Appendix AB-I, Old and Middle River Flow Management

Attachment I.6 Delta Passage Model: A Simulation Model of Chinook Salmon Survival, Routing, and Travel Time in the Sacramento–San Joaquin Delta

I.6.1 Model Overview

The DPM simulates migration of Chinook salmon smolts entering the Delta from the Sacramento River, Mokelumne River, and San Joaquin River and estimates survival to Chipps Island. For this application, only survival of fish entering the Delta from the Sacramento River are evaluated. The DPM uses available time-series data and values taken from empirical studies or other sources to parameterize model relationships and inform uncertainty, thereby using the greatest amount of data available to dynamically simulate responses of smolt survival to changes in water management.

Survival estimates generated by the DPM are not intended to predict current or future outcomes. Instead, the DPM provides a simulation tool that compares the effects of different water management operations on smolt migration survival, with accompanying estimates of uncertainty. It is possible that underlying relationships (e.g., flow-survival) that are used to inform the DPM will change in the future; there is an assumption these basic relationships are static to allow scenarios to be compared for the current analysis, recognizing that it may be necessary to re-examine the relationships as new information becomes available.

The major model functions in the DPM are as follows.

1. Delta Entry Timing, which models the temporal distribution of smolts entering the Delta for each race of Chinook salmon.
2. Fish Behavior at Junctions, which models fish movement as they approach river junctions.
3. Migration Speed, which models reach-specific smolt migration speed and travel time.

4. Route-Specific Survival, which models route-specific survival response to non-flow factors.
5. Flow-Dependent Survival, which models reach-specific survival response to flow.
6. Export-Dependent Survival, which models survival response to water export levels in the interior Delta reach (see Table I.6-1 for reach description).

I.6.2 Model Development

I.6.2.1 Methods

I.6.2.2 Model Timestep

The DPM operates on a daily timestep using simulated daily average flows and south 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 one day, not three-dimensional movements occurring over minutes or hours (e.g., Blake and Horn 2003). It is acknowledged that finer scale modeling with a shorter timestep may match the biological processes governing fish movement better than a daily timestep (e.g., because of diel activity patterns; Plumb et al. 2015) and that sub-daily differences in flow proportions into junctions make daily estimates somewhat coarse (Cavallo et al. 2015).

I.6.2.3 Spatial Framework

The DPM is composed of nine reaches and four junctions (Figure I.6-1; Table I.6-1) selected to represent primary salmonid migration corridors for fish originating from the Sacramento River basin where high-quality data were available for fish and hydrodynamics. For simplification, Sutter Slough and Steamboat Slough are combined as the reach "SS," and Georgiana Slough and the Delta Cross Channel (DCC) are a combined junction. Sacramento Chinook salmon that enter the DCC migrate through the Forks of the Mokelumne River, and fish entering Georgiana Slough migrate only through that route. The interior Delta reach can be entered from the Mokelumne River or Georgiana Slough route. The entire interior Delta region is treated as a single model reach. The three distributary junctions (channel splits) depicted in the DPM are (A) Sacramento River at Fremont 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 DCC (Figure I.6-1, Table I.6-1).

Table I.6-1. Description of Modeled Reaches and Junctions in the Delta Passage Model (Yolo and interior Delta reach lengths are not defined because multiple migration pathways are possible)

Reach/ Junction	Description	Approximate Reach Length (km)	Final Receiver name/location
Verona	Sacramento River between Fremont Weir and Freeport	57	Freeport
Sac_1	Sacramento River between Freeport and the combined junction of Steamboat and Sutter Slough	19	Sacramento River below Steamboat Slough
Sac_2	Sacramento River from Sutter/Steamboat Sloughs junction to junction with Delta Cross Channel/Georgiana Slough	11	Sacramento River below Georgiana Slough
Sac_3	Sacramento River from below Georgiana Slough to Rio Vista	16	Chipps Island
SS	Steamboat and Sutter Sloughs from their junction with the Sacramento River to Chipps Island	21	Chipps Island
Yolo Bypass	Fremont Weir to Highway 84 Ferry	NA	Highway 84 Ferry
Sac_4	Rio Vista to Chipps Island	30	Chipps Island
Geo/DCC	Georgiana Slough from the junction with the Sacramento River to the base of the Mokelumne River. Includes fish that migrate through the Mokelumne River via the Delta Cross Channel	25	Mokelumne Base
Interior Delta	Confluence of Mokelumne and San Joaquin Rivers to Chipps Island	NA	Chipps Island
A	Junction of Yolo Bypass and Sacramento River	NA	NA
B	Combined junction of Sutter Slough and Steamboat Slough with the Sacramento River	NA	NA
C	Combined junction of the Delta Cross Channel and Georgiana Slough with the Sacramento River	NA	NA

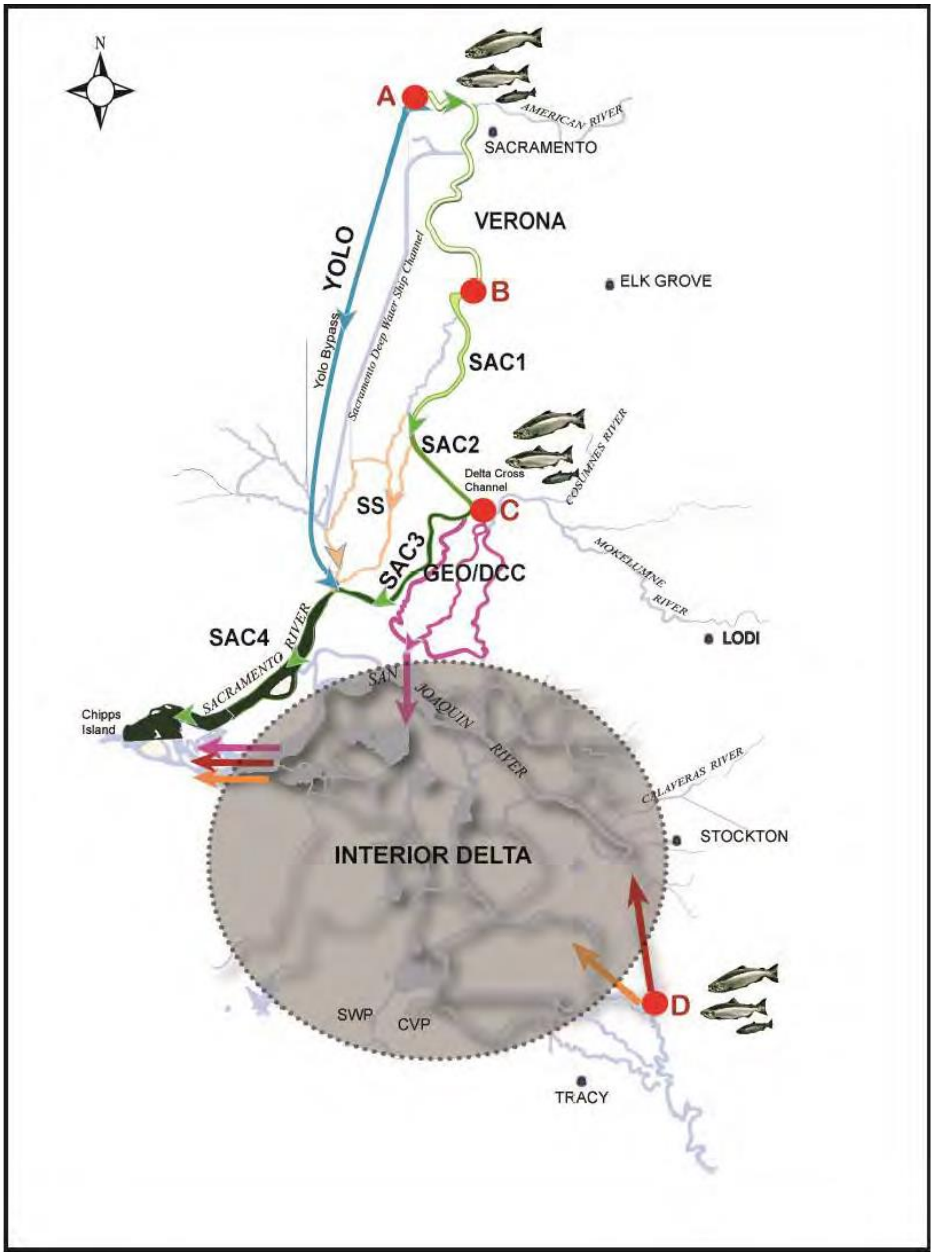

Figure I.6-1. Map of the Sacramento–San Joaquin River Delta Showing the Modeled Reaches and Junctions of the Delta Applied in the Delta Passage Model

I.6.2.4 Flow Input Data

Water movement through the Delta as input to the DPM is derived from daily (tidally averaged) flow output produced by the hydrology module of the Delta Simulation Model II (DSM2-HYDRO; http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/) or from CalSim 3.

The nodes in the DSM2-HYDRO and CalSim 3 models that were used to provide flow for specific reaches in the DPM are shown in Table I.6-2.

Table I.6-2. Delta Passage Model Reaches and Associated Output Locations from DSM2-HYDRO and CalSim 3 Models

DPM Reach or Model Component	DSM2 Output Locations	CalSim 3 Node
Sac1	rsac155	n/a
Sac2	rsac128	n/a
Sac3	rsac123	n/a
Sac4	rsac101	n/a
Yolo	n/a	Fremont Spill + Sac Weir Spill
Verona	n/a	C160a
SS	slsbt011	n/a
Geo/DCC	dcc+georg_sl	n/a
South Delta Export Flow	Clifton Court Forebay - CHDMC006	n/a
Sacramento River flow at Fremont Weir	n/a	Sac @ Fremont Weir

I.6.2.5 Delta Entry Timing

Catch data for emigrating juvenile smolts for four Central Valley Chinook salmon runs were used to inform the daily proportion of juveniles entering the Delta for each run (Table I.6-3). Because the DPM models the survival of smolt-sized juvenile salmon, pre-smolts were removed from catch data before creating entry timing distributions. The lower 95th percentile of the range of salmon fork lengths visually identified as smolts by the USFWS in Sacramento trawls was used to determine the lower length cutoff for smolts. A lower fork length cutoff of 70 mm for smolts was applied, and all catch data of fish smaller than 70 mm were eliminated. To isolate wild production, all fish identified as having an adipose-fin clip (hatchery production) were eliminated, recognizing that most (75%) of the fall-run hatchery fish released upstream of Sacramento are not marked. Daily catch data for each brood year were divided by total annual catch to determine the daily proportion of smolts entering the DPM for each run (Figure I.6-2). Sampling was not conducted daily at most stations and catch was not expanded for fish caught but not measured. Finally, a generic probability density function was fit to the data using the package “sm” in R software (R Core Team 2012). The R fitting procedure estimated the best-fit probability distribution of the daily proportion of fish entering the DPM. Due to the daily timing of delta entry being integrated into results, results cannot be presented based on inflow groups.

For the current analysis, the most recent data from the Sacramento Trawl survey was added to the previous data to determine if entry distributions had shifted since the original fitting. Only late fall–run Chinook Salmon exhibited substantial change from the original fit and the entry distribution for that race was updated.

Table I.6-3. Sampling Gear Used to Create Juvenile Delta Entry Timing Distributions for Each Central Valley Run of Chinook Salmon

Chinook Salmon Run	Gear	Agency	Brood Years
Sacramento River Winter Run	Trawls at Sacramento	USFWS	1995–2009
Sacramento River Spring Run	Trawls at Sacramento	USFWS	1995–2005
Sacramento River Fall Run	Trawls at Sacramento	USFWS	1995–2005
Sacramento River Late Fall Run	Trawls at Sacramento	USFWS	1995–2018

Agencies that conducted sampling are listed: USFWS = U.S. Fish and Wildlife Service; EBMUD = East Bay Municipal District; CDFW = California Department of Fish and Wildlife.

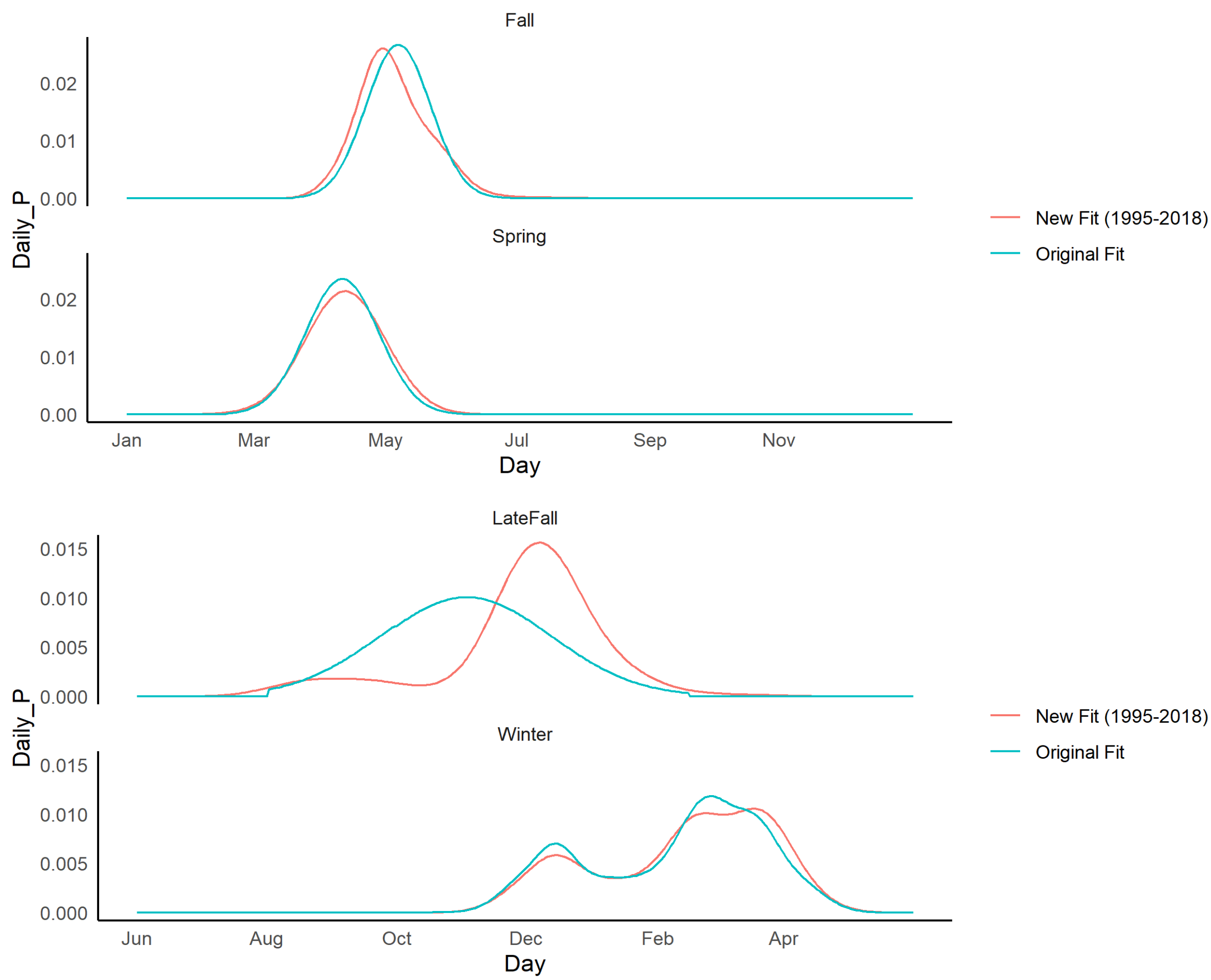

Figure I.6-2. Delta Entry Distributions for Chinook Salmon Smolts Applied in the Delta Passage Model for Sacramento River Winter-Run, Central Valley Spring-Run (Sacramento River), Central Valley Fall-Run (Sacramento River), and Central Valley Late Fall–Run. (Note the change in x axes between the upper and lower panel.)

I.6.2.6 Migration Speed

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 affect route selection and survival as flow conditions or water project operations change.

Smolt movement in all reaches except Yolo Bypass and the interior Delta is a function of reach-specific length and migration speed, as observed from acoustic-tagging results. Reach-specific length (kilometers [km]) is divided by reach migration speed (km/day) the day smolts enter the reach to calculate the number of days smolts will take to travel through the reach.

For north Delta reaches Verona, Sac1, Sac2, SS, and Geo/DCC, mean migration speed through the reach 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. Ordinary least squares regression was used to test for a logarithmic relationship between reach-specific migration speed (km/day) and average daily reach-specific flow (cubic meters per second [m^3/sec]) for the first day smolts entered a particular reach for reaches where acoustic-tagging data was available (Sac1, Sac2, Sac3, Sac4, Geo/DCC, and SS):

$$Speed = \beta_0 \ln(flow) + \beta_1;$$

Where β_0 is the slope parameter and β_1 is the intercept.

Individual smolt reach-specific travel times were calculated from detection histories of releases of acoustically-tagged smolts conducted in December and January for three consecutive winters (2006/2007, 2007/2008, and 2008/2009) (Perry 2010). Reach-specific migration speed (km/day) for each smolt was calculated by dividing reach length by travel days. Flow data was queried from the DWR's California Data Exchange website (http://cdec.water.ca.gov/).

Migration speed was significantly related to flow for reaches Sac1 (df = 450, F = 164.36, $P < 0.001$), Sac2 (df = 292, F = 4.17, P = 0.042), and Geo/DCC (df = 84, F = 13.74, $P < 0.001$). Migration speed increased as flow increased for all three reaches (Table I.6-4, Figure I.6-3). Therefore, for reaches Sac1, Sac2, and Geo/DCC, the regression coefficients shown in Table I.6-4 are used to calculate the expected average migration rate given the input flow for the reach; and the associated standard error of the regressions is used to inform a normal probability distribution that is sampled from the day that smolts enter the reach to determine their migration speed throughout the reach. The minimum migration speed for each reach is set at the minimum reach-specific migration speed observed from the acoustic-tagging data. The flow-migration rate relationship that was used for Sac1 also was applied for the Verona reach.

Table I.6-4. Sample Size and Slope (β_0) and Intercept (β_1) Parameter Estimates with Associated Standard Error (in Parenthesis) for the Relationship between Migration Speed and Flow for Reaches Sac1, Sac2, and Geo/DCC

Reach	*N*	β_0	β_1
Sac1	452	21.34 (1.66)	-105.98 (9.31)
Sac2	294	3.25 (1.59)	-8.00 (8.46)
Geo/DCC	86	11.08 (2.99)	-33.52 (12.90)

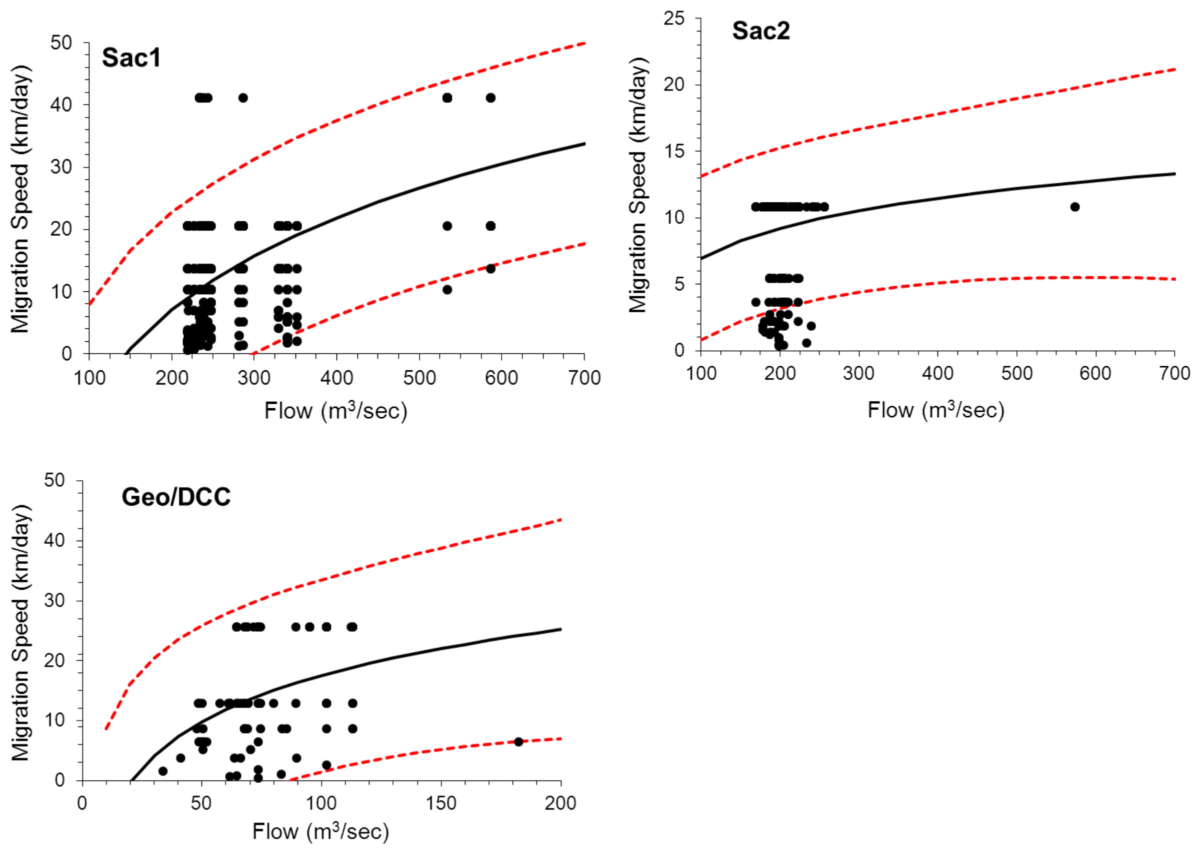

Figure I.6-3. Reach-Specific Migration Speed (km/day) as a Function of Flow (m^3/sec) Applied in Reaches Sac1, Sac2, and Geo/DCC

No significant relationship between migration speed and flow was found for reaches Sac3 (df = 100, F = 1.13, P =0.29), Sac4 (df = 60, F = 0.33, P = 0.57), and SS (df = 28, F = 0.86, P = 0.36). Therefore, for these reaches the observed mean migration speed and associated standard deviation is used to inform a normal probability distribution that is sampled from the day smolts enter the reach to determine their migration speed throughout the reach. As applied for reaches Sac1, Sac2, and Geo/DCC, the minimum migration speed for reaches Sac3, Sac4, and SS is set at the minimum reach-specific migration speed observed from the acoustic-tagging data.

Yolo Bypass travel time data from Sommer et al. (2005) for coded wire-tagged, fry-sized (mean size = 57 mm fork length [FL]) Chinook salmon were used to inform travel time through the Yolo Bypass in the DPM. Because the DPM models the migration and survival of smolt-sized juveniles, the range of the shortest travel times observed across all three years (1998–2000) by Sommer et al. (2005) was used to inform the bounds of a uniform distribution of travel times (range = 4–28 days), on the assumption that smolts would spend less time rearing and would travel faster than fry. On the day smolts enter the Yolo Bypass, their travel time through the reach is calculated by sampling from this uniform distribution of travel times.

The travel time of smolts migrating through the interior Delta in the DPM is informed by observed mean travel time (7.95 days) and associated standard deviation (6.74) from north Delta acoustic-tagging studies (Perry 2010). However, the timing of smolt passage through the interior Delta does not affect Delta survival because there are no Delta reaches located downstream of the interior Delta.

I.6.2.7 Fish Behavior at Junctions (Channel Splits)

Perry (2010) and Cavallo et al. (2015) found that acoustically-tagged smolts arriving at Delta junctions exhibited inconsistent movement patterns in relation to the flow being diverted. For Junction A (entry into the Yolo Bypass at Fremont Weir), the following relationships were used.

- Proportion of smolts entering Yolo Bypass = Fremont Weir spill/ (Fremont Weir spill + Sacramento River at Verona flows).

As noted above in *Flow Input Data*, the flow data informing Yolo Bypass entry were obtained by disaggregating CalSim estimates using historical daily patterns of variability because DSM2 does not provide daily flow data for these locations.

For Junction B (Sacramento River-Sutter/Steamboat Sloughs), both Perry (2010) and Cavallo et al. (2015) found that smolts consistently entered downstream distributaries in proportion to the flow being diverted. Therefore, smolts arriving at Junction B in the model move proportionally with flow according to the linear relationship found in Cavallo et al. (2015):

$$P_{SS} = -0.00203 + P_{flowSS} * 0.775344$$

Where P_{SS} is the proportion of fish entering the SS reach, and P_{flowSS} is the proportion of flow entering Sutter/Steamboat Slough distributaries from the total flow in the mainstem Sacramento River.

For Junction C (Sacramento River–Georgiana Slough/DCC), Perry (2010) found a linear, nonproportional relationship between flow and fish movement. His relationship for Junction C was applied in the DPM:

$$y = 0.22 + 0.47x;$$

where y is the proportion of fish diverted into Geo/DCC and x is the proportion of flow diverted into Geo/DCC (Figure I.6-4).

