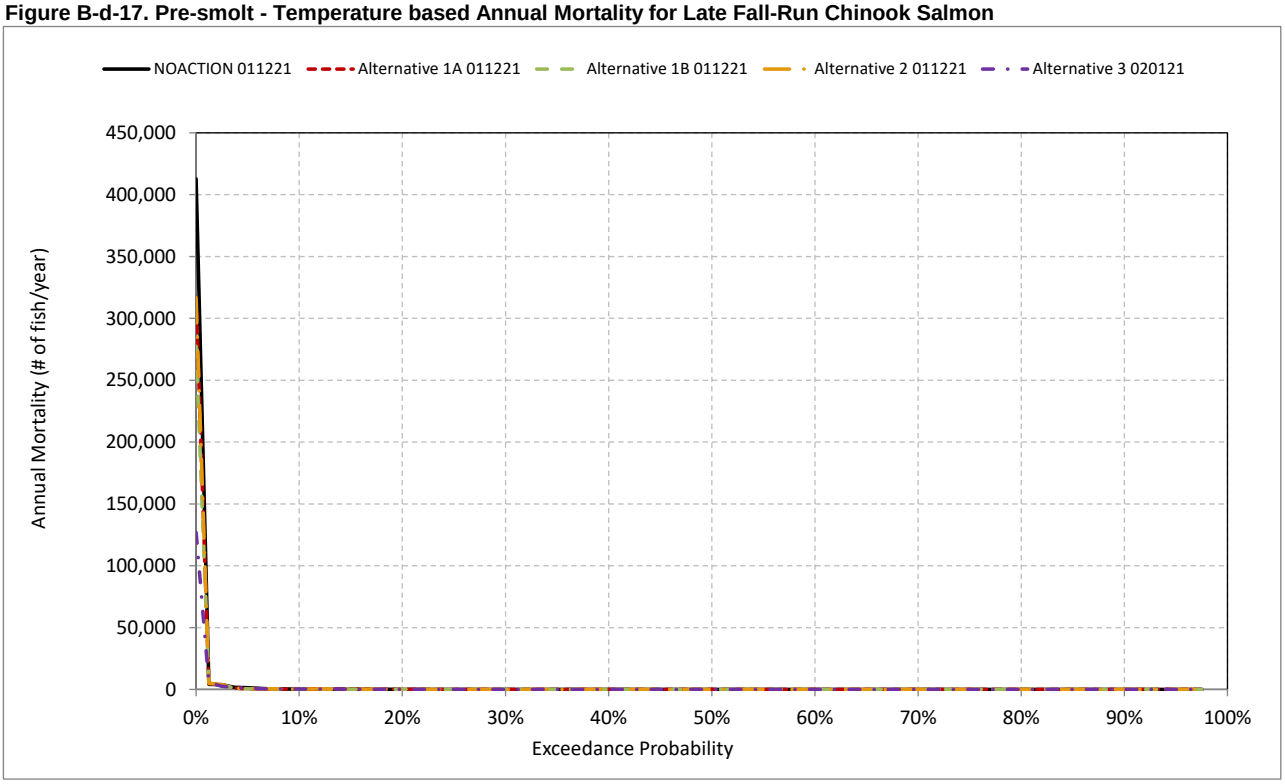


Figure B-d-18. Immature Smolt - Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

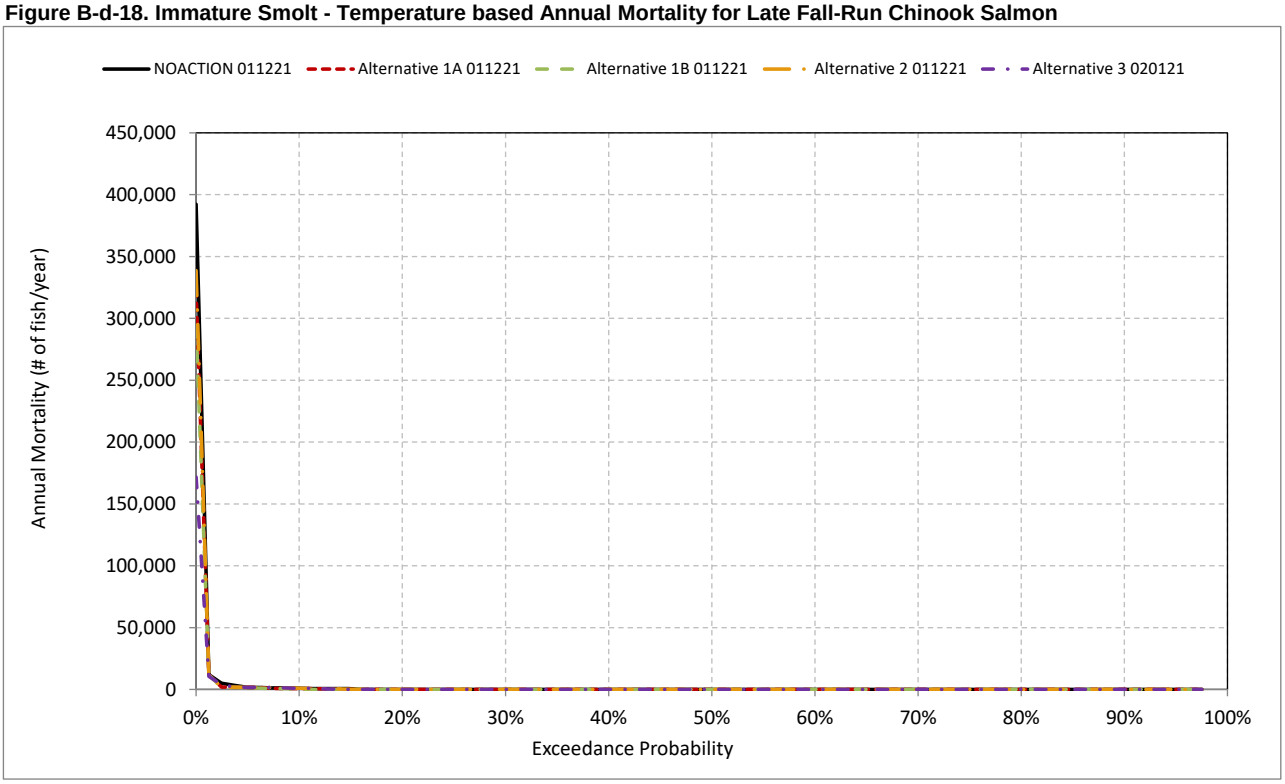


Figure B-d-19. Total Temperature based Annual Mortality for Late Fall-Run Chinook Salmon