In the DPM, this linear function is applied to predict the daily proportion of fish movement into Geo/DCC as a function of the proportion of flow into Geo/DCC.

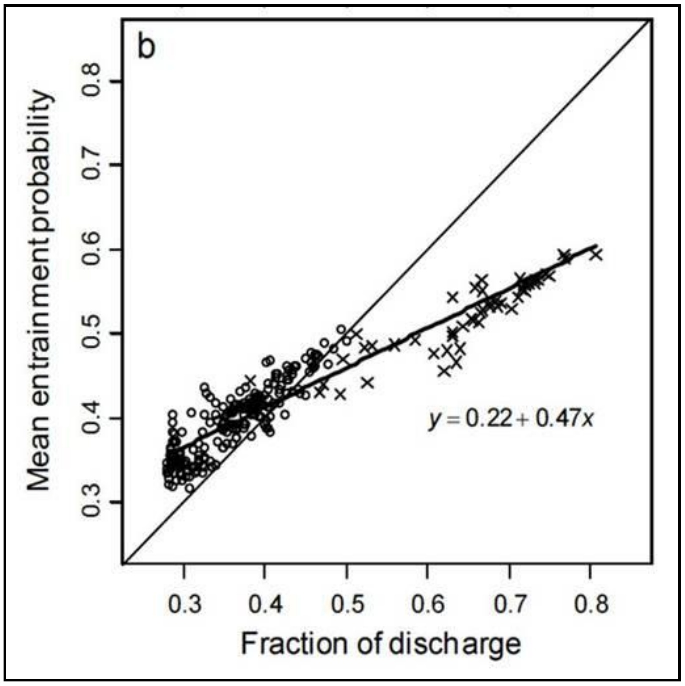

Figure I.6-4. Figure from Perry (2010) Depicting the Mean Entrainment Probability (Proportion of Fish Being Diverted into Reach Geo/DCC) as a Function of Fraction of Discharge (Proportion of Flow Entering Reach Geo/DCC). Circles Depict DCC Gates Closed, Crosses Depict DCC Gates Open.

I.6.2.8 Reach-Specific Survival

To update survival estimates in the DPM, we analyzed a dataset of detections from >2000 acoustically-tagged (JSATS) fish recorded in the DPM region of the Sacramento–San Joaquin Delta from 2013-2019. To estimate survival from such a large and heterogeneous dataset (receiver combinations, monitored reaches, and release locations differed from year to year), we used only detections from receivers at the endpoint of reaches in the DPM and constructed binary detection histories along DPM routes. Moving downstream from receiver to receiver along a route, we assumed that if a fish was not seen again in the route after a given receiver, the fish did not survive. The probability of being detected again downstream (assumed to be a direct proxy for survival) was then modeled as a function of an individual's detection history and time-specific covariates associated with reach entry. From this analysis, four reaches were associated with a consistent relationship between flow and survival: Sac1, Sac2, Sac3, and Sac4; all other reaches had no consistent flow-survival relationship, and survival in those reaches of the DPM is drawn from a normal distribution derived from a reach-specific, intercept-only model of survival and standard deviation from the JSATS data.

I.6.2.9 Flow-Dependent Survival

Survival through a given reach is estimated and applied the first day smolts enter that reach. For reaches where analysis of the JSATS detections supported a consistent flow-survival relationship, flow on the day fish enter the reach is used to predict survival through the entire reach even if migration through the reach takes place over more than one day.

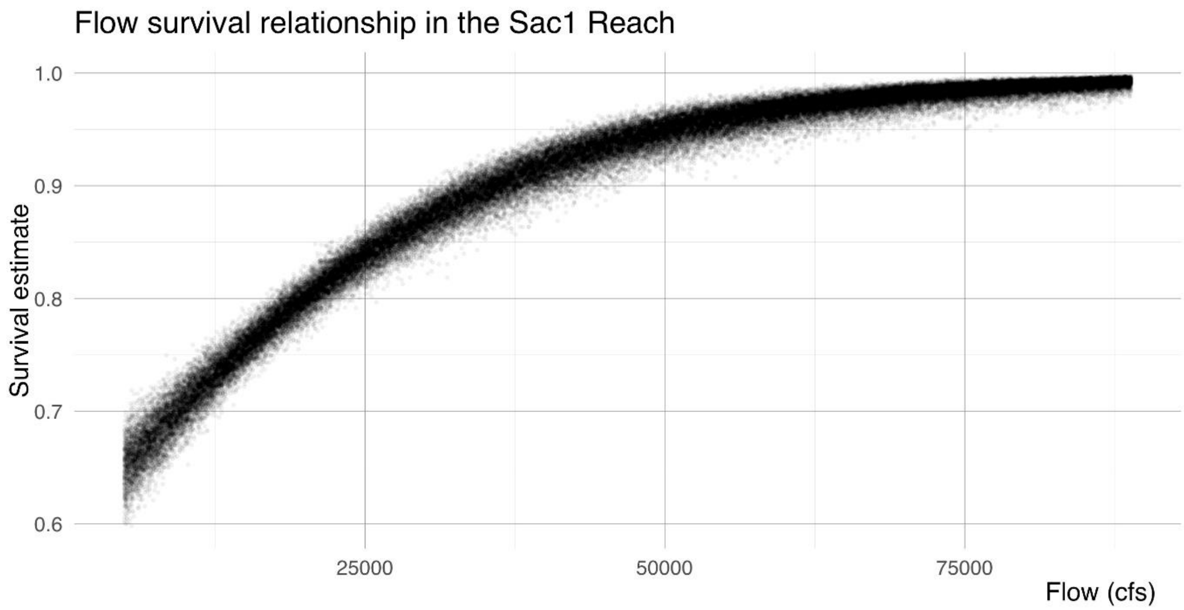

Figure I.6-5. Relationship between Sacramento River Discharge and Survival through the Sac 1 Reach Modeled with JSATS Releases of Multiple Runs of Chinook Salmon

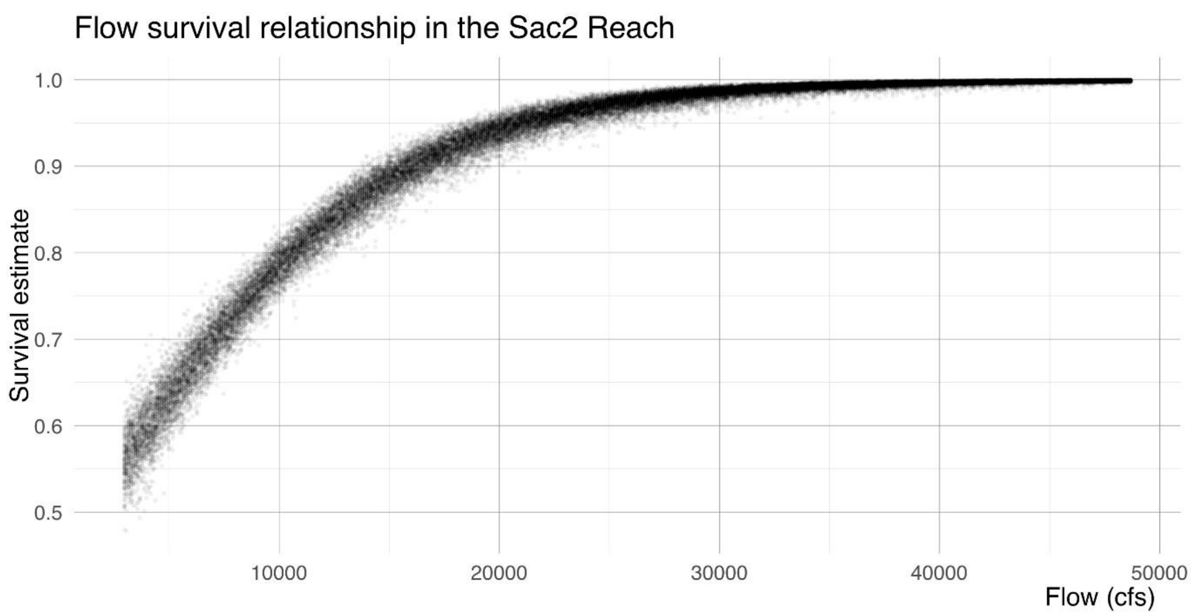

Figure I.6-6. Relationship between Sacramento River Discharge and Survival through the Sac 2 Reach Modeled with JSATS Releases of Multiple Runs of Chinook Salmon

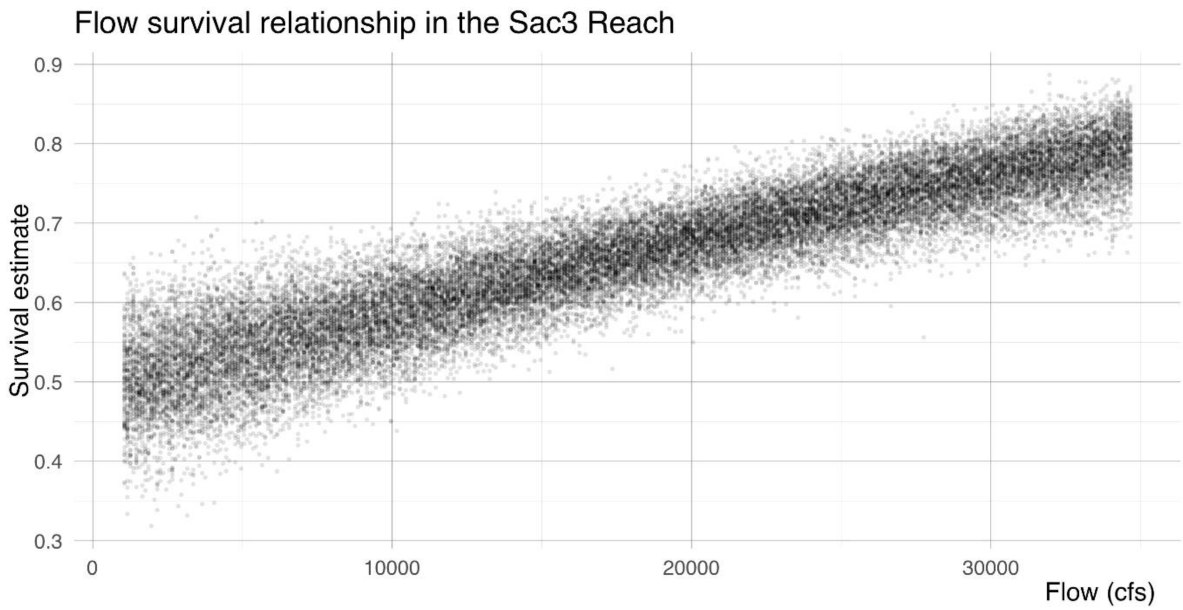

Figure I.6-7. Relationship between Sacramento River Discharge and Survival through the Sac 3 Reach Modeled with JSATS Releases of Multiple Runs of Chinook Salmon

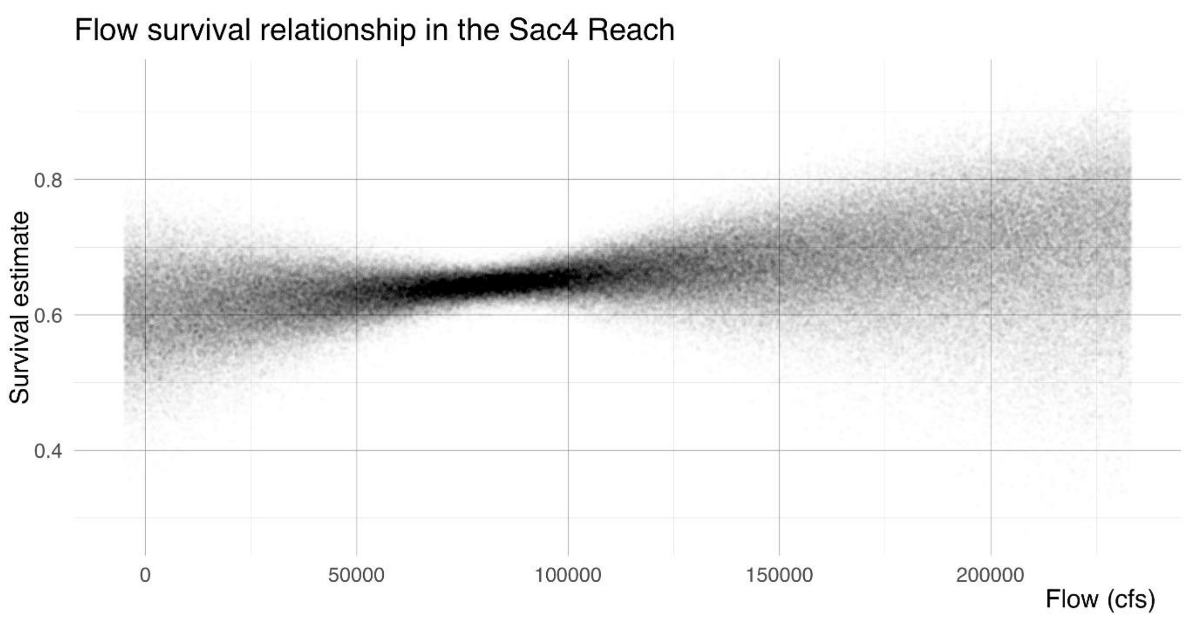

Figure I.6-8. Relationship between Sacramento River Discharge and Survival through the Sac 4 Reach Modeled with JSATS Releases of Multiple Runs of Chinook Salmon

I.6.2.10 Export-Dependent Survival

An export-survival relationship was tested for fish entering the interior Delta from the Mokelumne River and Georgiana Slough. Hydrodynamic data for exports covering the period of JSATS detection data (2013 – 2019) was queried from Dayflow (https://data.cnra.ca.gov/dataset/dayflow/resource/21c377fe-53b8-4bd6-9e1f-2025221be095). A model that included exports and Freeport flow was also tested. Exports observed over the data period ranged from 1038 to 14650 cfs. For the interior Delta route, the export value (cfs) on the day the fish enters the reach and the effect of exports from the JSATs model is used to predict survival through the entire reach, even if migration through the reach takes place over more than one day.

For the model that included exports only, the coefficient for the export effect was positive and well-supported, indicating higher survival probabilities with greater exports. In the model including both exports and flow, the export coefficient remained positive but was not well-supported with a mean effect that included zero in the distribution. This positive effect of exports may seem contradictory based on coded wire tag studies used in the previous model version that includes a weak, yet negative effect (Newman and Brandes 2010). Hydrodynamic analysis indicates that there is little effect of exports on hydrodynamics in the Sacramento River (Cavallo et al. 2015), and only fish entering the interior Delta, and the Old-Middle River corridor specifically, are likely to be exposed to the hydrodynamic effects of exports (Reclamation 2019). Previous studies of export effects relied on the relative survival of coded wire tagged salmon released into Georgiana Slough relative to the Sacramento River (Newman and Brandes 2010). Thus, export effects in the coded wire tag studies are not directly estimated for fish in the area of interest. In previous workshops and comments, it was suggested that modeling potential effects of exports on individually tagged fish would be a superior approach. The JSATS data analyzed here represents the best dataset available and covers a wide range of export conditions. Thus, the data strongly suggest the absence of a negative effect of exports on survival of Sacramento River-origin Chinook salmon that enter the interior Delta.

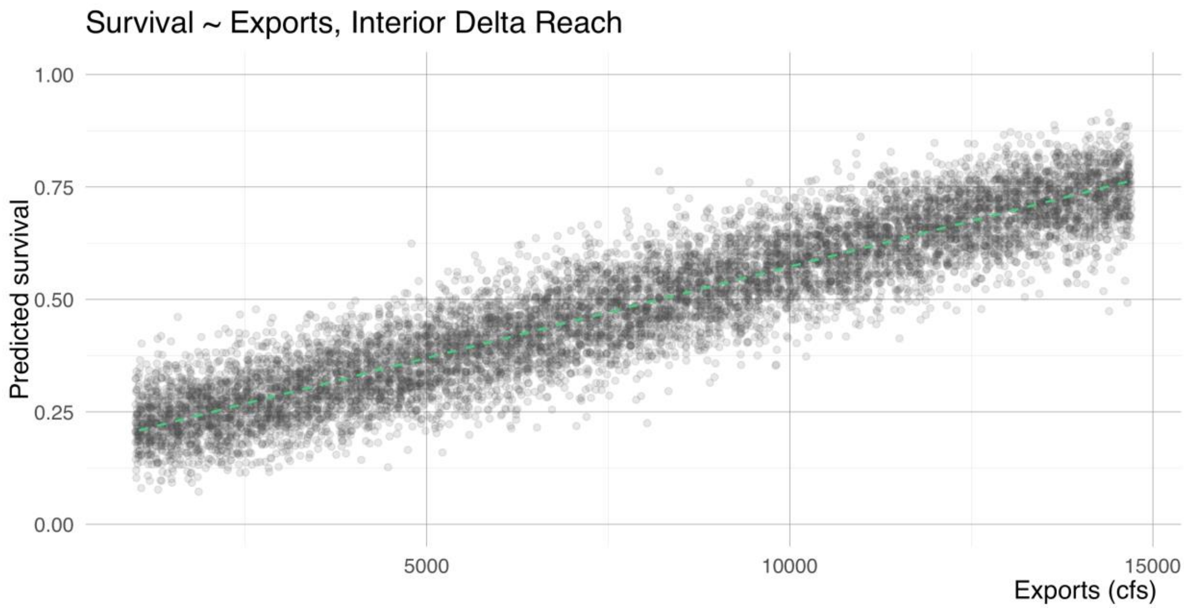

Figure I.6-9. Relationship between Exports and Survival of JSATS-Tagged Juvenile Chinook Salmon. The coefficient for the effect of exports was well-supported with a credible interval that did not include zero.

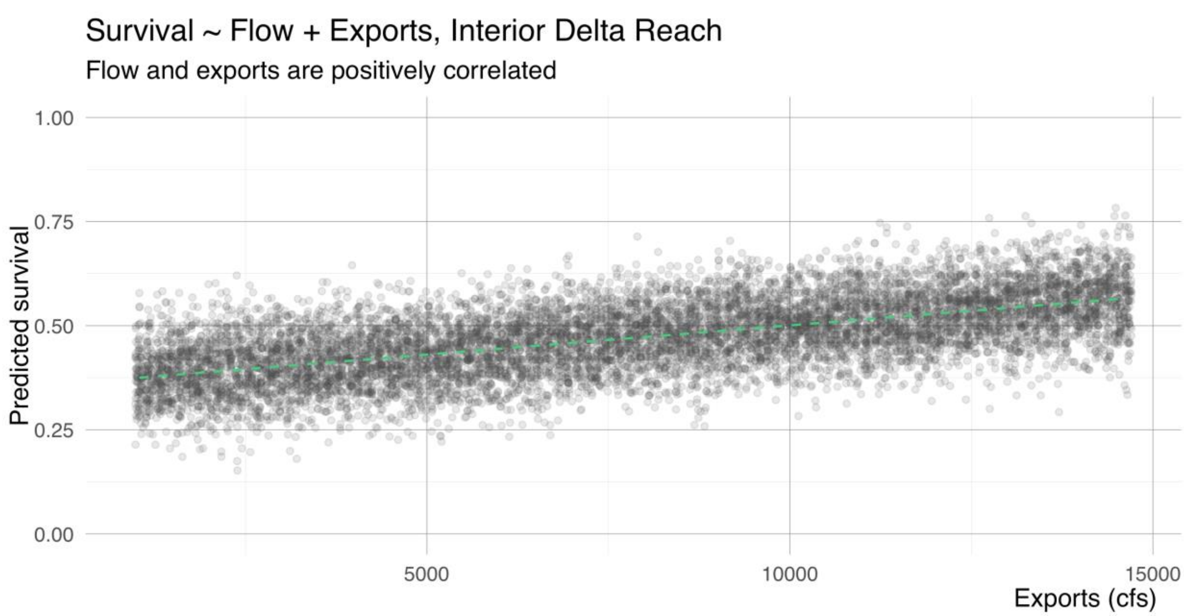

Figure I.6-10. Relationship between Exports and Survival of JSATS-Tagged Juvenile Chinook Salmon with Freeport Flow Was Held at the Mean Value. When flow is included in the model, the effect of exports on survival remains positive but is no longer well-supported.

I.6.2.11 Assumptions / Uncertainty

The DPM is based primarily on studies of winter-run Chinook salmon smolt surrogates (late fall–run Chinook salmon), it is applied here for winter-run, spring-run, fall-run, and late fall–run Chinook salmon by adjusting emigration timing and assuming that all migrating Chinook salmon smolts will respond similarly to Delta conditions. The DPM results presented here reflect the current version of the model, which continues to be reviewed and refined, and for which a sensitivity analysis has been completed to examine various aspects of uncertainty related to the model's inputs and parameters.

Although studies have shown considerable variation in emigrant size, with Central Valley Chinook salmon migrating as fry, parr, or smolts (Brandes and McLain 2001; Williams 2001), the DPM relies predominantly on data from acoustic-tagging studies of large (>140 mm) smolts, and therefore should be applied very cautiously to pre-smolt migrants. Salmon juveniles less than 70 mm are more likely to exhibit rearing behavior in the Delta (Moyle 2002) and thus likely will be represented poorly by the DPM. It has been assumed that the downstream emigration of fry, when spawning grounds are well upstream, is probably a dispersal mechanism that helps distribute fry among suitable rearing habitats. However, even when rearing habitat does not appear to be a limiting factor, downstream movement of fry still may be observed, suggesting that fry emigration is a viable alternative life-history strategy (Healy 1980; Healey and Jordan 1982; Miller et al. 2010). Unfortunately, survival data are lacking for small (fry-sized) juvenile emigrants because of the difficulty of tagging such small individuals. Therefore, the DPM should be viewed as a smolt survival model only, with its survival relationships generally having been derived from larger smolts (>140 mm), with the fate of pre-smolt emigrants not incorporated into model results.

The DPM has undergone substantial revisions based on comments received through the Bay Delta Conservation Plan (BDCP) preliminary proposal anadromous team meetings and in particular through feedback received during a workshop held on August 24, 2010, a 2-day workshop held June 23–24, 2011, and since then from various meetings of a workgroup consisting of agency biologists and consultants. This analysis uses the most recent version of the DPM as of September 2015. The DPM is viewed as a simulation framework that can be changed as more data or new hypotheses regarding smolt migration and survival become available. The results are based on these revisions. Uncertainty is explicitly modeled in the DPM by incorporating environmental stochasticity and estimation error whenever available.

I.6.2.12 Code and Data Repository

Analysis files for DPM input data and DPM analysis are available from Reclamation upon Request.

I.6.3 Results

I.6.3.1 EIS: Narrative, Tables, and Figure Results

Under Alt2 With TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 5.9% higher in 1977 to 2% lower in 1976 compared to the NAA for Winter-run Chinook salmon (Figure I.6-11 and Table I.6-5).

Under Alt2 Without TUCP Delta VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 5.6% higher in 1992 to 2.9% lower in 1993 compared to the NAA for Winter-run Chinook salmon.

Under Alt2 Without TUCP Systemwide VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 5.8% higher in 2010 to 1.9% lower in 1993 compared to the NAA for Winter-run Chinook salmon.

Under Alt2 Without TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 6% higher in 1977 to 4.2% lower in 1993 compared to the NAA for Winter-run Chinook salmon.

Under Alt3, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 14% higher in 1972 to 0.4% lower in 1949 compared to the NAA for Winter-run Chinook salmon.

Under Alt4, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 3.3% higher in 1990 to 2.2% lower in 2021 compared to the NAA for Winter-run Chinook salmon.

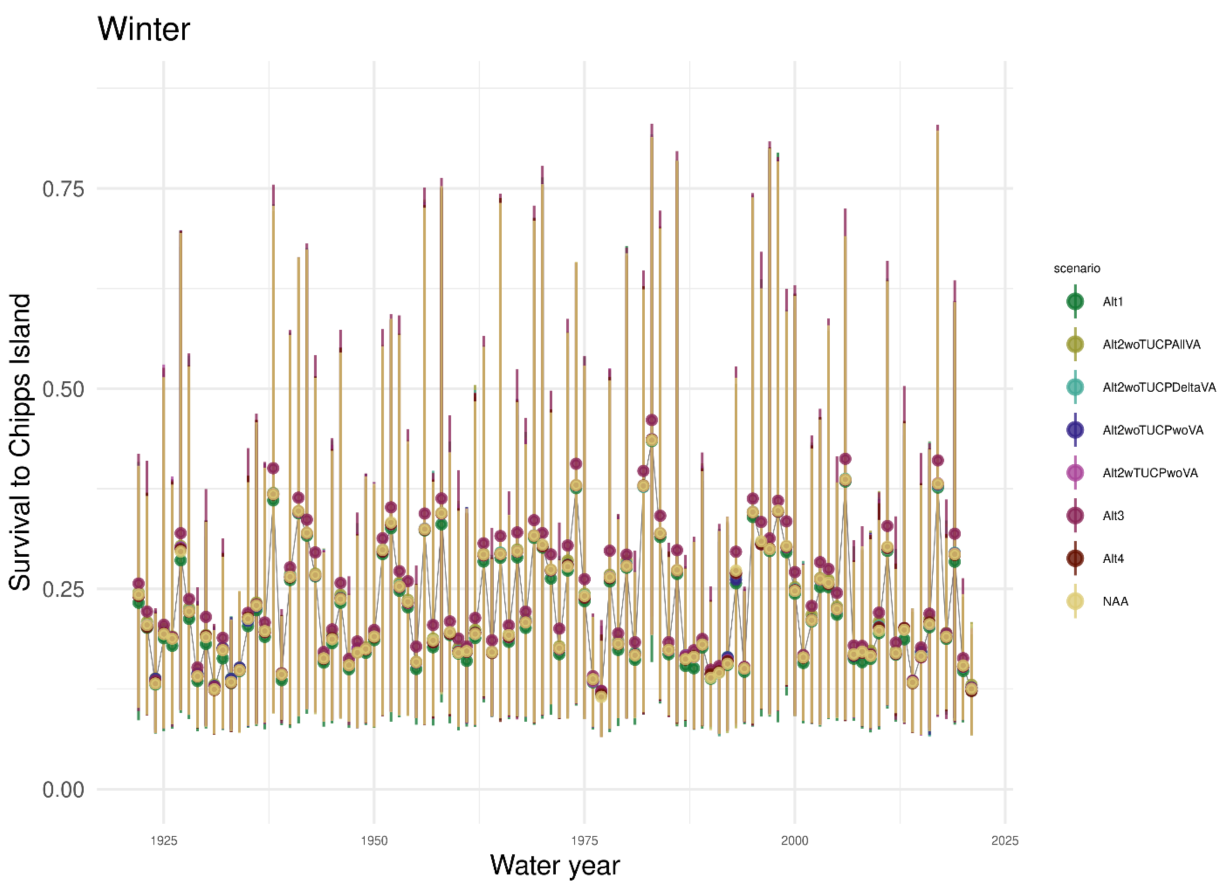

Figure I.6-11. Predicted annual winter-run Chinook salmon survival to Chipps Island.

Table I.6-5. Mean predicted annual winter-run Chinook salmon survival to Chipps Island. Percentage difference from NAA in parenthesis.

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1922	Above Normal	Winter	0.243	0.233 (-4.14%)	0.241 (-0.72%)	0.241 (-0.69%)	0.243 (-0.04%)	0.246 (1.11%)	0.257 (5.64%)	0.241 (-0.88%)
1923	Below Normal	Winter	0.205	0.202 (-1.53%)	0.204 (-0.21%)	0.204 (-0.14%)	0.205 (0.19%)	0.209 (1.94%)	0.222 (8.24%)	0.202 (-1.28%)
1924	Critical	Winter	0.132	0.130 (-1.06%)	0.133 (0.82%)	0.138 (4.51%)	0.137 (4.27%)	0.138 (4.75%)	0.136 (2.81%)	0.133 (0.61%)
1925	Dry	Winter	0.194	0.188 (-2.70%)	0.196 (1.05%)	0.195 (0.71%)	0.196 (1.31%)	0.200 (3.27%)	0.205 (6.14%)	0.194 (0.42%)
1926	Dry	Winter	0.188	0.179 (-4.60%)	0.189 (0.79%)	0.189 (0.95%)	0.189 (0.60%)	0.191 (1.57%)	0.190 (1.03%)	0.188 (0.26%)
1927	Wet	Winter	0.297	0.286 (-3.65%)	0.302 (1.71%)	0.301 (1.64%)	0.302 (1.74%)	0.304 (2.39%)	0.319 (7.65%)	0.299 (0.96%)
1928	Above Normal	Winter	0.222	0.212 (-4.18%)	0.221 (-0.13%)	0.222 (0.01%)	0.222 (0.32%)	0.226 (1.89%)	0.237 (7.00%)	0.221 (-0.11%)
1929	Critical	Winter	0.141	0.135 (-4.14%)	0.142 (0.66%)	0.144 (2.28%)	0.144 (2.31%)	0.145 (2.75%)	0.152 (7.91%)	0.140 (-0.32%)
1930	Dry	Winter	0.19	0.181 (-4.52%)	0.191 (0.75%)	0.190 (0.30%)	0.190 (0.37%)	0.192 (1.36%)	0.215 (13.31%)	0.191 (0.89%)
1931	Critical	Winter	0.125	0.126 (1.28%)	0.125 (0.22%)	0.129 (3.29%)	0.129 (3.52%)	0.131 (4.95%)	0.128 (2.98%)	0.124 (-0.73%)
1932	Critical	Winter	0.173	0.163 (-5.93%)	0.175 (0.63%)	0.176 (1.57%)	0.176 (1.31%)	0.176 (1.73%)	0.189 (8.85%)	0.174 (0.25%)
1933	Critical	Winter	0.134	0.132 (-1.01%)	0.133 (-0.51%)	0.138 (2.86%)	0.138 (3.06%)	0.138 (3.21%)	0.133 (-0.39%)	0.133 (-0.83%)
1934	Critical	Winter	0.149	0.147 (-0.82%)	0.148 (-0.19%)	0.152 (2.18%)	0.151 (1.50%)	0.152 (1.94%)	0.149 (0.10%)	0.149 (0.12%)
1935	Below Normal	Winter	0.212	0.203 (-4.26%)	0.214 (0.79%)	0.210 (-1.06%)	0.210 (-1.16%)	0.212 (-0.26%)	0.220 (3.52%)	0.214 (0.73%)
1936	Below Normal	Winter	0.229	0.223 (-2.69%)	0.229 (-0.21%)	0.228 (-0.59%)	0.228 (-0.54%)	0.233 (1.57%)	0.231 (0.54%)	0.229 (-0.11%)
1937	Below Normal	Winter	0.197	0.190 (-3.51%)	0.196 (-0.49%)	0.196 (-0.41%)	0.197 (0.01%)	0.199 (1.17%)	0.208 (5.52%)	0.196 (-0.53%)
1938	Wet	Winter	0.368	0.361 (-2.10%)	0.368 (0.05%)	0.368 (-0.01%)	0.369 (0.18%)	0.370 (0.42%)	0.401 (8.84%)	0.368 (-0.13%)
1939	Dry	Winter	0.143	0.136 (-5.11%)	0.144 (0.35%)	0.144 (0.21%)	0.143 (-0.03%)	0.145 (1.01%)	0.144 (0.80%)	0.143 (-0.24%)
1940	Above Normal	Winter	0.266	0.261 (-1.68%)	0.265 (-0.20%)	0.265 (-0.22%)	0.266 (0.35%)	0.268 (1.12%)	0.277 (4.26%)	0.264 (-0.46%)
1941	Wet	Winter	0.347	0.344 (-0.81%)	0.346 (-0.32%)	0.346 (-0.33%)	0.346 (-0.30%)	0.346 (-0.39%)	0.364 (4.76%)	0.347 (-0.15%)
1942	Wet	Winter	0.32	0.316 (-1.14%)	0.320 (-0.17%)	0.319 (-0.21%)	0.319 (-0.34%)	0.319 (-0.31%)	0.337 (5.16%)	0.320 (-0.13%)
1943	Wet	Winter	0.267	0.266 (-0.70%)	0.267 (-0.21%)	0.267 (-0.20%)	0.267 (-0.10%)	0.269 (0.61%)	0.295 (10.44%)	0.267 (-0.13%)
1944	Dry	Winter	0.163	0.158 (-3.55%)	0.163 (-0.00%)	0.163 (-0.16%)	0.164 (0.48%)	0.166 (1.58%)	0.171 (4.84%)	0.163 (-0.50%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1945	Dry	Winter	0.187	0.182 (-2.66%)	0.189 (0.82%)	0.189 (0.84%)	0.189 (1.25%)	0.193 (3.29%)	0.200 (6.62%)	0.188 (0.70%)
1946	Below Normal	Winter	0.237	0.233 (-1.93%)	0.238 (0.45%)	0.238 (0.33%)	0.239 (0.76%)	0.243 (2.38%)	0.257 (8.59%)	0.238 (0.30%)
1947	Dry	Winter	0.155	0.150 (-3.24%)	0.155 (0.00%)	0.155 (-0.11%)	0.155 (0.27%)	0.156 (0.99%)	0.162 (5.01%)	0.155 (0.05%)
1948	Dry	Winter	0.17	0.171 (0.23%)	0.175 (2.87%)	0.175 (3.01%)	0.173 (1.84%)	0.175 (3.03%)	0.185 (8.35%)	0.171 (0.23%)
1949	Dry	Winter	0.175	0.170 (-2.75%)	0.175 (-0.12%)	0.175 (-0.07%)	0.175 (-0.24%)	0.177 (1.11%)	0.174 (-0.42%)	0.174 (-0.42%)
1950	Dry	Winter	0.19	0.186 (-2.44%)	0.191 (0.28%)	0.191 (0.36%)	0.191 (0.41%)	0.196 (2.68%)	0.199 (4.39%)	0.189 (-0.51%)
1951	Above Normal	Winter	0.299	0.294 (-1.69%)	0.297 (-0.49%)	0.297 (-0.59%)	0.298 (-0.13%)	0.299 (0.04%)	0.313 (4.83%)	0.296 (-0.74%)
1952	Wet	Winter	0.333	0.326 (-2.24%)	0.331 (-0.63%)	0.331 (-0.65%)	0.331 (-0.66%)	0.331 (-0.67%)	0.352 (5.70%)	0.331 (-0.60%)
1953	Above Normal	Winter	0.253	0.248 (-2.17%)	0.252 (-0.32%)	0.252 (-0.32%)	0.255 (0.59%)	0.258 (1.82%)	0.272 (7.50%)	0.253 (-0.12%)
1954	Above Normal	Winter	0.234	0.227 (-2.97%)	0.233 (-0.59%)	0.232 (-0.77%)	0.234 (-0.15%)	0.236 (1.03%)	0.260 (10.92%)	0.233 (-0.35%)
1955	Dry	Winter	0.159	0.150 (-5.38%)	0.158 (-0.38%)	0.158 (-0.38%)	0.158 (-0.28%)	0.159 (0.27%)	0.178 (12.14%)	0.158 (-0.12%)
1956	Wet	Winter	0.324	0.323 (-0.41%)	0.325 (0.02%)	0.325 (0.14%)	0.325 (0.16%)	0.325 (0.11%)	0.344 (6.05%)	0.324 (-0.21%)
1957	Below Normal	Winter	0.186	0.177 (-4.54%)	0.184 (-0.96%)	0.183 (-1.18%)	0.185 (-0.30%)	0.188 (1.34%)	0.205 (10.37%)	0.183 (-1.36%)
1958	Wet	Winter	0.344	0.330 (-4.07%)	0.344 (-0.19%)	0.344 (-0.18%)	0.345 (0.01%)	0.345 (0.07%)	0.363 (5.30%)	0.344 (-0.18%)
1959	Below Normal	Winter	0.196	0.192 (-1.83%)	0.194 (-0.79%)	0.194 (-0.94%)	0.194 (-0.86%)	0.196 (0.06%)	0.209 (6.81%)	0.194 (-1.02%)
1960	Dry	Winter	0.17	0.169 (-0.62%)	0.172 (0.77%)	0.171 (0.74%)	0.172 (1.27%)	0.176 (3.54%)	0.188 (10.55%)	0.171 (0.47%)
1961	Dry	Winter	0.172	0.160 (-7.03%)	0.172 (-0.21%)	0.172 (-0.25%)	0.171 (-0.85%)	0.172 (-0.27%)	0.178 (3.47%)	0.171 (-0.59%)
1962	Dry	Winter	0.194	0.189 (-2.52%)	0.195 (0.51%)	0.194 (0.44%)	0.196 (1.08%)	0.199 (2.84%)	0.214 (10.42%)	0.195 (0.79%)
1963	Wet	Winter	0.293	0.284 (-3.08%)	0.292 (-0.44%)	0.292 (-0.38%)	0.293 (-0.15%)	0.294 (0.25%)	0.307 (4.73%)	0.292 (-0.29%)
1964	Dry	Winter	0.171	0.171 (-0.22%)	0.171 (-0.04%)	0.171 (-0.17%)	0.170 (-0.44%)	0.172 (0.54%)	0.186 (8.71%)	0.170 (-0.63%)
1965	Wet	Winter	0.294	0.289 (-1.66%)	0.294 (-0.05%)	0.293 (-0.25%)	0.295 (0.49%)	0.295 (0.45%)	0.316 (7.65%)	0.294 (-0.05%)
1966	Below Normal	Winter	0.192	0.184 (-4.39%)	0.190 (-1.42%)	0.190 (-1.41%)	0.190 (-1.04%)	0.193 (0.50%)	0.204 (6.26%)	0.190 (-1.16%)
1967	Wet	Winter	0.297	0.289 (-2.64%)	0.296 (-0.22%)	0.297 (-0.19%)	0.297 (-0.03%)	0.300 (0.80%)	0.320 (7.84%)	0.297 (-0.17%)
1968	Below Normal	Winter	0.208	0.201 (-3.28%)	0.209 (0.50%)	0.209 (0.39%)	0.210 (0.81%)	0.212 (1.99%)	0.222 (6.53%)	0.208 (0.09%)
1969	Wet	Winter	0.317	0.314 (-0.91%)	0.317 (0.05%)	0.317 (0.05%)	0.317 (0.06%)	0.316 (-0.22%)	0.336 (6.06%)	0.316 (-0.06%)
1970	Wet	Winter	0.305	0.302 (-1.18%)	0.304 (-0.53%)	0.304 (-0.54%)	0.304 (-0.54%)	0.303 (-0.82%)	0.320 (4.70%)	0.304 (-0.58%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1971	Wet	Winter	0.274	0.263 (-4.08%)	0.273 (-0.31%)	0.273 (-0.39%)	0.273 (-0.27%)	0.274 (-0.07%)	0.293 (6.85%)	0.273 (-0.35%)
1972	Below Normal	Winter	0.176	0.168 (-4.20%)	0.175 (-0.63%)	0.175 (-0.46%)	0.175 (-0.40%)	0.178 (1.33%)	0.200 (14.00%)	0.175 (-0.24%)
1973	Above Normal	Winter	0.278	0.273 (-1.72%)	0.279 (0.35%)	0.279 (0.40%)	0.281 (1.00%)	0.285 (2.71%)	0.304 (9.51%)	0.280 (0.72%)
1974	Wet	Winter	0.38	0.376 (-1.05%)	0.380 (-0.00%)	0.379 (-0.08%)	0.379 (-0.26%)	0.379 (-0.15%)	0.406 (6.99%)	0.379 (-0.06%)
1975	Above Normal	Winter	0.241	0.235 (-2.75%)	0.240 (-0.67%)	0.239 (-0.69%)	0.242 (0.26%)	0.244 (1.14%)	0.262 (8.71%)	0.239 (-0.86%)
1976	Critical	Winter	0.137	0.133 (-2.98%)	0.135 (-1.97%)	0.135 (-1.93%)	0.135 (-1.80%)	0.135 (-1.38%)	0.141 (2.76%)	0.137 (-0.31%)
1977	Critical	Winter	0.115	0.119 (3.49%)	0.122 (5.94%)	0.122 (6.01%)	0.118 (2.30%)	0.118 (2.85%)	0.123 (6.67%)	0.118 (2.59%)
1978	Above Normal	Winter	0.265	0.259 (-2.07%)	0.265 (0.13%)	0.264 (-0.40%)	0.265 (0.14%)	0.268 (1.14%)	0.298 (12.52%)	0.263 (-0.49%)
1979	Dry	Winter	0.182	0.174 (-4.30%)	0.182 (0.01%)	0.182 (0.00%)	0.182 (0.33%)	0.186 (2.26%)	0.194 (7.09%)	0.181 (-0.33%)
1980	Above Normal	Winter	0.279	0.276 (-0.84%)	0.279 (0.01%)	0.279 (0.17%)	0.280 (0.61%)	0.285 (2.36%)	0.293 (5.05%)	0.279 (-0.07%)
1981	Dry	Winter	0.167	0.161 (-3.45%)	0.168 (0.31%)	0.168 (0.44%)	0.169 (1.40%)	0.170 (1.95%)	0.183 (9.78%)	0.168 (0.46%)
1982	Wet	Winter	0.379	0.378 (-0.34%)	0.379 (-0.04%)	0.379 (-0.05%)	0.378 (-0.32%)	0.379 (0.02%)	0.397 (4.86%)	0.379 (0.10%)
1983	Wet	Winter	0.436	0.435 (-0.24%)	0.437 (0.18%)	0.437 (0.15%)	0.437 (0.18%)	0.437 (0.23%)	0.461 (5.77%)	0.437 (0.16%)
1984	Wet	Winter	0.319	0.315 (-1.52%)	0.319 (-0.07%)	0.319 (-0.01%)	0.319 (-0.07%)	0.319 (-0.01%)	0.341 (6.84%)	0.319 (-0.21%)
1985	Below Normal	Winter	0.174	0.168 (-3.13%)	0.173 (-0.29%)	0.173 (-0.38%)	0.174 (-0.13%)	0.175 (0.44%)	0.183 (5.49%)	0.174 (0.13%)
1986	Wet	Winter	0.274	0.269 (-1.87%)	0.274 (-0.12%)	0.274 (-0.05%)	0.273 (-0.18%)	0.273 (-0.49%)	0.299 (9.09%)	0.273 (-0.18%)
1987	Dry	Winter	0.162	0.154 (-5.21%)	0.167 (2.72%)	0.167 (2.84%)	0.166 (2.29%)	0.167 (3.02%)	0.165 (1.70%)	0.162 (-0.40%)
1988	Critical	Winter	0.165	0.151 (-8.57%)	0.165 (-0.09%)	0.165 (0.15%)	0.165 (-0.12%)	0.167 (1.37%)	0.173 (5.06%)	0.166 (0.31%)
1989	Dry	Winter	0.181	0.176 (-2.28%)	0.181 (0.02%)	0.181 (0.05%)	0.181 (0.22%)	0.182 (0.92%)	0.188 (3.83%)	0.181 (0.00%)
1990	Critical	Winter	0.139	0.138 (-0.81%)	0.143 (3.31%)	0.143 (3.11%)	0.144 (3.37%)	0.145 (4.52%)	0.149 (7.39%)	0.143 (3.26%)
1991	Critical	Winter	0.145	0.147 (1.38%)	0.151 (3.74%)	0.150 (3.28%)	0.146 (0.36%)	0.146 (0.66%)	0.154 (5.77%)	0.147 (1.09%)
1992	Critical	Winter	0.156	0.155 (-0.97%)	0.161 (2.95%)	0.164 (5.10%)	0.165 (5.58%)	0.164 (5.05%)	0.160 (2.13%)	0.159 (1.90%)
1993	Above Normal	Winter	0.273	0.257 (-5.78%)	0.270 (-1.25%)	0.261 (-4.22%)	0.265 (-2.88%)	0.268 (-1.94%)	0.296 (8.50%)	0.270 (-1.09%)
1994	Critical	Winter	0.15	0.146 (-2.59%)	0.151 (0.26%)	0.151 (0.12%)	0.150 (-0.08%)	0.152 (0.81%)	0.153 (1.51%)	0.150 (0.07%)
1995	Wet	Winter	0.346	0.340 (-1.85%)	0.346 (-0.06%)	0.346 (-0.13%)	0.346 (0.05%)	0.346 (-0.01%)	0.363 (4.79%)	0.345 (-0.21%)
1996	Wet	Winter	0.31	0.307 (-0.76%)	0.306 (-1.27%)	0.306 (-1.19%)	0.306 (-1.20%)	0.306 (-1.19%)	0.333 (7.70%)	0.306 (-1.19%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1997	Wet	Winter	0.3	0.298 (-0.88%)	0.301 (0.17%)	0.301 (0.12%)	0.300 (-0.01%)	0.300 (-0.08%)	0.313 (4.28%)	0.301 (0.23%)
1998	Wet	Winter	0.348	0.347 (-0.35%)	0.346 (-0.40%)	0.347 (-0.23%)	0.347 (-0.19%)	0.347 (-0.24%)	0.360 (3.63%)	0.347 (-0.27%)
1999	Wet	Winter	0.304	0.296 (-2.59%)	0.302 (-0.44%)	0.302 (-0.47%)	0.302 (-0.40%)	0.302 (-0.39%)	0.334 (10.14%)	0.303 (-0.30%)
2000	Above Normal	Winter	0.247	0.244 (-1.44%)	0.248 (0.38%)	0.248 (0.29%)	0.250 (0.93%)	0.252 (1.89%)	0.271 (9.56%)	0.248 (0.41%)
2001	Dry	Winter	0.164	0.157 (-4.36%)	0.165 (0.39%)	0.165 (0.14%)	0.165 (0.52%)	0.166 (1.05%)	0.167 (1.79%)	0.164 (-0.31%)
2002	Below Normal	Winter	0.211	0.209 (-0.74%)	0.211 (0.16%)	0.211 (-0.03%)	0.212 (0.45%)	0.218 (3.17%)	0.229 (8.43%)	0.211 (0.17%)
2003	Above Normal	Winter	0.262	0.252 (-3.83%)	0.262 (-0.15%)	0.262 (-0.23%)	0.261 (-0.38%)	0.264 (0.53%)	0.284 (8.12%)	0.262 (-0.05%)
2004	Above Normal	Winter	0.257	0.252 (-2.06%)	0.256 (-0.52%)	0.257 (-0.33%)	0.257 (-0.13%)	0.261 (1.57%)	0.275 (6.83%)	0.256 (-0.61%)
2005	Below Normal	Winter	0.225	0.218 (-3.09%)	0.225 (0.00%)	0.225 (0.04%)	0.225 (0.24%)	0.228 (1.46%)	0.245 (9.06%)	0.225 (0.13%)
2006	Wet	Winter	0.387	0.384 (-0.66%)	0.386 (-0.24%)	0.386 (-0.12%)	0.387 (0.13%)	0.387 (0.05%)	0.412 (6.61%)	0.386 (-0.22%)
2007	Below Normal	Winter	0.168	0.163 (-3.26%)	0.167 (-0.68%)	0.166 (-1.08%)	0.167 (-0.65%)	0.169 (0.59%)	0.179 (6.59%)	0.167 (-0.68%)
2008	Dry	Winter	0.172	0.158 (-7.71%)	0.170 (-0.87%)	0.170 (-1.09%)	0.170 (-1.10%)	0.170 (-1.01%)	0.179 (4.12%)	0.170 (-0.97%)
2009	Dry	Winter	0.166	0.162 (-2.34%)	0.167 (0.63%)	0.168 (0.72%)	0.168 (1.16%)	0.173 (4.03%)	0.169 (1.32%)	0.167 (0.25%)
2010	Below Normal	Winter	0.198	0.194 (-1.75%)	0.202 (2.11%)	0.202 (2.13%)	0.204 (3.00%)	0.209 (5.79%)	0.220 (11.49%)	0.202 (2.01%)
2011	Wet	Winter	0.302	0.297 (-1.69%)	0.301 (-0.31%)	0.301 (-0.36%)	0.300 (-0.79%)	0.300 (-0.79%)	0.328 (8.61%)	0.301 (-0.41%)
2012	Below Normal	Winter	0.17	0.168 (-1.20%)	0.169 (-0.59%)	0.169 (-0.56%)	0.169 (-0.31%)	0.173 (1.60%)	0.183 (7.63%)	0.169 (-0.49%)
2013	Dry	Winter	0.199	0.187 (-5.98%)	0.200 (0.74%)	0.200 (0.57%)	0.201 (0.88%)	0.201 (1.11%)	0.201 (1.36%)	0.201 (0.93%)
2014	Critical	Winter	0.133	0.133 (-0.26%)	0.133 (0.19%)	0.134 (0.91%)	0.135 (1.31%)	0.134 (0.83%)	0.135 (1.67%)	0.132 (-0.56%)
2015	Critical	Winter	0.166	0.168 (1.33%)	0.164 (-0.94%)	0.172 (3.53%)	0.171 (3.09%)	0.172 (3.57%)	0.177 (6.73%)	0.165 (-0.50%)
2016	Below Normal	Winter	0.206	0.202 (-1.83%)	0.208 (0.79%)	0.206 (-0.16%)	0.206 (0.09%)	0.213 (3.41%)	0.219 (6.25%)	0.208 (0.89%)
2017	Wet	Winter	0.382	0.377 (-1.33%)	0.382 (0.14%)	0.381 (-0.22%)	0.379 (-0.70%)	0.380 (-0.42%)	0.411 (7.65%)	0.381 (-0.08%)
2018	Below Normal	Winter	0.19	0.187 (-1.49%)	0.191 (0.58%)	0.191 (0.26%)	0.192 (1.17%)	0.195 (2.57%)	0.194 (2.26%)	0.190 (-0.32%)
2019	Wet	Winter	0.293	0.284 (-3.19%)	0.294 (0.25%)	0.294 (0.24%)	0.295 (0.62%)	0.295 (0.46%)	0.319 (8.70%)	0.292 (-0.46%)
2020	Dry	Winter	0.154	0.148 (-4.49%)	0.153 (-1.09%)	0.153 (-1.22%)	0.152 (-1.39%)	0.153 (-0.70%)	0.163 (5.73%)	0.153 (-0.96%)
2021	Critical	Winter	0.125	0.123 (-2.18%)	0.123 (-1.77%)	0.126 (0.72%)	0.127 (1.47%)	0.130 (3.90%)	0.127 (1.12%)	0.122 (-2.22%)

- **Above Normal**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.8% lower in Above Normal water years to 5.8% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon (Figure I.6-12 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Above Normal water years to 1.3% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1% higher in Above Normal water years to 2.9% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.7% higher in Above Normal water years to 1.9% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Above Normal water years to 4.2% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 12.5% higher in Above Normal water years to 4.3% higher in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.7% higher in Above Normal water years to 1.1% lower in Above Normal water years compared to the NAA for Winter-run Chinook salmon.
- **Below Normal**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.7% lower in Below Normal water years to 4.5% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon (Figure I.6-12 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.1% higher in Below Normal water years to 1.4% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3% higher in Below Normal water years to 1.2% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon.

    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 5.8% higher in Below Normal water years to 0.3% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.1% higher in Below Normal water years to 1.4% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 14% higher in Below Normal water years to 0.5% higher in Below Normal water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 2% higher in Below Normal water years to 1.4% lower in Below Normal water years compared to the NAA for Winter-run Chinook salmon.
- **Critical**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 3.5% higher in Critical water years to 8.6% lower in Critical water years compared to the NAA for Winter-run Chinook salmon (Figure I.6-12 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 5.9% higher in Critical water years to 2% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 5.6% higher in Critical water years to 1.8% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 5.1% higher in Critical water years to 1.4% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 6% higher in Critical water years to 1.9% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 8.8% higher in Critical water years to 0.4% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.
    - Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 3.3% higher in Critical water years to 2.2% lower in Critical water years compared to the NAA for Winter-run Chinook salmon.

- **Dry**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.2% higher in Dry water years to 7.7% lower in Dry water years compared to the NAA for Winter-run Chinook salmon (Figure I.6-12 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.9% higher in Dry water years to 1.1% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.3% higher in Dry water years to 1.4% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 4% higher in Dry water years to 1% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3% higher in Dry water years to 1.2% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 13.3% higher in Dry water years to 0.4% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.9% higher in Dry water years to 1% lower in Dry water years compared to the NAA for Winter-run Chinook salmon.
- **Wet**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.2% lower in Wet water years to 4.1% lower in Wet water years compared to the NAA for Winter-run Chinook salmon (Figure I.6-12 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.7% higher in Wet water years to 1.3% lower in Wet water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.7% higher in Wet water years to 1.2% lower in Wet water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.4% higher in Wet water years to 1.2% lower in Wet water years compared to the NAA for Winter-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.6% higher in Wet water years to 1.2% lower in Wet water years compared to the NAA for Winter-run Chinook salmon.

- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 10.4% higher in Wet water years to 3.6% higher in Wet water years compared to the NAA for Winter-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 1% higher in Wet water years to 1.2% lower in Wet water years compared to the NAA for Winter-run Chinook salmon.

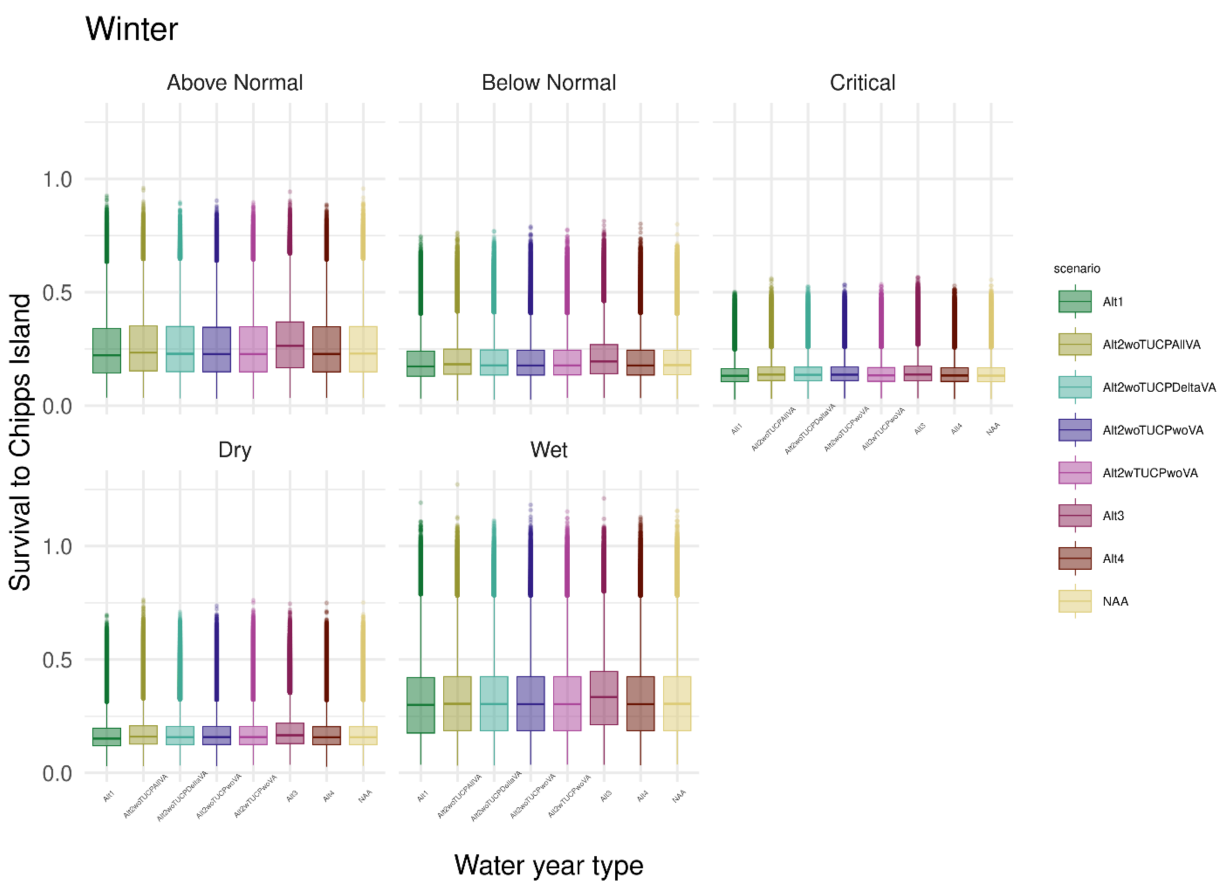

Figure I.6-12. Predicted winter-run Chinook salmon survival to Chipps Island averaged by water year type.

Table I.6-6. Mean predicted Chinook salmon survival to Chipps Island averaged by run and water year type. Parentheses indicate % difference from NAA (negative values indicate a decrease in survival).

Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP DeltaVA	Alt2 woTUCP AllVA	Alt3	Alt4
Above Normal	Fall	0.208	0.206 (-0.68%)	0.206 (-1.00%)	0.205 (-1.47%)	0.207 (-0.39%)	0.212 (2.14%)	0.225 (8.34%)	0.206 (-0.98%)
Below Normal	Fall	0.174	0.175 (0.42%)	0.172 (-0.77%)	0.172 (-0.91%)	0.173 (-0.70%)	0.179 (2.84%)	0.181 (4.33%)	0.172 (-0.95%)
Critical	Fall	0.122	0.129 (5.85%)	0.123 (0.50%)	0.130 (6.19%)	0.129 (6.08%)	0.131 (7.57%)	0.130 (6.24%)	0.122 (0.38%)
Dry	Fall	0.158	0.157 (-0.57%)	0.157 (-0.42%)	0.157 (-0.44%)	0.157 (-0.42%)	0.161 (2.05%)	0.163 (3.21%)	0.157 (-0.41%)
Wet	Fall	0.25	0.250 (-0.16%)	0.249 (-0.56%)	0.249 (-0.58%)	0.249 (-0.25%)	0.250 (-0.16%)	0.272 (8.81%)	0.249 (-0.58%)
Above Normal	Late Fall	0.213	0.203 (-4.55%)	0.214 (0.46%)	0.214 (0.37%)	0.214 (0.41%)	0.214 (0.61%)	0.220 (3.28%)	0.214 (0.43%)
Below Normal	Late Fall	0.173	0.168 (-2.93%)	0.173 (0.25%)	0.173 (-0.08%)	0.173 (0.11%)	0.174 (0.48%)	0.180 (4.06%)	0.173 (0.31%)
Critical	Late Fall	0.137	0.131 (-4.43%)	0.139 (0.88%)	0.137 (-0.06%)	0.137 (-0.51%)	0.137 (-0.47%)	0.141 (2.79%)	0.138 (0.21%)
Dry	Late Fall	0.151	0.144 (-4.49%)	0.151 (0.47%)	0.151 (0.49%)	0.151 (0.44%)	0.151 (0.56%)	0.159 (5.51%)	0.151 (-0.03%)
Wet	Late Fall	0.264	0.254 (-3.60%)	0.265 (0.21%)	0.264 (0.19%)	0.264 (0.09%)	0.264 (0.16%)	0.272 (2.93%)	0.265 (0.29%)
Above Normal	Spring	0.271	0.265 (-2.33%)	0.269 (-0.87%)	0.268 (-1.22%)	0.270 (-0.20%)	0.276 (1.86%)	0.296 (9.31%)	0.268 (-0.91%)
Below Normal	Spring	0.202	0.200 (-0.79%)	0.201 (-0.30%)	0.201 (-0.54%)	0.202 (0.12%)	0.209 (3.24%)	0.219 (8.40%)	0.201 (-0.61%)
Critical	Spring	0.134	0.139 (3.80%)	0.134 (0.26%)	0.141 (5.39%)	0.141 (5.46%)	0.143 (6.85%)	0.141 (5.60%)	0.134 (0.36%)
Dry	Spring	0.182	0.179 (-1.51%)	0.182 (-0.11%)	0.182 (-0.14%)	0.183 (0.23%)	0.187 (2.57%)	0.191 (5.16%)	0.182 (-0.22%)
Wet	Spring	0.328	0.326 (-0.89%)	0.327 (-0.56%)	0.327 (-0.57%)	0.328 (-0.27%)	0.328 (-0.22%)	0.356 (8.40%)	0.326 (-0.69%)
Above Normal	Winter	0.258	0.252 (-2.63%)	0.258 (-0.30%)	0.257 (-0.55%)	0.258 (0.02%)	0.261 (1.15%)	0.278 (7.73%)	0.258 (-0.34%)
Below Normal	Winter	0.199	0.194 (-2.68%)	0.199 (-0.02%)	0.198 (-0.27%)	0.199 (0.09%)	0.202 (1.76%)	0.213 (7.02%)	0.199 (-0.13%)
Critical	Winter	0.143	0.140 (-1.67%)	0.144 (0.78%)	0.146 (2.31%)	0.146 (1.94%)	0.147 (2.56%)	0.149 (4.04%)	0.143 (0.30%)
Dry	Winter	0.174	0.167 (-3.62%)	0.174 (0.44%)	0.174 (0.38%)	0.175 (0.49%)	0.177 (1.68%)	0.183 (5.54%)	0.174 (0.00%)
Wet	Winter	0.326	0.321 (-1.62%)	0.326 (-0.12%)	0.326 (-0.14%)	0.326 (-0.11%)	0.326 (-0.02%)	0.348 (6.62%)	0.326 (-0.18%)

- Under Alt1, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 15% higher in 1934 to 6.5% lower in 1993 compared to the NAA for Spring-run Chinook salmon (Figure I.6-13 and Table I.6-7).
- Under Alt2 With TUCP Without VA, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 7.3% higher in 1990 to 3.6% lower in 1976 compared to the NAA for Spring-run Chinook salmon.
- Under Alt2 Without TUCP Delta VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 14.6% higher in 1934 to 5.2% lower in 1993 compared to the NAA for Spring-run Chinook salmon.
- Under Alt2 Without TUCP Systemwide VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 15.2% higher in 1934 to 3.6% lower in 1993 compared to the NAA for Spring-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 14.7% higher in 1934 to 7.7% lower in 1993 compared to the NAA for Spring-run Chinook salmon.
- Under Alt3, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 19.8% higher in 1965 to 1.6% lower in 2013 compared to the NAA for Spring-run Chinook salmon.
- Under Alt4, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 7% higher in 1990 to 4.3% lower in 1923 compared to the NAA for Spring-run Chinook salmon.

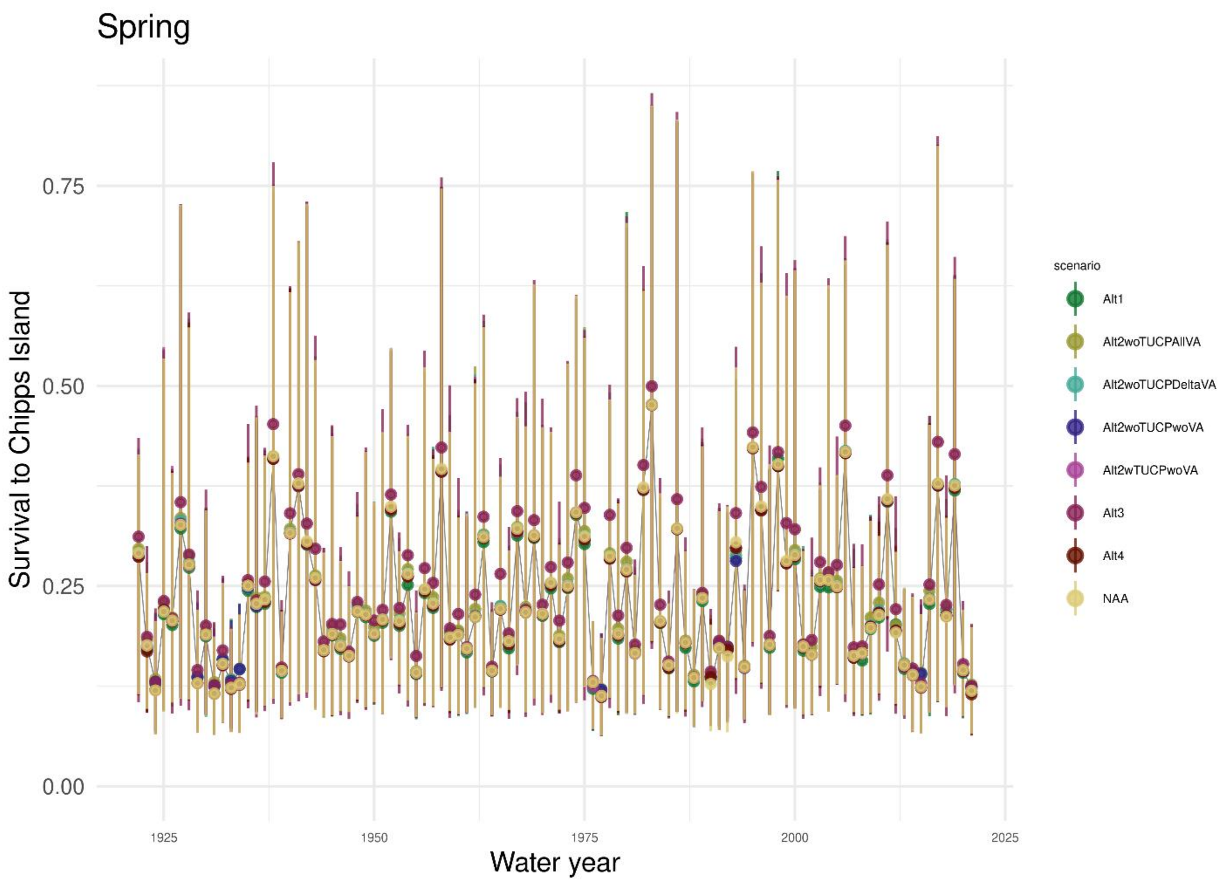

Figure I.6-13. Predicted annual spring-run Chinook salmon survival to Chipps Island.

Table I.6-7. Mean predicted spring-run Chinook salmon survival to Chipps Island averaged by run and water year type. Parentheses indicate % difference from NAA (negative values indicate a decrease in survival).

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1922	Above Normal	Spring	0.291	0.289 (-0.60%)	0.287 (-1.55%)	0.288 (-1.20%)	0.291 (-0.12%)	0.297 (1.98%)	0.312 (7.04%)	0.287 (-1.48%)
1923	Below Normal	Spring	0.176	0.171 (-2.53%)	0.174 (-0.84%)	0.174 (-0.84%)	0.176 (-0.04%)	0.182 (3.61%)	0.186 (6.12%)	0.168 (-4.28%)
1924	Critical	Spring	0.12	0.128 (6.97%)	0.121 (0.82%)	0.130 (9.05%)	0.131 (9.25%)	0.134 (11.99%)	0.131 (9.33%)	0.120 (0.43%)
1925	Dry	Spring	0.218	0.215 (-1.54%)	0.221 (1.43%)	0.220 (0.77%)	0.222 (1.49%)	0.229 (4.84%)	0.231 (5.96%)	0.220 (0.63%)
1926	Dry	Spring	0.207	0.201 (-2.70%)	0.207 (-0.06%)	0.206 (-0.26%)	0.206 (-0.41%)	0.210 (1.62%)	0.209 (1.24%)	0.206 (-0.58%)
1927	Wet	Spring	0.326	0.322 (-1.39%)	0.327 (0.06%)	0.328 (0.37%)	0.332 (1.84%)	0.335 (2.64%)	0.355 (8.66%)	0.326 (-0.15%)
1928	Above Normal	Spring	0.277	0.273 (-1.55%)	0.276 (-0.49%)	0.276 (-0.26%)	0.280 (0.96%)	0.287 (3.63%)	0.289 (4.45%)	0.277 (-0.08%)
1929	Critical	Spring	0.128	0.135 (5.33%)	0.128 (0.10%)	0.136 (6.17%)	0.137 (6.44%)	0.137 (6.93%)	0.145 (13.20%)	0.129 (0.42%)
1930	Dry	Spring	0.189	0.187 (-1.15%)	0.189 (0.02%)	0.189 (-0.08%)	0.189 (-0.17%)	0.193 (1.94%)	0.201 (5.91%)	0.189 (0.02%)
1931	Critical	Spring	0.116	0.125 (7.45%)	0.116 (-0.13%)	0.125 (7.80%)	0.125 (7.92%)	0.130 (11.75%)	0.126 (8.76%)	0.116 (-0.38%)
1932	Critical	Spring	0.153	0.152 (-0.23%)	0.151 (-1.33%)	0.158 (3.62%)	0.158 (3.49%)	0.159 (4.06%)	0.170 (11.31%)	0.152 (-0.70%)
1933	Critical	Spring	0.123	0.130 (5.89%)	0.122 (-1.01%)	0.132 (6.87%)	0.133 (8.01%)	0.134 (8.81%)	0.127 (3.26%)	0.122 (-1.25%)
1934	Critical	Spring	0.127	0.147 (15.01%)	0.126 (-0.78%)	0.146 (14.68%)	0.146 (14.62%)	0.147 (15.22%)	0.129 (1.35%)	0.127 (-0.10%)
1935	Below Normal	Spring	0.25	0.244 (-2.53%)	0.252 (0.59%)	0.248 (-0.86%)	0.248 (-0.97%)	0.252 (0.83%)	0.257 (2.84%)	0.251 (0.44%)
1936	Below Normal	Spring	0.228	0.224 (-1.77%)	0.228 (0.00%)	0.225 (-1.39%)	0.227 (-0.61%)	0.235 (3.30%)	0.232 (1.92%)	0.228 (-0.07%)
1937	Below Normal	Spring	0.233	0.228 (-2.23%)	0.231 (-1.07%)	0.231 (-1.02%)	0.232 (-0.61%)	0.236 (1.38%)	0.256 (9.74%)	0.230 (-1.20%)
1938	Wet	Spring	0.413	0.412 (-0.16%)	0.409 (-0.76%)	0.409 (-0.91%)	0.410 (-0.69%)	0.410 (-0.74%)	0.453 (9.69%)	0.409 (-0.91%)
1939	Dry	Spring	0.144	0.142 (-1.86%)	0.144 (-0.28%)	0.144 (-0.37%)	0.144 (-0.32%)	0.146 (1.28%)	0.148 (2.67%)	0.145 (0.45%)
1940	Above Normal	Spring	0.316	0.316 (-0.02%)	0.316 (-0.28%)	0.316 (-0.26%)	0.318 (0.54%)	0.321 (1.51%)	0.341 (7.84%)	0.316 (-0.19%)
1941	Wet	Spring	0.378	0.375 (-0.94%)	0.375 (-0.83%)	0.375 (-0.92%)	0.375 (-0.77%)	0.375 (-0.94%)	0.390 (3.02%)	0.375 (-0.72%)
1942	Wet	Spring	0.306	0.302 (-1.34%)	0.303 (-0.84%)	0.303 (-0.95%)	0.303 (-0.93%)	0.303 (-0.75%)	0.328 (7.27%)	0.302 (-1.05%)
1943	Wet	Spring	0.26	0.261 (0.28%)	0.258 (-0.93%)	0.257 (-0.99%)	0.259 (-0.45%)	0.263 (1.18%)	0.297 (14.10%)	0.258 (-0.92%)
1944	Dry	Spring	0.17	0.170 (-0.32%)	0.169 (-0.45%)	0.169 (-0.50%)	0.169 (-0.37%)	0.174 (2.04%)	0.181 (6.29%)	0.169 (-0.93%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1945	Dry	Spring	0.19	0.188 (-0.97%)	0.190 (-0.14%)	0.190 (-0.12%)	0.192 (0.90%)	0.199 (4.75%)	0.203 (6.66%)	0.189 (-0.44%)
1946	Below Normal	Spring	0.175	0.172 (-2.07%)	0.175 (0.03%)	0.174 (-0.60%)	0.177 (0.79%)	0.185 (5.18%)	0.202 (15.26%)	0.174 (-0.74%)
1947	Dry	Spring	0.163	0.162 (-0.56%)	0.162 (-0.46%)	0.162 (-0.26%)	0.162 (-0.30%)	0.166 (1.82%)	0.168 (3.23%)	0.162 (-0.35%)
1948	Dry	Spring	0.219	0.218 (-0.49%)	0.219 (0.11%)	0.219 (0.23%)	0.224 (2.68%)	0.227 (3.68%)	0.230 (5.25%)	0.217 (-0.50%)
1949	Dry	Spring	0.214	0.211 (-1.45%)	0.214 (-0.15%)	0.214 (-0.14%)	0.215 (0.31%)	0.219 (2.27%)	0.214 (-0.38%)	0.214 (-0.23%)
1950	Dry	Spring	0.191	0.188 (-1.44%)	0.190 (-0.33%)	0.190 (-0.18%)	0.191 (0.34%)	0.199 (4.53%)	0.207 (8.58%)	0.190 (-0.41%)
1951	Above Normal	Spring	0.208	0.204 (-1.74%)	0.207 (-0.45%)	0.207 (-0.34%)	0.209 (0.63%)	0.207 (-0.35%)	0.220 (5.78%)	0.207 (-0.65%)
1952	Wet	Spring	0.349	0.343 (-1.79%)	0.346 (-0.88%)	0.346 (-0.98%)	0.346 (-0.96%)	0.345 (-1.05%)	0.365 (4.42%)	0.346 (-0.94%)
1953	Above Normal	Spring	0.206	0.200 (-2.99%)	0.204 (-1.15%)	0.204 (-1.38%)	0.207 (0.39%)	0.215 (4.36%)	0.223 (7.89%)	0.203 (-1.57%)
1954	Above Normal	Spring	0.265	0.252 (-5.17%)	0.262 (-1.23%)	0.262 (-1.14%)	0.266 (0.26%)	0.271 (2.14%)	0.289 (8.77%)	0.262 (-1.34%)
1955	Dry	Spring	0.142	0.140 (-1.46%)	0.141 (-0.30%)	0.141 (-0.50%)	0.141 (-0.57%)	0.144 (1.33%)	0.163 (14.63%)	0.141 (-0.43%)
1956	Wet	Spring	0.247	0.241 (-2.16%)	0.245 (-0.61%)	0.245 (-0.76%)	0.245 (-0.65%)	0.244 (-0.92%)	0.273 (10.58%)	0.244 (-1.13%)
1957	Below Normal	Spring	0.229	0.223 (-2.43%)	0.226 (-1.17%)	0.226 (-1.26%)	0.229 (-0.01%)	0.236 (3.40%)	0.254 (10.96%)	0.226 (-1.22%)
1958	Wet	Spring	0.397	0.393 (-1.01%)	0.393 (-0.92%)	0.393 (-0.85%)	0.393 (-0.86%)	0.393 (-0.93%)	0.423 (6.74%)	0.393 (-0.93%)
1959	Below Normal	Spring	0.186	0.192 (3.39%)	0.184 (-1.00%)	0.183 (-1.45%)	0.184 (-0.80%)	0.188 (1.32%)	0.197 (6.11%)	0.183 (-1.24%)
1960	Dry	Spring	0.189	0.193 (1.92%)	0.190 (0.42%)	0.190 (0.34%)	0.188 (-0.24%)	0.194 (2.94%)	0.215 (13.94%)	0.189 (0.21%)
1961	Dry	Spring	0.172	0.167 (-3.06%)	0.171 (-0.44%)	0.171 (-0.36%)	0.170 (-1.07%)	0.172 (-0.10%)	0.174 (1.03%)	0.171 (-0.51%)
1962	Dry	Spring	0.211	0.211 (-0.02%)	0.212 (0.37%)	0.212 (0.39%)	0.213 (0.99%)	0.221 (4.82%)	0.239 (13.30%)	0.212 (0.35%)
1963	Wet	Spring	0.311	0.305 (-2.11%)	0.311 (-0.25%)	0.311 (-0.29%)	0.313 (0.57%)	0.315 (1.04%)	0.336 (8.02%)	0.310 (-0.46%)
1964	Dry	Spring	0.144	0.145 (0.44%)	0.144 (0.09%)	0.144 (-0.11%)	0.143 (-0.73%)	0.146 (1.59%)	0.149 (3.41%)	0.143 (-0.47%)
1965	Wet	Spring	0.221	0.221 (-0.02%)	0.220 (-0.48%)	0.221 (-0.25%)	0.225 (1.76%)	0.225 (1.55%)	0.265 (19.83%)	0.220 (-0.46%)
1966	Below Normal	Spring	0.181	0.172 (-4.91%)	0.178 (-1.69%)	0.178 (-1.78%)	0.179 (-0.70%)	0.185 (2.41%)	0.191 (5.52%)	0.177 (-1.88%)
1967	Wet	Spring	0.322	0.313 (-2.57%)	0.317 (-1.31%)	0.318 (-1.13%)	0.322 (0.00%)	0.324 (0.67%)	0.344 (6.85%)	0.318 (-1.00%)
1968	Below Normal	Spring	0.217	0.219 (0.88%)	0.218 (0.55%)	0.218 (0.48%)	0.219 (0.98%)	0.224 (3.11%)	0.220 (1.51%)	0.217 (-0.11%)
1969	Wet	Spring	0.313	0.310 (-0.98%)	0.313 (-0.03%)	0.313 (0.08%)	0.313 (-0.15%)	0.312 (-0.45%)	0.332 (6.11%)	0.311 (-0.49%)
1970	Wet	Spring	0.215	0.213 (-1.17%)	0.215 (-0.03%)	0.215 (-0.16%)	0.215 (-0.26%)	0.215 (-0.20%)	0.227 (5.30%)	0.214 (-0.40%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1971	Wet	Spring	0.255	0.247 (-2.91%)	0.252 (-1.06%)	0.252 (-0.88%)	0.253 (-0.76%)	0.253 (-0.74%)	0.274 (7.57%)	0.251 (-1.42%)
1972	Below Normal	Spring	0.184	0.180 (-2.18%)	0.182 (-1.10%)	0.181 (-1.39%)	0.182 (-1.03%)	0.188 (2.48%)	0.207 (12.56%)	0.181 (-1.28%)
1973	Above Normal	Spring	0.25	0.248 (-0.99%)	0.249 (-0.49%)	0.250 (-0.17%)	0.252 (0.56%)	0.259 (3.73%)	0.279 (11.68%)	0.249 (-0.58%)
1974	Wet	Spring	0.342	0.339 (-0.98%)	0.342 (-0.15%)	0.342 (-0.13%)	0.342 (-0.20%)	0.341 (-0.47%)	0.388 (13.38%)	0.341 (-0.48%)
1975	Above Normal	Spring	0.312	0.302 (-3.01%)	0.308 (-1.13%)	0.309 (-0.96%)	0.313 (0.27%)	0.319 (2.28%)	0.348 (11.58%)	0.308 (-1.06%)
1976	Critical	Spring	0.13	0.122 (-6.18%)	0.125 (-3.55%)	0.125 (-3.79%)	0.125 (-3.69%)	0.125 (-3.23%)	0.132 (1.57%)	0.129 (-0.19%)
1977	Critical	Spring	0.113	0.120 (6.58%)	0.111 (-1.40%)	0.120 (6.49%)	0.120 (6.58%)	0.121 (7.55%)	0.114 (1.20%)	0.111 (-1.33%)
1978	Above Normal	Spring	0.287	0.285 (-0.69%)	0.285 (-0.87%)	0.284 (-0.98%)	0.287 (0.05%)	0.291 (1.33%)	0.339 (18.02%)	0.284 (-0.97%)
1979	Dry	Spring	0.19	0.184 (-3.32%)	0.188 (-1.02%)	0.189 (-0.94%)	0.190 (-0.37%)	0.197 (3.35%)	0.213 (11.97%)	0.188 (-1.13%)
1980	Above Normal	Spring	0.27	0.269 (-0.52%)	0.269 (-0.54%)	0.269 (-0.38%)	0.271 (0.23%)	0.280 (3.64%)	0.298 (10.14%)	0.268 (-0.94%)
1981	Dry	Spring	0.167	0.169 (1.31%)	0.166 (-0.42%)	0.166 (-0.54%)	0.167 (0.54%)	0.170 (2.21%)	0.177 (6.23%)	0.166 (-0.01%)
1982	Wet	Spring	0.373	0.369 (-1.03%)	0.370 (-0.76%)	0.371 (-0.66%)	0.371 (-0.64%)	0.370 (-0.83%)	0.402 (7.59%)	0.370 (-0.86%)
1983	Wet	Spring	0.477	0.477 (-0.03%)	0.477 (0.02%)	0.476 (-0.20%)	0.477 (0.04%)	0.477 (-0.04%)	0.500 (4.88%)	0.476 (-0.10%)
1984	Wet	Spring	0.207	0.204 (-1.33%)	0.205 (-0.54%)	0.206 (-0.50%)	0.206 (-0.51%)	0.205 (-0.57%)	0.227 (9.89%)	0.204 (-1.02%)
1985	Below Normal	Spring	0.151	0.147 (-2.66%)	0.148 (-2.11%)	0.148 (-1.95%)	0.148 (-1.81%)	0.151 (0.00%)	0.156 (2.94%)	0.148 (-2.21%)
1986	Wet	Spring	0.323	0.322 (-0.19%)	0.322 (-0.35%)	0.322 (-0.24%)	0.322 (-0.07%)	0.322 (-0.18%)	0.360 (11.44%)	0.322 (-0.33%)
1987	Dry	Spring	0.18	0.173 (-3.82%)	0.178 (-0.60%)	0.179 (-0.44%)	0.179 (-0.22%)	0.182 (1.30%)	0.179 (-0.12%)	0.179 (-0.42%)
1988	Critical	Spring	0.135	0.131 (-3.46%)	0.135 (0.01%)	0.136 (0.21%)	0.136 (0.12%)	0.139 (2.71%)	0.136 (0.52%)	0.136 (0.22%)
1989	Dry	Spring	0.235	0.231 (-1.66%)	0.236 (0.36%)	0.235 (0.12%)	0.236 (0.64%)	0.240 (2.15%)	0.241 (2.80%)	0.235 (0.01%)
1990	Critical	Spring	0.127	0.134 (4.97%)	0.137 (7.28%)	0.137 (7.54%)	0.137 (7.55%)	0.141 (10.33%)	0.143 (12.18%)	0.136 (6.96%)
1991	Critical	Spring	0.172	0.174 (0.78%)	0.173 (0.47%)	0.178 (3.40%)	0.179 (3.88%)	0.180 (4.53%)	0.182 (5.29%)	0.172 (-0.08%)
1992	Critical	Spring	0.162	0.172 (5.87%)	0.169 (4.57%)	0.174 (7.59%)	0.174 (7.59%)	0.174 (7.62%)	0.174 (7.17%)	0.170 (5.01%)
1993	Above Normal	Spring	0.305	0.285 (-6.47%)	0.298 (-2.29%)	0.281 (-7.67%)	0.289 (-5.21%)	0.294 (-3.57%)	0.341 (11.97%)	0.297 (-2.36%)
1994	Critical	Spring	0.149	0.148 (-0.35%)	0.148 (-0.36%)	0.148 (-0.41%)	0.147 (-0.82%)	0.151 (1.36%)	0.148 (-0.18%)	0.149 (0.22%)
1995	Wet	Spring	0.423	0.423 (-0.18%)	0.423 (-0.14%)	0.422 (-0.31%)	0.423 (-0.16%)	0.422 (-0.23%)	0.442 (4.44%)	0.422 (-0.34%)
1996	Wet	Spring	0.35	0.346 (-1.09%)	0.345 (-1.31%)	0.345 (-1.33%)	0.345 (-1.24%)	0.345 (-1.37%)	0.374 (6.92%)	0.344 (-1.50%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1997	Wet	Spring	0.177	0.173 (-2.11%)	0.177 (0.06%)	0.177 (0.20%)	0.177 (0.15%)	0.176 (-0.37%)	0.188 (6.09%)	0.177 (-0.14%)
1998	Wet	Spring	0.402	0.409 (1.67%)	0.400 (-0.61%)	0.400 (-0.67%)	0.400 (-0.58%)	0.401 (-0.34%)	0.418 (3.91%)	0.400 (-0.59%)
1999	Wet	Spring	0.281	0.278 (-1.07%)	0.278 (-1.14%)	0.278 (-1.05%)	0.279 (-0.96%)	0.279 (-0.98%)	0.328 (16.65%)	0.279 (-1.02%)
2000	Above Normal	Spring	0.289	0.283 (-2.07%)	0.287 (-0.72%)	0.287 (-0.53%)	0.290 (0.31%)	0.295 (1.93%)	0.321 (11.05%)	0.287 (-0.59%)
2001	Dry	Spring	0.174	0.169 (-2.69%)	0.173 (-0.41%)	0.174 (-0.37%)	0.174 (0.09%)	0.177 (1.42%)	0.177 (1.88%)	0.174 (-0.39%)
2002	Below Normal	Spring	0.164	0.164 (0.05%)	0.164 (0.06%)	0.164 (-0.01%)	0.164 (-0.03%)	0.174 (6.14%)	0.182 (11.18%)	0.164 (-0.01%)
2003	Above Normal	Spring	0.258	0.249 (-3.30%)	0.256 (-0.60%)	0.256 (-0.62%)	0.255 (-1.14%)	0.260 (0.75%)	0.280 (8.54%)	0.256 (-0.64%)
2004	Above Normal	Spring	0.258	0.248 (-3.69%)	0.258 (-0.10%)	0.257 (-0.30%)	0.258 (0.23%)	0.267 (3.53%)	0.267 (3.44%)	0.257 (-0.24%)
2005	Below Normal	Spring	0.249	0.249 (-0.22%)	0.249 (-0.27%)	0.249 (-0.23%)	0.251 (0.61%)	0.256 (2.73%)	0.277 (10.92%)	0.248 (-0.49%)
2006	Wet	Spring	0.418	0.419 (0.25%)	0.416 (-0.43%)	0.416 (-0.39%)	0.419 (0.17%)	0.418 (0.11%)	0.451 (7.83%)	0.416 (-0.51%)
2007	Below Normal	Spring	0.163	0.162 (-0.26%)	0.160 (-1.51%)	0.161 (-1.42%)	0.161 (-1.30%)	0.165 (1.60%)	0.173 (6.53%)	0.161 (-1.31%)
2008	Dry	Spring	0.167	0.157 (-5.74%)	0.166 (-0.34%)	0.166 (-0.12%)	0.166 (-0.34%)	0.167 (0.39%)	0.175 (4.85%)	0.167 (0.39%)
2009	Dry	Spring	0.198	0.196 (-0.88%)	0.199 (0.38%)	0.199 (0.63%)	0.201 (1.41%)	0.211 (6.47%)	0.199 (0.62%)	0.199 (0.48%)
2010	Below Normal	Spring	0.214	0.211 (-1.53%)	0.217 (1.18%)	0.217 (1.20%)	0.220 (2.71%)	0.229 (7.10%)	0.252 (17.69%)	0.216 (1.13%)
2011	Wet	Spring	0.359	0.355 (-1.05%)	0.357 (-0.63%)	0.356 (-0.69%)	0.357 (-0.62%)	0.357 (-0.64%)	0.388 (8.23%)	0.357 (-0.46%)
2012	Below Normal	Spring	0.192	0.202 (5.29%)	0.194 (1.09%)	0.195 (1.42%)	0.194 (0.86%)	0.201 (4.47%)	0.221 (15.23%)	0.194 (1.24%)
2013	Dry	Spring	0.151	0.146 (-3.27%)	0.151 (-0.45%)	0.151 (-0.43%)	0.152 (0.46%)	0.154 (1.53%)	0.149 (-1.64%)	0.151 (-0.44%)
2014	Critical	Spring	0.139	0.142 (1.87%)	0.139 (0.30%)	0.142 (2.38%)	0.143 (2.67%)	0.144 (3.34%)	0.147 (5.93%)	0.139 (-0.28%)
2015	Critical	Spring	0.124	0.139 (12.10%)	0.123 (-0.69%)	0.140 (13.26%)	0.140 (13.03%)	0.141 (14.01%)	0.128 (3.55%)	0.123 (-0.68%)
2016	Below Normal	Spring	0.233	0.227 (-2.48%)	0.233 (-0.02%)	0.233 (-0.05%)	0.235 (0.60%)	0.244 (4.66%)	0.252 (8.02%)	0.234 (0.12%)
2017	Wet	Spring	0.378	0.376 (-0.57%)	0.377 (-0.32%)	0.376 (-0.73%)	0.377 (-0.40%)	0.378 (-0.17%)	0.430 (13.69%)	0.376 (-0.60%)
2018	Below Normal	Spring	0.212	0.221 (4.18%)	0.213 (0.78%)	0.213 (0.78%)	0.217 (2.61%)	0.221 (4.49%)	0.226 (6.92%)	0.213 (0.60%)
2019	Wet	Spring	0.375	0.369 (-1.58%)	0.373 (-0.48%)	0.374 (-0.38%)	0.377 (0.50%)	0.376 (0.27%)	0.415 (10.57%)	0.373 (-0.73%)
2020	Dry	Spring	0.145	0.142 (-2.21%)	0.143 (-0.98%)	0.144 (-0.89%)	0.143 (-1.14%)	0.145 (0.17%)	0.153 (5.29%)	0.143 (-1.03%)
2021	Critical	Spring	0.119	0.121 (1.93%)	0.118 (-1.21%)	0.124 (4.34%)	0.124 (3.67%)	0.127 (6.47%)	0.125 (4.78%)	0.115 (-3.89%)

- **Above Normal**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0% lower in Above Normal water years to 6.5% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon (Figure I.6-14 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.1% lower in Above Normal water years to 2.3% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1% higher in Above Normal water years to 5.2% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 4.4% higher in Above Normal water years to 3.6% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.2% lower in Above Normal water years to 7.7% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 18% higher in Above Normal water years to 3.4% higher in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.1% lower in Above Normal water years to 2.4% lower in Above Normal water years compared to the NAA for Spring-run Chinook salmon.
- **Below Normal**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 5.3% higher in Below Normal water years to 4.9% lower in Below Normal water years compared to the NAA for Spring-run Chinook salmon (Figure I.6-14 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.2% higher in Below Normal water years to 2.1% lower in Below Normal water years compared to the NAA for Spring-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.7% higher in Below Normal water years to

1.8% lower in Below Normal water years compared to the NAA for Spring-run Chinook salmon.

- Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 7.1% higher in Below Normal water years to 0% higher in Below Normal water years compared to the NAA for Spring-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.4% higher in Below Normal water years to 1.9% lower in Below Normal water years compared to the NAA for Spring-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 17.7% higher in Below Normal water years to 1.5% higher in Below Normal water years compared to the NAA for Spring-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.2% higher in Below Normal water years to 4.3% lower in Below Normal water years compared to the NAA for Spring-run Chinook salmon.

- **Critical**
    - Under Alt1, mean predicted survival to Chipps Island is higher than NAA, ranging from 15% higher in Critical water years to 6.2% lower in Critical water years compared to the NAA for Spring-run Chinook salmon (Figure I.6-14 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 7.3% higher in Critical water years to 3.6% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 14.6% higher in Critical water years to 3.7% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 15.2% higher in Critical water years to 3.2% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 14.7% higher in Critical water years to 3.8% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 13.2% higher in Critical water years to 0.2% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.

- Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 7% higher in Critical water years to 3.9% lower in Critical water years compared to the NAA for Spring-run Chinook salmon.

- **Dry**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.9% higher in Dry water years to 5.7% lower in Dry water years compared to the NAA for Spring-run Chinook salmon (Figure I.6-14 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.4% higher in Dry water years to 1% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.7% higher in Dry water years to 1.1% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 6.5% higher in Dry water years to 0.1% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.8% higher in Dry water years to 0.9% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 14.6% higher in Dry water years to 1.6% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.6% higher in Dry water years to 1.1% lower in Dry water years compared to the NAA for Spring-run Chinook salmon.
- **Wet**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.7% higher in Wet water years to 2.9% lower in Wet water years compared to the NAA for Spring-run Chinook salmon (Figure I.6-14 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.1% higher in Wet water years to 1.3% lower in Wet water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.8% higher in Wet water years to 1.2% lower in Wet water years compared to the NAA for Spring-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.6% higher in Wet water years to 1.4% lower in Wet water years compared to the NAA for Spring-run Chinook salmon.

- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Wet water years to 1.3% lower in Wet water years compared to the NAA for Spring-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 19.8% higher in Wet water years to 3% higher in Wet water years compared to the NAA for Spring-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.1% lower in Wet water years to 1.5% lower in Wet water years compared to the NAA for Spring-run Chinook salmon.

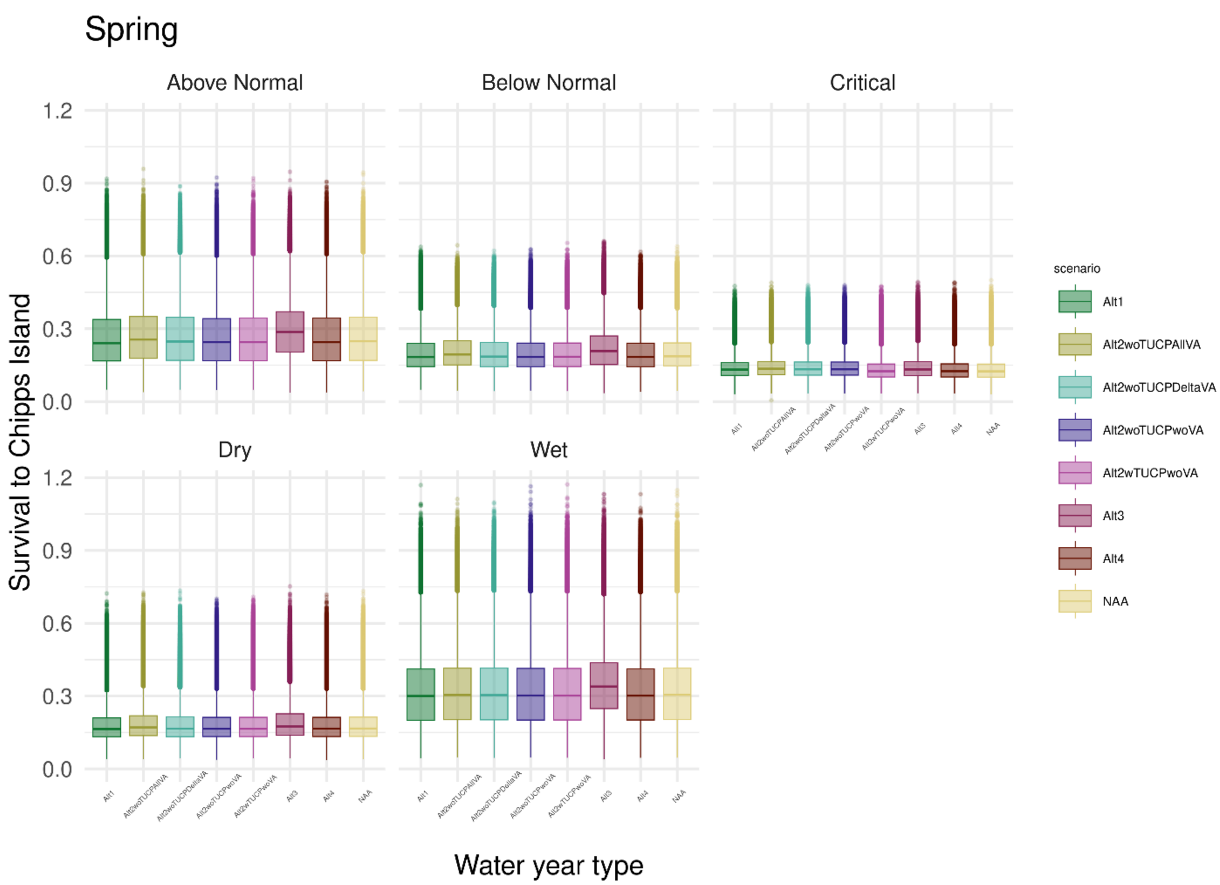

Figure I.6-14. Predicted spring-run Chinook salmon survival to Chipps Island averaged by water year type.

- Under Alt1, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 17.9% higher in 1934 to 5.9% lower in 1993 compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 With TUCP Without VA, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 11.6% higher in 1992 to 3.4% lower in 2021 compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 Without TUCP Delta VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 17.8% higher in 1934 to 5.6% lower in 1993 compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 Without TUCP Systemwide VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 18.5% higher in 1934 to 3.6% lower in 1993 compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 18.5% higher in 1934 to 7.6% lower in 1993 compared to the NAA for Fall-run Chinook salmon.
- Under Alt3, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 21.7% higher in 1999 to 3.8% lower in 1994 compared to the NAA for Fall-run Chinook salmon.
- Under Alt4, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 11.7% higher in 1992 to 4.9% lower in 2021 compared to the NAA for Fall-run Chinook salmon.
- Under NAA, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 0% lower in 1922 to 0% lower in 1922 compared to the NAA for Fall-run Chinook salmon. (Figure I.6-15, Table I.6-8).

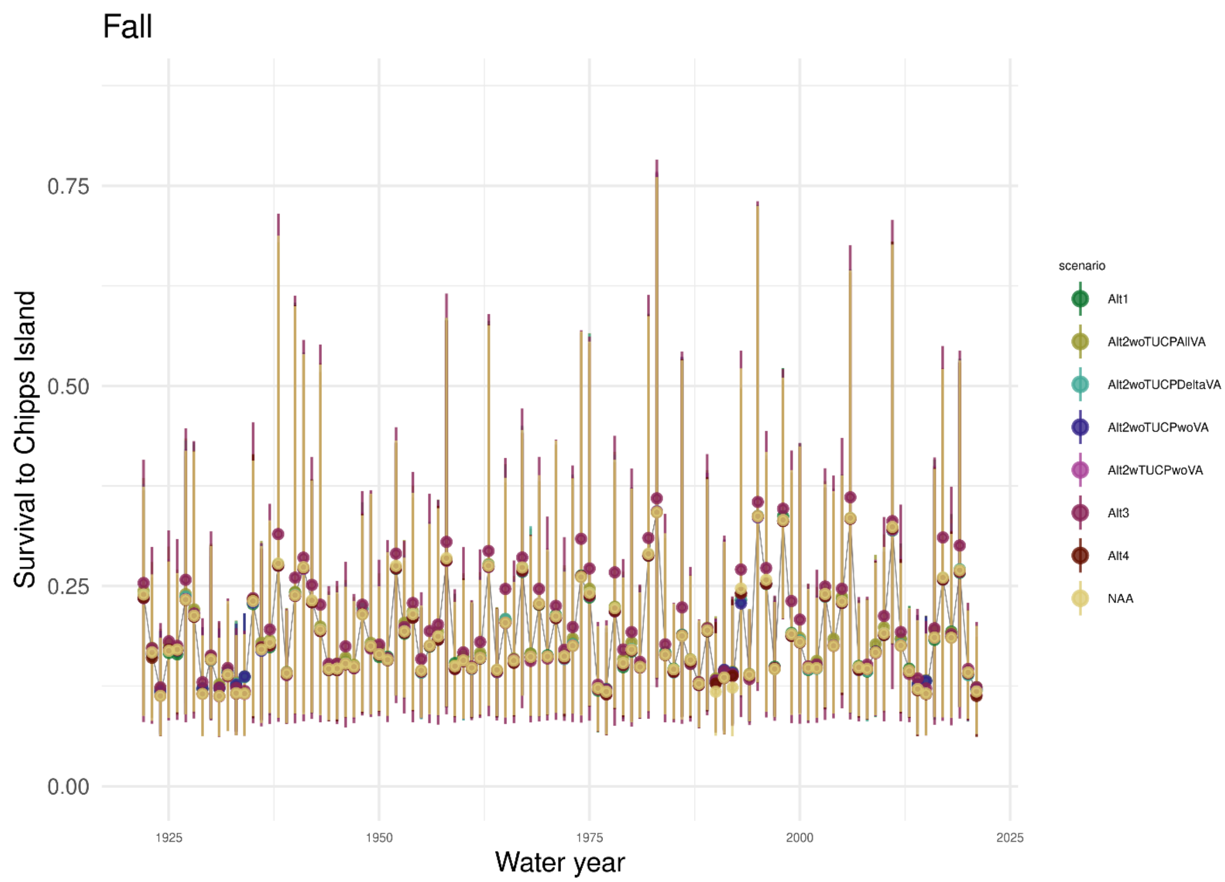

Figure I.6-15. Predicted annual fall-run Chinook salmon survival to Chipps Island. Parentheses indicate % difference from NAA (negative values indicate a decrease in survival).

Table I.6-8. Mean predicted fall-run Chinook salmon survival to Chipps Island averaged by run and water year type. Parentheses indicate % difference from NAA (negative values indicate a decrease in survival).

Water Year	Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP Delta VA	Alt2 woTUCP AllVA	Alt3	Alt4
1922	Above Normal	Fall	0.239	0.237 (-0.90%)	0.235 (-1.88%)	0.235 (-1.76%)	0.238 (-0.47%)	0.244 (1.74%)	0.254 (6.11%)	0.235 (-1.73%)
1923	Below Normal	Fall	0.167	0.164 (-1.57%)	0.166 (-0.35%)	0.166 (-0.69%)	0.167 (-0.09%)	0.173 (3.47%)	0.172 (3.18%)	0.160 (-4.18%)
1924	Critical	Fall	0.113	0.118 (4.38%)	0.113 (0.51%)	0.118 (5.06%)	0.118 (4.91%)	0.122 (7.94%)	0.123 (9.52%)	0.113 (-0.03%)
1925	Dry	Fall	0.169	0.166 (-1.62%)	0.171 (1.01%)	0.171 (1.06%)	0.171 (0.95%)	0.177 (4.77%)	0.181 (7.08%)	0.171 (0.92%)
1926	Dry	Fall	0.171	0.165 (-3.53%)	0.170 (-0.46%)	0.169 (-0.94%)	0.169 (-0.82%)	0.172 (0.89%)	0.175 (2.57%)	0.170 (-0.70%)
1927	Wet	Fall	0.233	0.236 (1.32%)	0.233 (0.16%)	0.234 (0.31%)	0.237 (1.69%)	0.240 (3.02%)	0.258 (10.67%)	0.232 (-0.26%)
1928	Above Normal	Fall	0.213	0.214 (0.55%)	0.212 (-0.43%)	0.212 (-0.60%)	0.214 (0.43%)	0.221 (3.69%)	0.216 (1.33%)	0.212 (-0.56%)
1929	Critical	Fall	0.115	0.121 (4.88%)	0.115 (0.17%)	0.122 (5.94%)	0.122 (5.84%)	0.122 (6.12%)	0.130 (12.77%)	0.115 (0.01%)
1930	Dry	Fall	0.158	0.161 (1.43%)	0.158 (-0.25%)	0.158 (-0.14%)	0.157 (-0.59%)	0.162 (2.17%)	0.163 (3.22%)	0.158 (-0.31%)
1931	Critical	Fall	0.113	0.122 (8.53%)	0.112 (-0.48%)	0.123 (8.85%)	0.122 (8.59%)	0.128 (13.18%)	0.123 (9.51%)	0.113 (-0.07%)
1932	Critical	Fall	0.139	0.144 (3.82%)	0.137 (-1.04%)	0.141 (1.72%)	0.141 (1.66%)	0.142 (2.00%)	0.148 (6.32%)	0.138 (-0.65%)
1933	Critical	Fall	0.116	0.126 (8.72%)	0.116 (-0.43%)	0.126 (8.78%)	0.128 (10.32%)	0.129 (11.28%)	0.123 (5.73%)	0.116 (-0.45%)
1934	Critical	Fall	0.116	0.136 (17.86%)	0.115 (-0.49%)	0.137 (18.50%)	0.136 (17.78%)	0.137 (18.46%)	0.119 (2.81%)	0.116 (0.26%)
1935	Below Normal	Fall	0.231	0.227 (-1.58%)	0.231 (0.15%)	0.229 (-0.74%)	0.229 (-0.84%)	0.233 (0.91%)	0.235 (1.60%)	0.232 (0.56%)
1936	Below Normal	Fall	0.171	0.172 (0.65%)	0.171 (0.25%)	0.169 (-0.94%)	0.170 (-0.26%)	0.179 (5.08%)	0.174 (1.87%)	0.172 (0.86%)
1937	Below Normal	Fall	0.179	0.173 (-3.27%)	0.176 (-1.85%)	0.175 (-2.09%)	0.177 (-1.33%)	0.182 (1.46%)	0.196 (9.12%)	0.176 (-1.74%)
1938	Wet	Fall	0.278	0.277 (-0.36%)	0.275 (-0.91%)	0.275 (-0.95%)	0.276 (-0.81%)	0.276 (-0.89%)	0.315 (13.21%)	0.275 (-0.97%)
1939	Dry	Fall	0.141	0.140 (-0.75%)	0.141 (0.01%)	0.141 (0.24%)	0.141 (-0.10%)	0.143 (1.13%)	0.139 (-1.81%)	0.141 (-0.28%)
1940	Above Normal	Fall	0.238	0.242 (1.62%)	0.238 (-0.17%)	0.237 (-0.29%)	0.239 (0.41%)	0.243 (1.83%)	0.260 (9.36%)	0.238 (-0.18%)
1941	Wet	Fall	0.274	0.272 (-0.64%)	0.272 (-0.74%)	0.272 (-0.76%)	0.272 (-0.58%)	0.272 (-0.71%)	0.285 (4.27%)	0.273 (-0.33%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP Delta VA	Alt2 woTUCP AllVA	Alt3	Alt4
1942	Wet	Fall	0.232	0.230 (-0.88%)	0.230 (-0.94%)	0.229 (-1.19%)	0.230 (-0.81%)	0.230 (-0.93%)	0.251 (8.30%)	0.230 (-1.02%)
1943	Wet	Fall	0.196	0.196 (0.31%)	0.194 (-1.13%)	0.194 (-0.96%)	0.195 (-0.17%)	0.200 (1.87%)	0.227 (15.87%)	0.194 (-1.05%)
1944	Dry	Fall	0.147	0.146 (-0.11%)	0.145 (-0.91%)	0.145 (-0.90%)	0.145 (-1.21%)	0.148 (1.20%)	0.152 (3.97%)	0.145 (-1.02%)
1945	Dry	Fall	0.147	0.146 (-0.53%)	0.145 (-1.28%)	0.145 (-0.90%)	0.146 (-0.53%)	0.153 (4.44%)	0.153 (4.19%)	0.145 (-1.11%)
1946	Below Normal	Fall	0.153	0.155 (1.56%)	0.152 (-0.51%)	0.152 (-0.42%)	0.153 (0.14%)	0.161 (5.02%)	0.175 (14.05%)	0.152 (-0.60%)
1947	Dry	Fall	0.149	0.147 (-1.24%)	0.147 (-1.17%)	0.148 (-0.83%)	0.148 (-0.95%)	0.152 (1.69%)	0.147 (-1.18%)	0.149 (-0.23%)
1948	Dry	Fall	0.214	0.216 (0.69%)	0.216 (0.83%)	0.216 (0.58%)	0.222 (3.54%)	0.222 (3.34%)	0.227 (5.86%)	0.215 (0.24%)
1949	Dry	Fall	0.175	0.174 (-0.74%)	0.174 (-0.46%)	0.173 (-0.94%)	0.175 (0.02%)	0.179 (2.24%)	0.172 (-1.67%)	0.175 (-0.23%)
1950	Dry	Fall	0.165	0.161 (-2.19%)	0.164 (-0.47%)	0.164 (-0.34%)	0.165 (-0.25%)	0.172 (4.24%)	0.177 (7.03%)	0.164 (-0.76%)
1951	Above Normal	Fall	0.158	0.162 (2.55%)	0.158 (-0.08%)	0.157 (-0.40%)	0.159 (0.58%)	0.158 (-0.17%)	0.160 (1.56%)	0.157 (-0.37%)
1952	Wet	Fall	0.275	0.271 (-1.37%)	0.272 (-1.01%)	0.272 (-1.13%)	0.273 (-0.97%)	0.272 (-1.12%)	0.290 (5.51%)	0.272 (-1.10%)
1953	Above Normal	Fall	0.193	0.191 (-1.41%)	0.192 (-0.84%)	0.192 (-0.85%)	0.195 (0.91%)	0.204 (5.75%)	0.199 (2.93%)	0.192 (-0.79%)
1954	Above Normal	Fall	0.215	0.210 (-2.24%)	0.210 (-2.21%)	0.211 (-2.12%)	0.215 (-0.28%)	0.218 (1.39%)	0.229 (6.30%)	0.210 (-2.22%)
1955	Dry	Fall	0.145	0.142 (-1.77%)	0.143 (-1.34%)	0.143 (-1.11%)	0.142 (-1.90%)	0.144 (-0.43%)	0.159 (9.92%)	0.143 (-0.87%)
1956	Wet	Fall	0.176	0.174 (-1.02%)	0.175 (-0.34%)	0.175 (-0.43%)	0.175 (-0.45%)	0.175 (-0.40%)	0.194 (10.16%)	0.175 (-0.46%)
1957	Below Normal	Fall	0.187	0.183 (-1.96%)	0.183 (-2.13%)	0.183 (-2.20%)	0.184 (-1.57%)	0.193 (2.95%)	0.202 (7.83%)	0.183 (-2.05%)
1958	Wet	Fall	0.284	0.282 (-0.78%)	0.282 (-0.94%)	0.282 (-0.76%)	0.282 (-0.75%)	0.282 (-0.71%)	0.305 (7.25%)	0.282 (-0.83%)
1959	Below Normal	Fall	0.15	0.154 (2.82%)	0.147 (-1.73%)	0.147 (-1.95%)	0.147 (-1.99%)	0.151 (0.88%)	0.146 (-2.40%)	0.147 (-2.03%)
1960	Dry	Fall	0.157	0.162 (3.01%)	0.156 (-0.87%)	0.156 (-0.56%)	0.156 (-0.39%)	0.162 (3.08%)	0.167 (6.32%)	0.156 (-0.60%)
1961	Dry	Fall	0.148	0.148 (0.08%)	0.147 (-0.46%)	0.147 (-0.36%)	0.146 (-0.85%)	0.149 (0.67%)	0.149 (1.07%)	0.147 (-0.48%)
1962	Dry	Fall	0.16	0.163 (1.87%)	0.160 (-0.03%)	0.160 (-0.28%)	0.160 (-0.37%)	0.167 (4.02%)	0.180 (12.39%)	0.160 (-0.26%)
1963	Wet	Fall	0.275	0.275 (-0.13%)	0.274 (-0.40%)	0.274 (-0.57%)	0.276 (0.06%)	0.277 (0.60%)	0.294 (6.60%)	0.274 (-0.48%)
1964	Dry	Fall	0.145	0.144 (-0.96%)	0.144 (-0.86%)	0.144 (-1.16%)	0.142 (-1.97%)	0.145 (-0.06%)	0.142 (-2.02%)	0.145 (-0.57%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP Delta VA	Alt2 woTUCP AllVA	Alt3	Alt4
1965	Wet	Fall	0.204	0.207 (1.19%)	0.204 (-0.35%)	0.204 (-0.05%)	0.209 (2.12%)	0.209 (2.05%)	0.246 (20.49%)	0.204 (-0.27%)
1966	Below Normal	Fall	0.157	0.155 (-1.19%)	0.155 (-1.39%)	0.154 (-1.58%)	0.155 (-1.23%)	0.159 (1.67%)	0.158 (0.69%)	0.154 (-1.74%)
1967	Wet	Fall	0.273	0.268 (-1.97%)	0.269 (-1.53%)	0.268 (-1.70%)	0.271 (-0.71%)	0.273 (0.08%)	0.285 (4.52%)	0.269 (-1.42%)
1968	Below Normal	Fall	0.162	0.166 (2.41%)	0.161 (-0.40%)	0.161 (-0.32%)	0.161 (-0.17%)	0.166 (2.47%)	0.156 (-3.38%)	0.161 (-0.53%)
1969	Wet	Fall	0.228	0.226 (-0.67%)	0.228 (0.16%)	0.228 (-0.18%)	0.228 (0.04%)	0.227 (-0.37%)	0.246 (8.12%)	0.227 (-0.48%)
1970	Wet	Fall	0.162	0.163 (0.88%)	0.162 (0.14%)	0.162 (0.03%)	0.162 (0.04%)	0.161 (-0.28%)	0.160 (-1.35%)	0.162 (0.20%)
1971	Wet	Fall	0.212	0.214 (0.86%)	0.210 (-0.99%)	0.210 (-0.94%)	0.210 (-0.96%)	0.210 (-0.95%)	0.225 (6.15%)	0.210 (-1.04%)
1972	Below Normal	Fall	0.162	0.161 (-0.60%)	0.160 (-1.52%)	0.160 (-1.25%)	0.159 (-2.04%)	0.165 (1.52%)	0.171 (5.20%)	0.160 (-1.24%)
1973	Above Normal	Fall	0.175	0.179 (1.88%)	0.176 (0.32%)	0.175 (0.08%)	0.177 (1.24%)	0.184 (5.22%)	0.199 (13.55%)	0.175 (0.04%)
1974	Wet	Fall	0.261	0.263 (0.69%)	0.262 (0.39%)	0.262 (0.45%)	0.262 (0.31%)	0.262 (0.34%)	0.309 (18.38%)	0.262 (0.41%)
1975	Above Normal	Fall	0.242	0.236 (-2.52%)	0.238 (-1.59%)	0.238 (-1.76%)	0.241 (-0.35%)	0.247 (1.97%)	0.272 (12.49%)	0.238 (-1.45%)
1976	Critical	Fall	0.123	0.119 (-2.94%)	0.121 (-1.62%)	0.122 (-0.96%)	0.121 (-1.19%)	0.122 (-0.65%)	0.127 (3.12%)	0.121 (-1.03%)
1977	Critical	Fall	0.118	0.122 (2.92%)	0.115 (-2.85%)	0.121 (2.33%)	0.121 (2.39%)	0.122 (3.05%)	0.121 (2.15%)	0.115 (-2.94%)
1978	Above Normal	Fall	0.222	0.223 (0.38%)	0.218 (-1.77%)	0.218 (-1.85%)	0.220 (-0.97%)	0.224 (0.89%)	0.267 (20.13%)	0.219 (-1.53%)
1979	Dry	Fall	0.154	0.149 (-3.43%)	0.151 (-1.66%)	0.152 (-1.51%)	0.152 (-0.91%)	0.159 (3.15%)	0.171 (11.05%)	0.152 (-1.51%)
1980	Above Normal	Fall	0.171	0.168 (-1.44%)	0.170 (-0.72%)	0.170 (-0.53%)	0.171 (0.34%)	0.180 (5.33%)	0.193 (12.80%)	0.170 (-0.52%)
1981	Dry	Fall	0.149	0.150 (0.93%)	0.148 (-0.37%)	0.148 (-0.49%)	0.148 (-0.29%)	0.151 (1.28%)	0.155 (4.45%)	0.148 (-0.28%)
1982	Wet	Fall	0.29	0.288 (-0.87%)	0.288 (-0.66%)	0.288 (-0.85%)	0.289 (-0.51%)	0.288 (-0.66%)	0.311 (6.96%)	0.288 (-0.79%)
1983	Wet	Fall	0.342	0.343 (0.29%)	0.343 (0.26%)	0.343 (0.33%)	0.343 (0.38%)	0.343 (0.23%)	0.360 (5.27%)	0.342 (0.00%)
1984	Wet	Fall	0.164	0.167 (1.90%)	0.164 (-0.18%)	0.164 (0.05%)	0.164 (0.05%)	0.164 (-0.40%)	0.177 (8.03%)	0.164 (-0.17%)
1985	Below Normal	Fall	0.146	0.147 (0.49%)	0.143 (-2.35%)	0.143 (-1.81%)	0.142 (-2.73%)	0.145 (-0.51%)	0.143 (-1.85%)	0.143 (-2.15%)
1986	Wet	Fall	0.188	0.189 (0.86%)	0.188 (0.28%)	0.188 (0.40%)	0.189 (0.61%)	0.188 (0.40%)	0.223 (19.06%)	0.188 (0.17%)
1987	Dry	Fall	0.157	0.153 (-2.73%)	0.155 (-1.41%)	0.155 (-1.40%)	0.156 (-1.12%)	0.159 (0.68%)	0.152 (-3.23%)	0.156 (-1.18%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP Delta VA	Alt2 woTUCP AllVA	Alt3	Alt4
1988	Critical	Fall	0.128	0.128 (-0.11%)	0.126 (-1.54%)	0.126 (-1.31%)	0.126 (-1.43%)	0.130 (1.43%)	0.130 (1.44%)	0.126 (-1.41%)
1989	Dry	Fall	0.195	0.194 (-0.68%)	0.194 (-0.31%)	0.194 (-0.38%)	0.194 (-0.33%)	0.198 (1.46%)	0.197 (1.01%)	0.194 (-0.58%)
1990	Critical	Fall	0.118	0.128 (8.82%)	0.129 (9.39%)	0.131 (10.78%)	0.131 (11.33%)	0.135 (14.15%)	0.133 (12.36%)	0.128 (8.63%)
1991	Critical	Fall	0.136	0.142 (4.93%)	0.136 (0.38%)	0.145 (7.06%)	0.144 (5.93%)	0.144 (6.38%)	0.143 (5.63%)	0.135 (-0.62%)
1992	Critical	Fall	0.123	0.142 (15.28%)	0.138 (11.64%)	0.142 (14.95%)	0.142 (15.26%)	0.143 (16.12%)	0.140 (13.35%)	0.138 (11.74%)
1993	Above Normal	Fall	0.247	0.232 (-5.93%)	0.241 (-2.49%)	0.228 (-7.55%)	0.233 (-5.57%)	0.238 (-3.59%)	0.271 (9.58%)	0.241 (-2.23%)
1994	Critical	Fall	0.139	0.139 (0.20%)	0.138 (-0.88%)	0.138 (-0.82%)	0.137 (-1.54%)	0.140 (0.92%)	0.134 (-3.80%)	0.138 (-0.40%)
1995	Wet	Fall	0.337	0.338 (0.22%)	0.337 (-0.15%)	0.336 (-0.39%)	0.337 (-0.07%)	0.337 (-0.15%)	0.355 (5.34%)	0.337 (0.05%)
1996	Wet	Fall	0.258	0.252 (-2.16%)	0.253 (-1.89%)	0.253 (-1.85%)	0.253 (-1.84%)	0.253 (-1.79%)	0.272 (5.50%)	0.252 (-2.15%)
1997	Wet	Fall	0.147	0.149 (1.84%)	0.147 (0.15%)	0.147 (0.29%)	0.147 (0.11%)	0.146 (-0.17%)	0.148 (0.66%)	0.147 (0.33%)
1998	Wet	Fall	0.332	0.337 (1.50%)	0.331 (-0.36%)	0.331 (-0.36%)	0.331 (-0.28%)	0.331 (-0.37%)	0.346 (4.21%)	0.331 (-0.42%)
1999	Wet	Fall	0.19	0.192 (0.86%)	0.188 (-1.12%)	0.188 (-1.08%)	0.188 (-1.01%)	0.188 (-1.05%)	0.231 (21.71%)	0.188 (-1.15%)
2000	Above Normal	Fall	0.18	0.182 (1.22%)	0.180 (-0.25%)	0.180 (-0.07%)	0.182 (1.18%)	0.185 (3.03%)	0.208 (15.49%)	0.180 (-0.19%)
2001	Dry	Fall	0.148	0.145 (-1.64%)	0.147 (-0.25%)	0.147 (-0.10%)	0.146 (-0.87%)	0.149 (0.98%)	0.150 (1.30%)	0.148 (0.09%)
2002	Below Normal	Fall	0.147	0.151 (2.20%)	0.148 (0.54%)	0.149 (0.79%)	0.147 (-0.54%)	0.156 (6.13%)	0.152 (2.95%)	0.148 (0.34%)
2003	Above Normal	Fall	0.24	0.237 (-1.01%)	0.238 (-0.96%)	0.237 (-1.01%)	0.237 (-1.30%)	0.241 (0.70%)	0.249 (3.96%)	0.237 (-1.08%)
2004	Above Normal	Fall	0.175	0.175 (0.11%)	0.176 (0.41%)	0.176 (0.41%)	0.176 (0.44%)	0.184 (4.99%)	0.175 (-0.17%)	0.175 (0.09%)
2005	Below Normal	Fall	0.231	0.234 (1.18%)	0.229 (-0.60%)	0.229 (-1.02%)	0.230 (-0.22%)	0.237 (2.46%)	0.247 (6.80%)	0.229 (-0.78%)
2006	Wet	Fall	0.335	0.335 (0.00%)	0.334 (-0.28%)	0.334 (-0.27%)	0.335 (0.03%)	0.334 (-0.13%)	0.361 (7.82%)	0.334 (-0.29%)
2007	Below Normal	Fall	0.148	0.150 (1.40%)	0.146 (-1.75%)	0.145 (-2.04%)	0.145 (-2.35%)	0.149 (0.65%)	0.147 (-1.05%)	0.146 (-1.67%)
2008	Dry	Fall	0.146	0.143 (-2.12%)	0.146 (0.05%)	0.146 (-0.12%)	0.144 (-1.50%)	0.146 (-0.57%)	0.152 (3.67%)	0.146 (-0.12%)
2009	Dry	Fall	0.167	0.169 (1.37%)	0.168 (0.61%)	0.168 (0.75%)	0.168 (0.68%)	0.177 (6.33%)	0.166 (-0.10%)	0.168 (0.51%)
2010	Below Normal	Fall	0.191	0.189 (-1.13%)	0.189 (-0.87%)	0.189 (-0.84%)	0.190 (-0.30%)	0.198 (3.79%)	0.213 (11.33%)	0.189 (-1.18%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2 wTUCP woVA	Alt2 woTUCP woVA	Alt2 woTUCP Delta VA	Alt2 woTUCP AllVA	Alt3	Alt4
2011	Wet	Fall	0.324	0.319 (-1.51%)	0.320 (-1.19%)	0.321 (-1.09%)	0.320 (-1.31%)	0.321 (-0.99%)	0.331 (2.07%)	0.322 (-0.80%)
2012	Below Normal	Fall	0.176	0.184 (4.73%)	0.176 (-0.03%)	0.176 (0.32%)	0.177 (0.90%)	0.184 (4.69%)	0.193 (9.71%)	0.176 (-0.03%)
2013	Dry	Fall	0.144	0.147 (1.93%)	0.143 (-0.46%)	0.143 (-0.64%)	0.144 (-0.30%)	0.145 (0.81%)	0.140 (-2.73%)	0.143 (-0.47%)
2014	Critical	Fall	0.121	0.127 (4.97%)	0.120 (-0.63%)	0.127 (4.72%)	0.127 (4.77%)	0.128 (5.44%)	0.135 (11.07%)	0.120 (-1.36%)
2015	Critical	Fall	0.116	0.131 (13.29%)	0.115 (-0.47%)	0.132 (13.68%)	0.132 (13.53%)	0.132 (14.26%)	0.122 (5.45%)	0.115 (-0.58%)
2016	Below Normal	Fall	0.186	0.183 (-1.53%)	0.186 (-0.05%)	0.185 (-0.14%)	0.186 (0.02%)	0.195 (4.95%)	0.197 (6.29%)	0.186 (-0.04%)
2017	Wet	Fall	0.261	0.258 (-0.94%)	0.259 (-0.82%)	0.258 (-1.00%)	0.259 (-0.64%)	0.260 (-0.29%)	0.311 (19.25%)	0.258 (-0.96%)
2018	Below Normal	Fall	0.185	0.193 (4.29%)	0.185 (0.07%)	0.186 (0.33%)	0.187 (1.04%)	0.192 (3.43%)	0.190 (2.30%)	0.186 (0.14%)
2019	Wet	Fall	0.27	0.267 (-1.14%)	0.268 (-0.76%)	0.268 (-0.68%)	0.271 (0.50%)	0.271 (0.35%)	0.301 (11.58%)	0.268 (-0.47%)
2020	Dry	Fall	0.142	0.140 (-1.22%)	0.141 (-0.51%)	0.141 (-0.77%)	0.139 (-2.12%)	0.141 (-0.30%)	0.146 (3.34%)	0.141 (-0.47%)
2021	Critical	Fall	0.118	0.119 (0.53%)	0.114 (-3.41%)	0.121 (2.66%)	0.121 (2.41%)	0.124 (4.63%)	0.124 (4.72%)	0.112 (-4.94%)

- **Above Normal**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.6% higher in Above Normal water years to 5.9% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon (Figure I.6-16 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Above Normal water years to 2.5% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.2% higher in Above Normal water years to 5.6% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 5.8% higher in Above Normal water years to 3.6% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Above Normal water years to 7.6% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 20.1% higher in Above Normal water years to 0.2% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.1% higher in Above Normal water years to 2.2% lower in Above Normal water years compared to the NAA for Fall-run Chinook salmon.
- **Below Normal**
  - Under Alt1, mean predicted survival to Chipps Island is higher than NAA, ranging from 4.7% higher in Below Normal water years to 3.3% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon (Figure I.6-16 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.5% higher in Below Normal water years to 2.3% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.

- Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1% higher in Below Normal water years to 2.7% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 6.1% higher in Below Normal water years to 0.5% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.8% higher in Below Normal water years to 2.2% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 14.1% higher in Below Normal water years to 3.4% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.9% higher in Below Normal water years to 4.2% lower in Below Normal water years compared to the NAA for Fall-run Chinook salmon.

- **Critical**
  - Under Alt1, mean predicted survival to Chipps Island is higher than NAA, ranging from 17.9% higher in Critical water years to 2.9% lower in Critical water years compared to the NAA for Fall-run Chinook salmon (Figure I.6-16 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 11.6% higher in Critical water years to 3.4% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 17.8% higher in Critical water years to 1.5% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 18.5% higher in Critical water years to 0.6% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 18.5% higher in Critical water years to 1.3% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 13.3% higher in Critical water years to 3.8% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.

- Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 11.7% higher in Critical water years to 4.9% lower in Critical water years compared to the NAA for Fall-run Chinook salmon.

- **Dry**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 3% higher in Dry water years to 3.5% lower in Dry water years compared to the NAA for Fall-run Chinook salmon (Figure I.6-16 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1% higher in Dry water years to 1.7% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 3.5% higher in Dry water years to 2.1% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 6.3% higher in Dry water years to 0.6% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.1% higher in Dry water years to 1.5% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 12.4% higher in Dry water years to 3.2% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.9% higher in Dry water years to 1.5% lower in Dry water years compared to the NAA for Fall-run Chinook salmon.
- **Wet**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.9% higher in Wet water years to 2.2% lower in Wet water years compared to the NAA for Fall-run Chinook salmon (Figure I.6-16 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Wet water years to 1.9% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.1% higher in Wet water years to 1.8% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 3% higher in Wet water years to 1.8% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.

- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Wet water years to 1.8% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 21.7% higher in Wet water years to 1.3% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Wet water years to 2.1% lower in Wet water years compared to the NAA for Fall-run Chinook salmon.

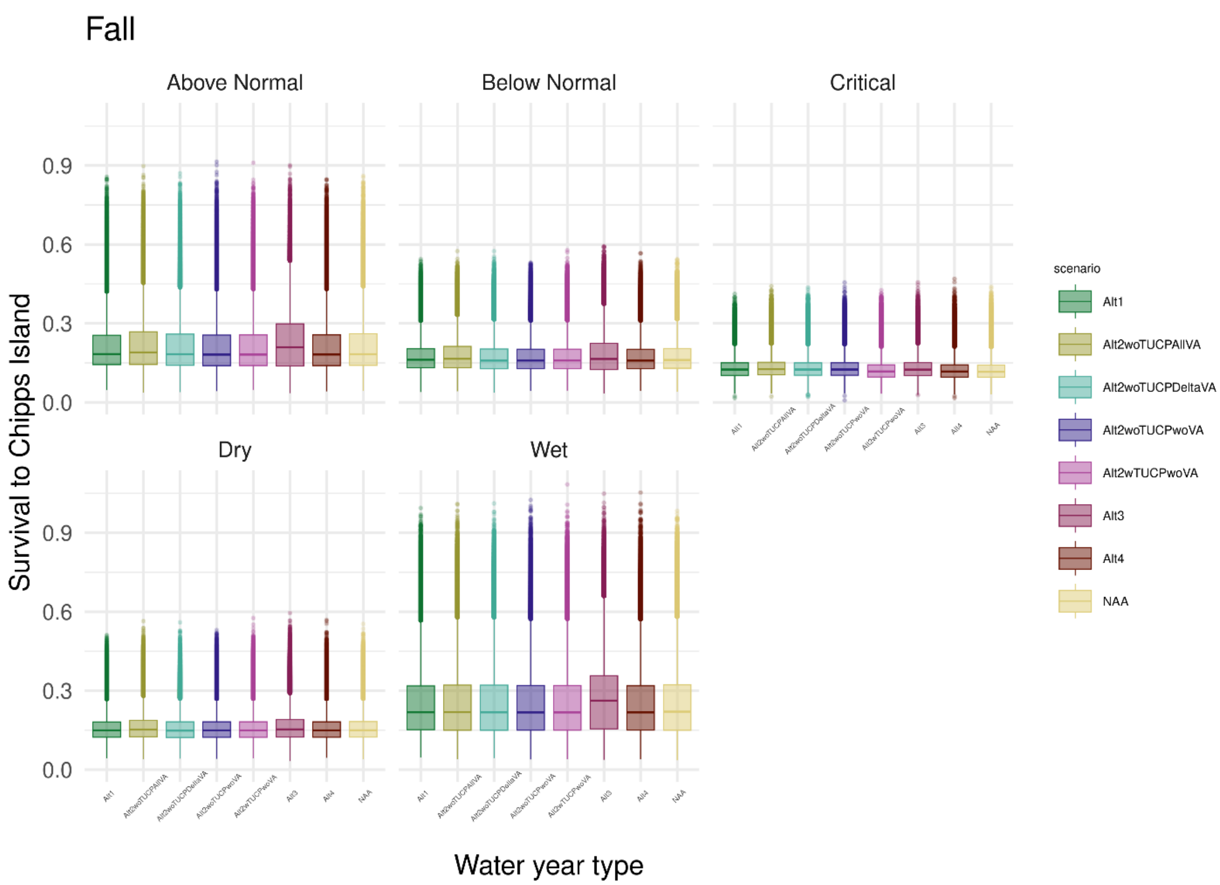

Figure I.6-16. Predicted fall-run Chinook salmon survival to Chipps Island averaged by water year type.

- Under Alt1, mean annual predicted survival to Chipps Island is lower than NAA, ranging from 1.8% higher in 1991 to 9.7% lower in 1922 compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-17 and Table I.6-9).
- Under Alt2 With TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 6.5% higher in 1977 to 2.4% lower in 2012 compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Delta VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 4.3% higher in 1992 to 4.6% lower in 1934 compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Systemwide VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 3.5% higher in 1992 to 4.5% lower in 1934 compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 4.6% higher in 1948 to 4.6% lower in 1934 compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt3, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 15.9% higher in 1930 to 3% lower in 2018 compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt4, mean annual predicted survival to Chipps Island is higher than NAA, ranging from 2.6% higher in 2016 to 2.2% lower in 2012 compared to the NAA for Late Fall-run Chinook salmon.

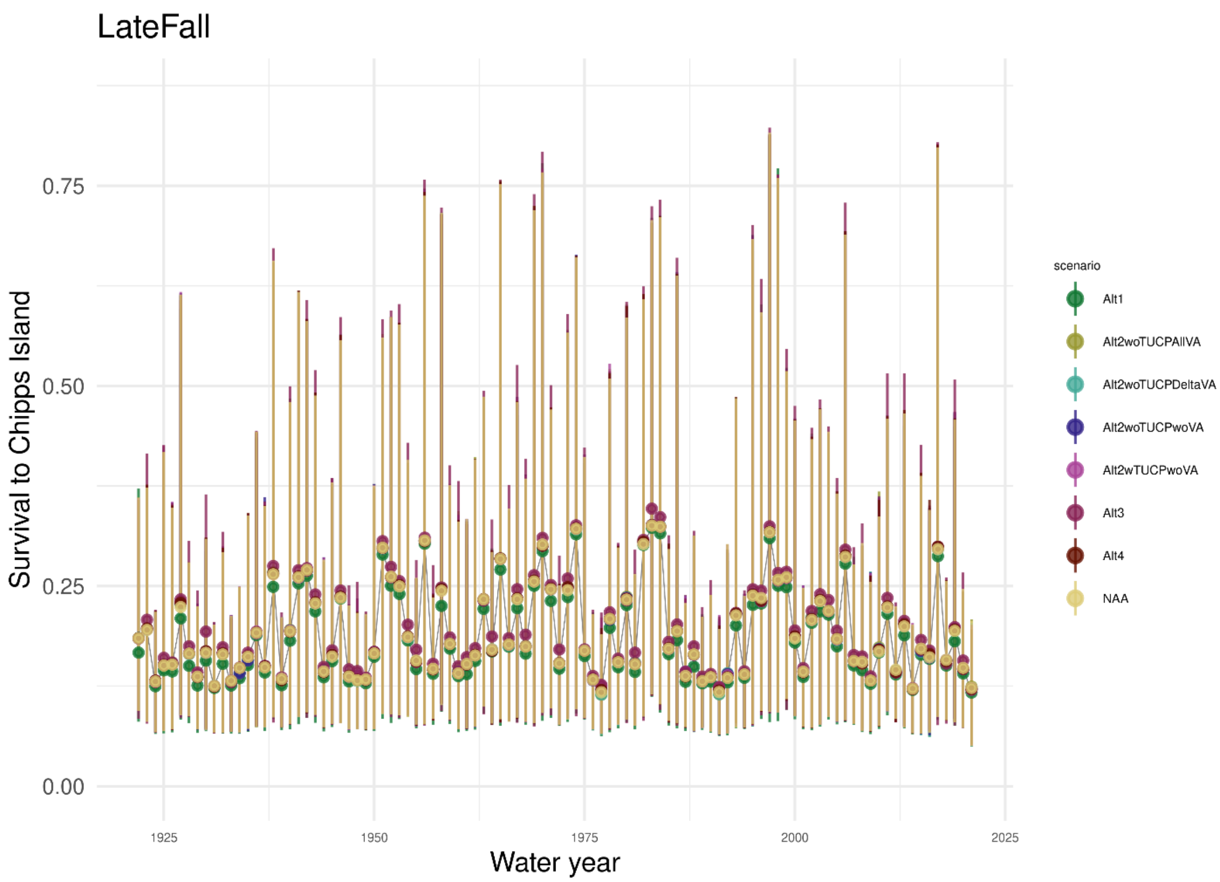

Figure I.6-17. Predicted annual late fall-run Chinook salmon survival to Chipps Island.

Table I.6-9. Predicted annual late fall-run Chinook salmon survival to Chipps Island. Parentheses indicate % difference from NAA (negative values indicate a decrease in survival).

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1922	Above Normal	Late Fall	0.185	0.167 (-9.73%)	0.185 (0.03%)	0.184 (-0.13%)	0.185 (0.32%)	0.184 (-0.09%)	0.185 (-0.06%)	0.185 (0.10%)
1923	Below Normal	Late Fall	0.195	0.196 (0.36%)	0.196 (0.52%)	0.196 (0.54%)	0.196 (0.42%)	0.196 (0.50%)	0.208 (6.47%)	0.197 (0.87%)
1924	Critical	Late Fall	0.131	0.125 (-4.61%)	0.132 (0.88%)	0.131 (0.45%)	0.131 (-0.13%)	0.130 (-0.62%)	0.130 (-0.52%)	0.132 (0.80%)
1925	Dry	Late Fall	0.151	0.145 (-4.10%)	0.152 (0.74%)	0.152 (0.70%)	0.152 (0.72%)	0.152 (0.85%)	0.160 (6.39%)	0.151 (0.38%)
1926	Dry	Late Fall	0.152	0.143 (-5.53%)	0.153 (0.42%)	0.153 (0.88%)	0.153 (0.70%)	0.154 (1.24%)	0.155 (1.80%)	0.152 (0.31%)
1927	Wet	Late Fall	0.224	0.210 (-6.28%)	0.230 (2.86%)	0.229 (2.40%)	0.227 (1.42%)	0.228 (2.03%)	0.233 (4.40%)	0.229 (2.38%)
1928	Above Normal	Late Fall	0.166	0.150 (-9.25%)	0.167 (0.70%)	0.166 (0.33%)	0.165 (-0.34%)	0.166 (0.16%)	0.175 (5.46%)	0.165 (-0.09%)
1929	Critical	Late Fall	0.137	0.126 (-8.01%)	0.138 (0.88%)	0.136 (-0.23%)	0.136 (-0.35%)	0.136 (-0.19%)	0.142 (3.85%)	0.136 (-0.38%)
1930	Dry	Late Fall	0.166	0.157 (-5.76%)	0.168 (0.97%)	0.166 (0.03%)	0.167 (0.63%)	0.167 (0.37%)	0.193 (15.91%)	0.169 (1.40%)
1931	Critical	Late Fall	0.125	0.123 (-2.18%)	0.125 (-0.11%)	0.125 (-0.25%)	0.125 (0.03%)	0.125 (-0.49%)	0.125 (-0.30%)	0.124 (-0.73%)
1932	Critical	Late Fall	0.165	0.153 (-7.08%)	0.167 (1.50%)	0.166 (0.79%)	0.166 (0.62%)	0.166 (0.68%)	0.174 (5.51%)	0.166 (0.85%)
1933	Critical	Late Fall	0.132	0.126 (-4.66%)	0.132 (0.11%)	0.132 (0.01%)	0.131 (-0.41%)	0.132 (-0.22%)	0.130 (-1.59%)	0.132 (-0.08%)
1934	Critical	Late Fall	0.148	0.135 (-8.70%)	0.148 (0.21%)	0.141 (-4.63%)	0.141 (-4.63%)	0.141 (-4.48%)	0.148 (-0.16%)	0.148 (0.16%)
1935	Below Normal	Late Fall	0.162	0.151 (-6.27%)	0.162 (0.24%)	0.157 (-2.73%)	0.158 (-2.21%)	0.158 (-2.25%)	0.167 (3.43%)	0.162 (0.40%)
1936	Below Normal	Late Fall	0.191	0.188 (-1.62%)	0.193 (0.93%)	0.191 (-0.23%)	0.191 (-0.43%)	0.192 (0.04%)	0.191 (-0.20%)	0.192 (0.46%)
1937	Below Normal	Late Fall	0.148	0.142 (-4.24%)	0.150 (1.00%)	0.150 (1.19%)	0.150 (1.23%)	0.150 (1.26%)	0.150 (1.52%)	0.149 (0.77%)
1938	Wet	Late Fall	0.264	0.249 (-5.81%)	0.265 (0.30%)	0.265 (0.33%)	0.266 (0.67%)	0.267 (1.09%)	0.275 (3.96%)	0.266 (0.55%)
1939	Dry	Late Fall	0.134	0.126 (-5.94%)	0.134 (-0.34%)	0.134 (-0.30%)	0.135 (0.27%)	0.134 (0.00%)	0.136 (1.16%)	0.132 (-1.39%)
1940	Above Normal	Late Fall	0.194	0.182 (-6.09%)	0.194 (0.33%)	0.194 (0.47%)	0.195 (0.54%)	0.195 (0.93%)	0.193 (-0.18%)	0.193 (-0.16%)
1941	Wet	Late Fall	0.261	0.253 (-2.91%)	0.261 (0.01%)	0.260 (-0.18%)	0.261 (-0.05%)	0.261 (0.14%)	0.270 (3.50%)	0.262 (0.29%)
1942	Wet	Late Fall	0.27	0.263 (-2.67%)	0.269 (-0.25%)	0.269 (-0.30%)	0.269 (-0.31%)	0.269 (-0.46%)	0.272 (0.81%)	0.270 (-0.09%)
1943	Wet	Late Fall	0.228	0.219 (-4.29%)	0.229 (0.22%)	0.229 (0.17%)	0.228 (0.04%)	0.228 (0.03%)	0.240 (5.01%)	0.230 (0.53%)
1944	Dry	Late Fall	0.143	0.136 (-5.10%)	0.143 (0.10%)	0.144 (0.24%)	0.145 (1.09%)	0.144 (0.84%)	0.149 (4.12%)	0.142 (-0.59%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1945	Dry	Late Fall	0.162	0.156 (-3.61%)	0.164 (1.26%)	0.164 (1.02%)	0.163 (0.67%)	0.164 (1.35%)	0.170 (4.81%)	0.164 (1.07%)
1946	Below Normal	Late Fall	0.235	0.234 (-0.27%)	0.236 (0.57%)	0.237 (0.70%)	0.236 (0.50%)	0.238 (1.16%)	0.244 (3.96%)	0.237 (0.70%)
1947	Dry	Late Fall	0.137	0.131 (-4.44%)	0.137 (-0.11%)	0.137 (0.03%)	0.138 (0.59%)	0.137 (0.26%)	0.146 (6.64%)	0.138 (0.45%)
1948	Dry	Late Fall	0.132	0.132 (-0.38%)	0.138 (4.37%)	0.138 (4.57%)	0.132 (-0.31%)	0.133 (0.49%)	0.144 (8.79%)	0.133 (0.43%)
1949	Dry	Late Fall	0.133	0.129 (-3.73%)	0.133 (-0.06%)	0.133 (-0.16%)	0.132 (-0.77%)	0.133 (-0.44%)	0.135 (1.42%)	0.133 (-0.71%)
1950	Dry	Late Fall	0.166	0.162 (-2.57%)	0.167 (0.60%)	0.168 (1.03%)	0.166 (0.33%)	0.168 (1.17%)	0.168 (1.34%)	0.166 (0.22%)
1951	Above Normal	Late Fall	0.298	0.289 (-2.81%)	0.298 (-0.01%)	0.297 (-0.23%)	0.297 (-0.32%)	0.298 (0.21%)	0.306 (2.73%)	0.297 (-0.19%)
1952	Wet	Late Fall	0.262	0.250 (-4.35%)	0.261 (-0.32%)	0.261 (-0.11%)	0.261 (-0.13%)	0.261 (-0.21%)	0.274 (4.65%)	0.261 (-0.20%)
1953	Above Normal	Late Fall	0.249	0.240 (-3.68%)	0.251 (0.66%)	0.251 (0.58%)	0.251 (0.66%)	0.251 (0.55%)	0.256 (2.67%)	0.251 (0.71%)
1954	Above Normal	Late Fall	0.186	0.182 (-2.39%)	0.186 (-0.07%)	0.186 (-0.04%)	0.186 (-0.44%)	0.187 (0.07%)	0.202 (8.32%)	0.187 (0.37%)
1955	Dry	Late Fall	0.157	0.146 (-6.73%)	0.155 (-1.13%)	0.155 (-0.92%)	0.156 (-0.70%)	0.155 (-0.91%)	0.171 (8.72%)	0.156 (-0.80%)
1956	Wet	Late Fall	0.307	0.303 (-1.47%)	0.307 (-0.15%)	0.307 (-0.20%)	0.307 (-0.19%)	0.307 (-0.20%)	0.310 (0.96%)	0.306 (-0.42%)
1957	Below Normal	Late Fall	0.147	0.140 (-4.42%)	0.146 (-0.60%)	0.146 (-0.34%)	0.146 (-0.44%)	0.146 (-0.58%)	0.153 (4.04%)	0.146 (-0.52%)
1958	Wet	Late Fall	0.244	0.225 (-7.84%)	0.245 (0.43%)	0.246 (0.70%)	0.247 (0.92%)	0.247 (1.10%)	0.248 (1.55%)	0.246 (0.74%)
1959	Below Normal	Late Fall	0.178	0.172 (-3.27%)	0.178 (0.08%)	0.178 (-0.03%)	0.178 (0.38%)	0.178 (0.29%)	0.186 (4.65%)	0.178 (0.02%)
1960	Dry	Late Fall	0.141	0.137 (-2.51%)	0.142 (0.81%)	0.142 (0.94%)	0.143 (1.65%)	0.145 (2.88%)	0.150 (6.51%)	0.141 (0.18%)
1961	Dry	Late Fall	0.153	0.140 (-8.40%)	0.152 (-0.29%)	0.152 (-0.37%)	0.152 (-0.51%)	0.152 (-0.47%)	0.162 (5.69%)	0.152 (-0.46%)
1962	Dry	Late Fall	0.163	0.156 (-4.22%)	0.164 (0.44%)	0.163 (0.09%)	0.164 (0.54%)	0.164 (0.60%)	0.172 (5.69%)	0.164 (0.55%)
1963	Wet	Late Fall	0.233	0.222 (-5.05%)	0.233 (0.01%)	0.233 (-0.27%)	0.233 (-0.00%)	0.233 (0.07%)	0.232 (-0.65%)	0.233 (0.03%)
1964	Dry	Late Fall	0.171	0.168 (-1.49%)	0.170 (-0.37%)	0.170 (-0.49%)	0.171 (0.02%)	0.171 (0.02%)	0.187 (9.70%)	0.169 (-1.10%)
1965	Wet	Late Fall	0.284	0.271 (-4.70%)	0.284 (-0.04%)	0.284 (0.09%)	0.284 (0.06%)	0.285 (0.42%)	0.284 (0.19%)	0.284 (0.07%)
1966	Below Normal	Late Fall	0.177	0.174 (-1.48%)	0.177 (0.11%)	0.177 (-0.13%)	0.176 (-0.33%)	0.177 (0.04%)	0.185 (4.66%)	0.177 (0.12%)
1967	Wet	Late Fall	0.233	0.222 (-4.72%)	0.234 (0.56%)	0.235 (0.65%)	0.233 (0.06%)	0.234 (0.22%)	0.246 (5.54%)	0.235 (0.74%)
1968	Below Normal	Late Fall	0.174	0.165 (-5.06%)	0.174 (0.11%)	0.175 (0.33%)	0.174 (0.09%)	0.175 (0.50%)	0.189 (8.65%)	0.175 (0.19%)
1969	Wet	Late Fall	0.255	0.250 (-2.03%)	0.256 (0.27%)	0.256 (0.30%)	0.257 (0.50%)	0.257 (0.45%)	0.264 (3.15%)	0.257 (0.55%)
1970	Wet	Late Fall	0.302	0.294 (-2.74%)	0.301 (-0.33%)	0.301 (-0.39%)	0.300 (-0.59%)	0.300 (-0.61%)	0.310 (2.79%)	0.300 (-0.52%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1971	Wet	Late Fall	0.246	0.231 (-5.84%)	0.246 (0.07%)	0.246 (0.00%)	0.246 (0.16%)	0.246 (0.07%)	0.251 (2.22%)	0.247 (0.32%)
1972	Below Normal	Late Fall	0.153	0.147 (-4.42%)	0.154 (0.05%)	0.154 (0.10%)	0.154 (0.06%)	0.153 (-0.02%)	0.171 (11.24%)	0.154 (0.26%)
1973	Above Normal	Late Fall	0.245	0.236 (-3.56%)	0.248 (1.18%)	0.248 (1.25%)	0.248 (1.42%)	0.249 (1.85%)	0.260 (6.10%)	0.248 (1.51%)
1974	Wet	Late Fall	0.321	0.314 (-2.07%)	0.321 (0.08%)	0.322 (0.16%)	0.321 (-0.02%)	0.321 (0.08%)	0.326 (1.52%)	0.322 (0.32%)
1975	Above Normal	Late Fall	0.169	0.163 (-3.96%)	0.170 (0.13%)	0.170 (0.16%)	0.170 (0.31%)	0.169 (-0.08%)	0.171 (0.94%)	0.169 (-0.26%)
1976	Critical	Late Fall	0.133	0.132 (-0.53%)	0.133 (-0.18%)	0.133 (-0.25%)	0.133 (-0.07%)	0.133 (0.24%)	0.138 (3.51%)	0.133 (0.41%)
1977	Critical	Late Fall	0.117	0.116 (-1.29%)	0.125 (6.54%)	0.120 (2.09%)	0.114 (-2.47%)	0.114 (-2.60%)	0.127 (7.77%)	0.120 (2.48%)
1978	Above Normal	Late Fall	0.209	0.198 (-5.42%)	0.210 (0.57%)	0.208 (-0.41%)	0.209 (0.06%)	0.210 (0.32%)	0.217 (3.87%)	0.209 (0.00%)
1979	Dry	Late Fall	0.155	0.149 (-4.09%)	0.156 (0.61%)	0.156 (0.54%)	0.155 (0.15%)	0.155 (0.12%)	0.159 (2.89%)	0.155 (0.39%)
1980	Above Normal	Late Fall	0.233	0.226 (-2.84%)	0.234 (0.68%)	0.235 (1.02%)	0.236 (1.21%)	0.237 (1.67%)	0.232 (-0.45%)	0.234 (0.63%)
1981	Dry	Late Fall	0.152	0.143 (-6.31%)	0.153 (0.43%)	0.153 (0.34%)	0.154 (0.97%)	0.154 (1.27%)	0.167 (9.42%)	0.153 (0.15%)
1982	Wet	Late Fall	0.302	0.301 (-0.40%)	0.305 (0.83%)	0.304 (0.63%)	0.303 (0.05%)	0.304 (0.67%)	0.308 (1.70%)	0.305 (0.95%)
1983	Wet	Late Fall	0.325	0.323 (-0.73%)	0.326 (0.26%)	0.326 (0.23%)	0.326 (0.16%)	0.325 (0.02%)	0.347 (6.56%)	0.326 (0.15%)
1984	Wet	Late Fall	0.324	0.316 (-2.59%)	0.324 (-0.02%)	0.324 (-0.02%)	0.325 (0.18%)	0.325 (0.17%)	0.336 (3.77%)	0.324 (0.07%)
1985	Below Normal	Late Fall	0.172	0.165 (-4.00%)	0.172 (-0.06%)	0.171 (-0.10%)	0.172 (0.15%)	0.173 (0.62%)	0.180 (5.10%)	0.172 (0.29%)
1986	Wet	Late Fall	0.194	0.182 (-5.89%)	0.194 (0.15%)	0.194 (0.36%)	0.194 (0.18%)	0.193 (-0.35%)	0.202 (4.37%)	0.194 (0.23%)
1987	Dry	Late Fall	0.138	0.130 (-5.35%)	0.143 (3.98%)	0.143 (3.87%)	0.142 (3.19%)	0.142 (3.38%)	0.142 (3.54%)	0.137 (-0.56%)
1988	Critical	Late Fall	0.165	0.149 (-9.34%)	0.164 (-0.29%)	0.164 (-0.20%)	0.164 (-0.31%)	0.164 (-0.12%)	0.175 (6.15%)	0.164 (-0.05%)
1989	Dry	Late Fall	0.131	0.129 (-1.90%)	0.131 (0.03%)	0.131 (0.25%)	0.132 (0.84%)	0.132 (0.42%)	0.137 (4.67%)	0.131 (0.11%)
1990	Critical	Late Fall	0.136	0.130 (-4.35%)	0.136 (-0.07%)	0.136 (-0.11%)	0.136 (0.04%)	0.136 (-0.01%)	0.140 (3.03%)	0.137 (0.18%)
1991	Critical	Late Fall	0.118	0.120 (1.83%)	0.124 (5.25%)	0.120 (2.37%)	0.115 (-2.09%)	0.115 (-2.44%)	0.124 (5.22%)	0.119 (1.54%)
1992	Critical	Late Fall	0.135	0.129 (-4.36%)	0.138 (2.26%)	0.140 (3.40%)	0.141 (4.30%)	0.140 (3.49%)	0.136 (0.47%)	0.136 (0.56%)
1993	Above Normal	Late Fall	0.213	0.201 (-5.90%)	0.215 (0.51%)	0.215 (0.56%)	0.215 (0.56%)	0.215 (0.63%)	0.216 (1.38%)	0.216 (1.00%)
1994	Critical	Late Fall	0.14	0.135 (-2.99%)	0.141 (0.71%)	0.140 (0.54%)	0.140 (0.35%)	0.140 (0.51%)	0.143 (2.76%)	0.140 (0.06%)
1995	Wet	Late Fall	0.238	0.226 (-4.84%)	0.240 (0.73%)	0.240 (0.79%)	0.240 (0.71%)	0.240 (0.94%)	0.246 (3.32%)	0.239 (0.55%)
1996	Wet	Late Fall	0.235	0.228 (-2.96%)	0.231 (-1.62%)	0.231 (-1.57%)	0.231 (-1.76%)	0.231 (-1.67%)	0.244 (4.03%)	0.232 (-1.43%)

Water Year	Water Year Type	Run	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
1997	Wet	Late Fall	0.318	0.310 (-2.43%)	0.318 (-0.01%)	0.319 (0.28%)	0.318 (0.07%)	0.318 (0.15%)	0.325 (2.34%)	0.318 (0.05%)
1998	Wet	Late Fall	0.258	0.251 (-2.55%)	0.257 (-0.21%)	0.257 (-0.13%)	0.257 (-0.16%)	0.257 (-0.28%)	0.267 (3.48%)	0.258 (0.02%)
1999	Wet	Late Fall	0.261	0.248 (-4.71%)	0.260 (-0.38%)	0.260 (-0.20%)	0.260 (-0.20%)	0.260 (-0.35%)	0.268 (2.70%)	0.261 (0.02%)
2000	Above Normal	Late Fall	0.185	0.179 (-2.98%)	0.187 (1.27%)	0.187 (1.15%)	0.186 (0.93%)	0.187 (1.22%)	0.195 (5.35%)	0.187 (1.21%)
2001	Dry	Late Fall	0.143	0.137 (-4.55%)	0.143 (0.20%)	0.144 (0.43%)	0.144 (0.58%)	0.144 (0.62%)	0.147 (3.04%)	0.142 (-0.69%)
2002	Below Normal	Late Fall	0.208	0.204 (-1.67%)	0.208 (0.29%)	0.208 (0.12%)	0.211 (1.43%)	0.212 (1.90%)	0.219 (5.39%)	0.209 (0.61%)
2003	Above Normal	Late Fall	0.231	0.218 (-5.50%)	0.232 (0.37%)	0.232 (0.29%)	0.232 (0.51%)	0.232 (0.43%)	0.240 (3.67%)	0.233 (0.65%)
2004	Above Normal	Late Fall	0.219	0.214 (-2.08%)	0.219 (0.07%)	0.219 (0.09%)	0.219 (0.15%)	0.219 (0.31%)	0.233 (6.38%)	0.219 (0.23%)
2005	Below Normal	Late Fall	0.184	0.175 (-5.05%)	0.183 (-0.27%)	0.183 (-0.32%)	0.183 (-0.70%)	0.184 (-0.02%)	0.194 (5.65%)	0.184 (0.09%)
2006	Wet	Late Fall	0.286	0.278 (-2.80%)	0.287 (0.35%)	0.287 (0.21%)	0.288 (0.62%)	0.288 (0.59%)	0.296 (3.30%)	0.288 (0.65%)
2007	Below Normal	Late Fall	0.156	0.151 (-3.46%)	0.157 (0.08%)	0.156 (-0.19%)	0.157 (0.15%)	0.157 (0.53%)	0.164 (4.86%)	0.156 (-0.04%)
2008	Dry	Late Fall	0.155	0.145 (-6.86%)	0.154 (-0.82%)	0.154 (-0.80%)	0.153 (-1.17%)	0.153 (-1.43%)	0.162 (4.58%)	0.153 (-1.35%)
2009	Dry	Late Fall	0.132	0.128 (-2.95%)	0.132 (0.36%)	0.132 (0.51%)	0.133 (0.97%)	0.133 (0.80%)	0.137 (4.14%)	0.132 (0.12%)
2010	Below Normal	Late Fall	0.168	0.167 (-0.77%)	0.171 (1.52%)	0.171 (1.75%)	0.172 (2.05%)	0.173 (3.06%)	0.171 (1.41%)	0.171 (1.35%)
2011	Wet	Late Fall	0.223	0.215 (-3.45%)	0.224 (0.36%)	0.224 (0.45%)	0.223 (-0.27%)	0.223 (-0.08%)	0.235 (5.44%)	0.225 (0.66%)
2012	Below Normal	Late Fall	0.145	0.140 (-4.05%)	0.142 (-2.36%)	0.142 (-2.57%)	0.144 (-1.05%)	0.144 (-0.88%)	0.144 (-1.17%)	0.142 (-2.20%)
2013	Dry	Late Fall	0.199	0.188 (-5.46%)	0.201 (0.60%)	0.201 (0.98%)	0.202 (1.48%)	0.202 (1.34%)	0.206 (3.52%)	0.202 (1.41%)
2014	Critical	Late Fall	0.122	0.120 (-1.33%)	0.122 (0.34%)	0.121 (-0.37%)	0.122 (-0.07%)	0.121 (-0.48%)	0.122 (0.48%)	0.121 (-0.28%)
2015	Critical	Late Fall	0.172	0.164 (-4.55%)	0.171 (-0.64%)	0.169 (-1.85%)	0.168 (-2.47%)	0.169 (-1.91%)	0.183 (6.27%)	0.171 (-0.66%)
2016	Below Normal	Late Fall	0.161	0.159 (-1.07%)	0.164 (2.01%)	0.161 (-0.24%)	0.161 (0.33%)	0.165 (2.40%)	0.169 (5.28%)	0.165 (2.57%)
2017	Wet	Late Fall	0.297	0.288 (-3.02%)	0.300 (0.98%)	0.298 (0.49%)	0.296 (-0.18%)	0.296 (-0.15%)	0.298 (0.51%)	0.300 (0.89%)
2018	Below Normal	Late Fall	0.158	0.151 (-4.70%)	0.157 (-0.31%)	0.158 (-0.08%)	0.158 (-0.21%)	0.157 (-0.65%)	0.153 (-3.01%)	0.156 (-1.02%)
2019	Wet	Late Fall	0.194	0.181 (-6.75%)	0.197 (1.53%)	0.196 (1.21%)	0.196 (1.11%)	0.196 (1.04%)	0.198 (2.28%)	0.195 (0.52%)
2020	Dry	Late Fall	0.148	0.141 (-4.79%)	0.146 (-1.04%)	0.146 (-1.11%)	0.146 (-1.32%)	0.146 (-1.23%)	0.157 (6.11%)	0.146 (-1.05%)
2021	Critical	Late Fall	0.123	0.117 (-4.85%)	0.120 (-2.09%)	0.121 (-1.59%)	0.123 (-0.12%)	0.124 (1.25%)	0.123 (0.01%)	0.121 (-1.31%)

- **Above Normal**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 2.1% lower in Above Normal water years to 9.7% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-18 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.3% higher in Above Normal water years to 0.1% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.4% higher in Above Normal water years to 0.4% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.9% higher in Above Normal water years to 0.1% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.2% higher in Above Normal water years to 0.4% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 8.3% higher in Above Normal water years to 0.4% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.5% higher in Above Normal water years to 0.3% lower in Above Normal water years compared to the NAA for Late Fall-run Chinook salmon.
- **Below Normal**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% higher in Below Normal water years to 6.3% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-18 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2% higher in Below Normal water years to 2.4% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.

- Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2% higher in Below Normal water years to 2.2% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3.1% higher in Below Normal water years to 2.2% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.7% higher in Below Normal water years to 2.7% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 11.2% higher in Below Normal water years to 3% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.6% higher in Below Normal water years to 2.2% lower in Below Normal water years compared to the NAA for Late Fall-run Chinook salmon.

- **Critical**
    - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.8% higher in Critical water years to 9.3% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-18 and Table I.6-6).
    - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 6.5% higher in Critical water years to 2.1% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 4.3% higher in Critical water years to 4.6% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is lower than NAA, ranging from 3.5% higher in Critical water years to 4.5% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.
    - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3.4% higher in Critical water years to 4.6% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.

- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 7.8% higher in Critical water years to 1.6% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.5% higher in Critical water years to 1.3% lower in Critical water years compared to the NAA for Late Fall-run Chinook salmon.

- **Dry**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% lower in Dry water years to 8.4% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-18 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 4.4% higher in Dry water years to 1.1% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3.2% higher in Dry water years to 1.3% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 3.4% higher in Dry water years to 1.4% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 4.6% higher in Dry water years to 1.1% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 15.9% higher in Dry water years to 1.2% higher in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt4, mean predicted survival to Chipps Island is lower than NAA, ranging from 1.4% higher in Dry water years to 1.4% lower in Dry water years compared to the NAA for Late Fall-run Chinook salmon.
- **Wet**
  - Under Alt1, mean predicted survival to Chipps Island is lower than NAA, ranging from 0.4% lower in Wet water years to 7.8% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon (Figure I.6-18 and Table I.6-6).
  - Under Alt2 With TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.9% higher in Wet water years to 1.6% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.
  - Under Alt2 Without TUCP Delta VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 1.4% higher in Wet water years to 1.8% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.

- Under Alt2 Without TUCP Systemwide VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2% higher in Wet water years to 1.7% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt2 Without TUCP Without VA, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.4% higher in Wet water years to 1.6% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt3, mean predicted survival to Chipps Island is higher than NAA, ranging from 6.6% higher in Wet water years to 0.7% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.
- Under Alt4, mean predicted survival to Chipps Island is higher than NAA, ranging from 2.4% higher in Wet water years to 1.4% lower in Wet water years compared to the NAA for Late Fall-run Chinook salmon.

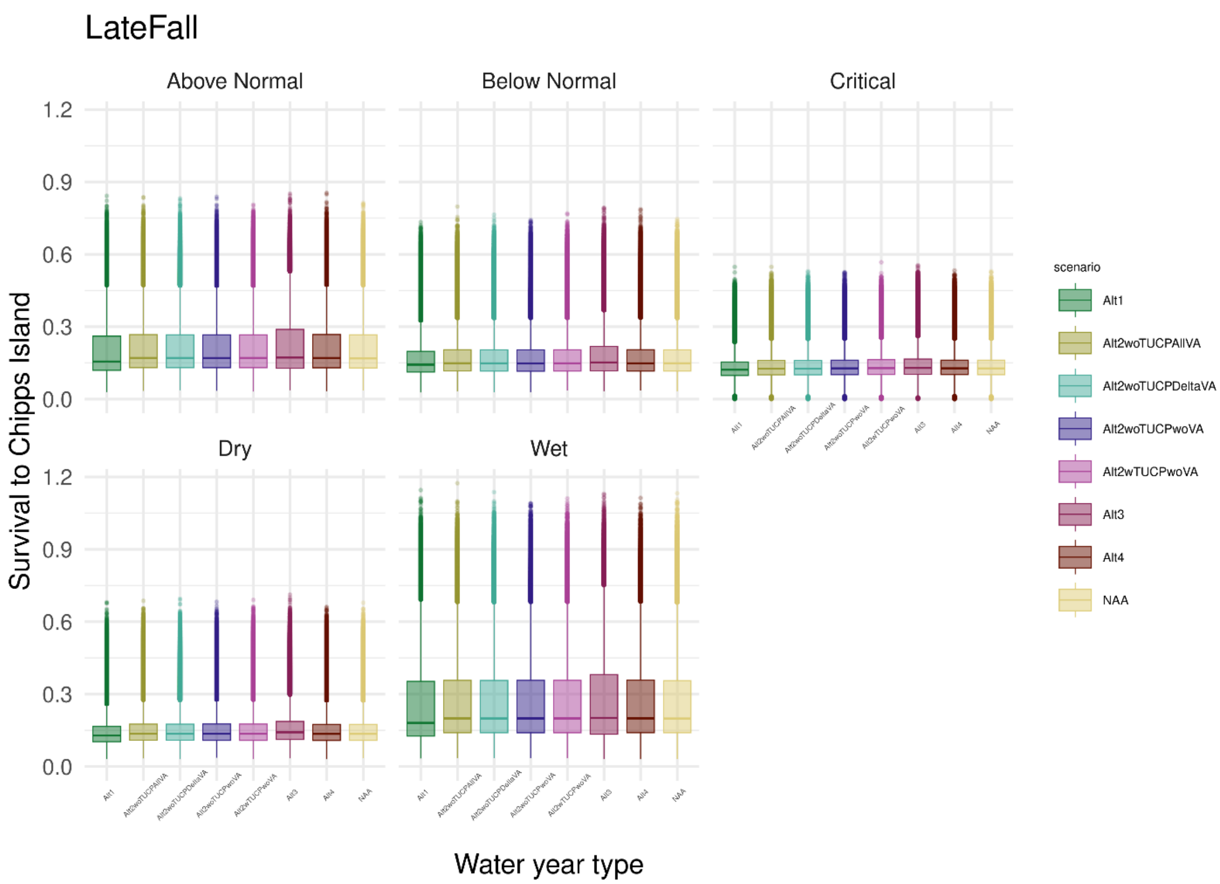

Figure I.6-18. Predicted late fall-run Chinook salmon survival to Chipps Island averaged by water year type.

I.6.3.2 BA: Narrative, Tables, and Figure Results

Mean predicted survival was very similar across alternatives, and the highest mean predicted survival to Chipps Island for Winter-run Chinook salmon occurred under NAA in wet water years, followed by wet water years under Alt2 Without TUCP Systemwide VA. The lowest survival of Winter-run Chinook salmon occurred under NAA in critical water years followed by critical water years under Alt2 With TUCP Without VA. (Figure I.6-19, Table I.6-10).

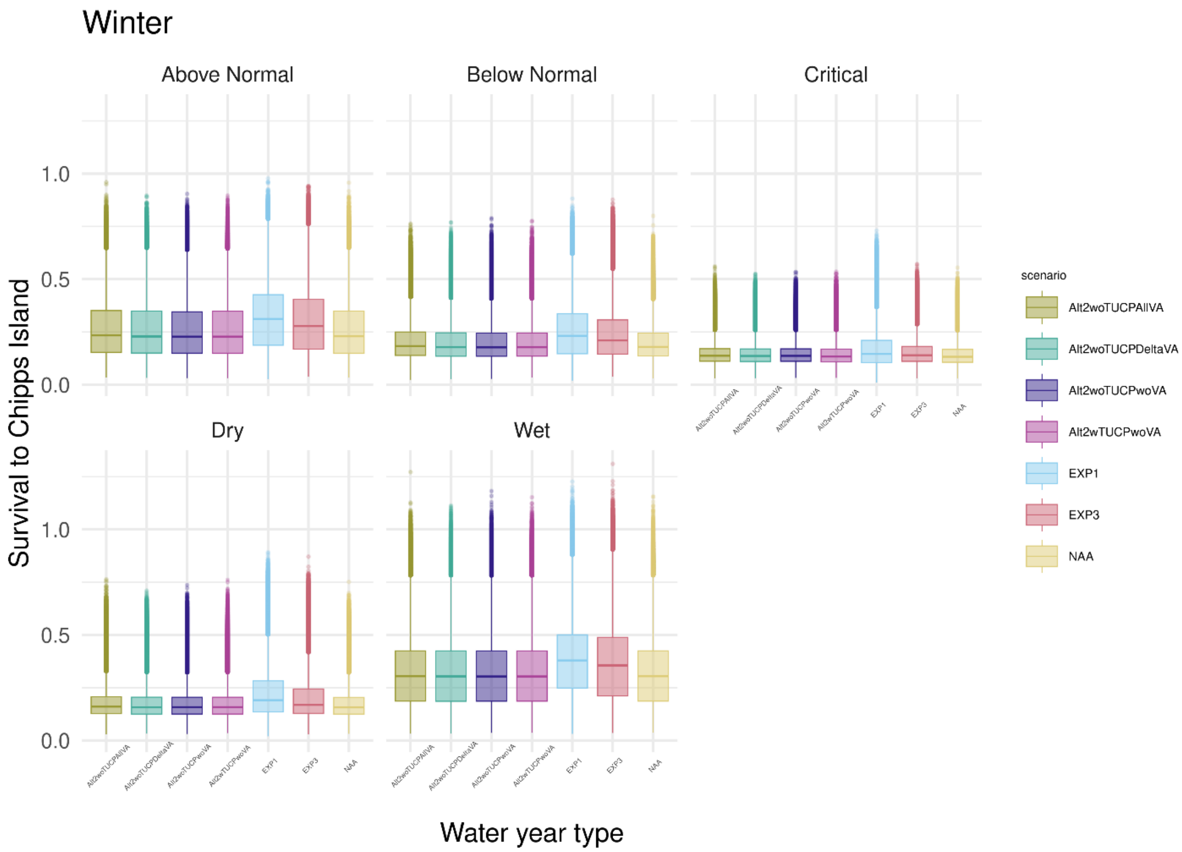

Figure I.6-19. Predicted winter-run Chinook salmon survival to Chipps Island averaged by water year type for Alt2 phases, EXP 1, EXP 3, and NAA.

Table I.6-10. Mean predicted winter-run Chinook salmon survival to Chipps Island averaged by water year type for Alt2 phases, EXP 1, EXP 3, and NAA.

Water Year Type	Run	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
Above Normal	Winter	0.32	0.3	0.26	0.26	0.26	0.26	0.26
Below Normal	Winter	0.25	0.23	0.2	0.2	0.2	0.2	0.2
Critical	Winter	0.17	0.15	0.14	0.14	0.15	0.15	0.15
Dry	Winter	0.22	0.2	0.17	0.17	0.17	0.17	0.18
Wet	Winter	0.39	0.37	0.33	0.33	0.33	0.33	0.33

The highest mean predicted survival to Chipps Island for Spring-run Chinook salmon occurred under NAA in wet water years, followed by wet water years under Alt2 Without TUCP Systemwide VA. The lowest survival of Spring-run Chinook salmon occurred under NAA in critical water years followed by critical water years under Alt2 With TUCP Without VA. (Figure I.6-20, Table I.6-11).

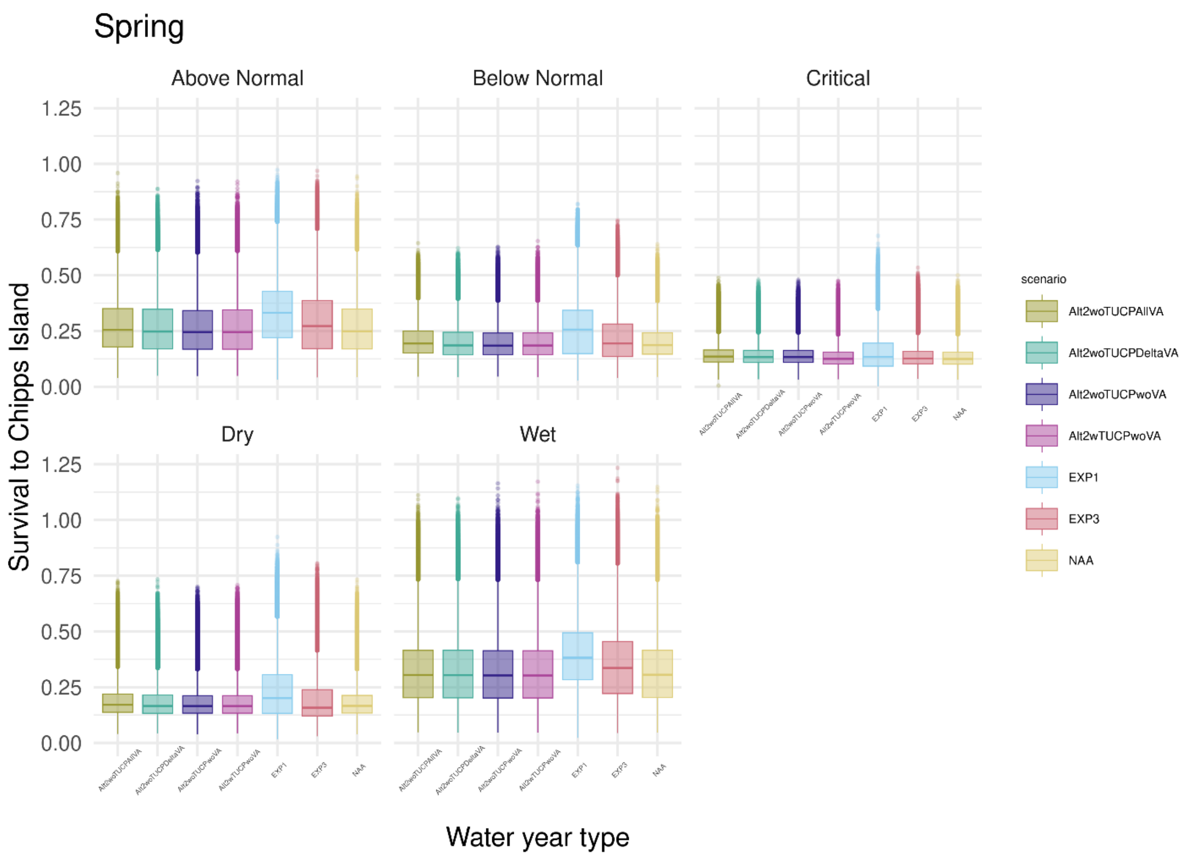

Figure I.6-20. Predicted spring-run Chinook salmon survival to Chipps Island averaged by water year type for Alt2 phases, EXP 1, EXP 3, and NAA.

Table I.6-11. Mean-run Chinook salmon survival to Chipps Island averaged by water year type for Alt2 phases, EXP 1, EXP 3, and NAA.

Water Year Type	Run	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
Above Normal	Spring	0.33	0.29	0.27	0.27	0.27	0.27	0.28
Below Normal	Spring	0.26	0.22	0.2	0.2	0.2	0.2	0.21
Critical	Spring	0.15	0.14	0.13	0.13	0.14	0.14	0.14
Dry	Spring	0.23	0.19	0.18	0.18	0.18	0.18	0.19
Wet	Spring	0.39	0.36	0.33	0.33	0.33	0.33	0.33

I.6.4 References

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