Appendix K, Summer and Fall Delta Outflow and Habitat

Attachment K.1 Summer and Fall Habitat X2 Modeling and Analysis

K.1.1 Model Overview

During the summer-fall period, sub-adult Delta smelt primarily rear in the west Delta, Suisun Bay, and Cache Slough Complex (Merz et al. 2011; Sommer and Mejia 2013; IEP MAST 2015). The degree to which Delta smelt use these areas depends on salinity, temperature, turbidity, and current speed (Nobriga et al. 2008; Feyrer et al. 2011; Sommer and Mejia 2013; Bever et al. 2016). Bever et al. (2016) developed a habitat suitability index) for Delta smelt using long-term data from the California Department of Fish and Wildlife's (CDFW) Fall Midwater Trawl survey (FMWT) along with three-dimensional hydrodynamic modeling using the 3D UnTRIM Bay-Delta model. They developed a statistical model using salinity (percent of time < 6 practical salinity units [psu]), velocity (maximum depth-averaged current speed over a 4-month period), and turbidity (0.5 meter [m] Secchi depth threshold) metrics to predict a catch station index, which is the relative ranking of FMWT stations based on Delta smelt catch. This index was validated using Delta smelt data from the CDFW Bay Study survey, indicating general applicability of the index throughout the Delta (Bever et al. 2016). Bever et al. (2016) concluded that the index is useful for predicting the favorability of environmental conditions among years and, specifically, that historical Delta smelt catch was higher at locations with overlapping conditions of low salinity, low maximum velocity, and high turbidity.

For this analysis, HSI was calculated using a methodology derived from Bever et al. (2016) and RMA (2021), with model runs performed using the 3D Bay-Delta SCHISM model. The HSI represents spatially- and temporally-averaged suitability of habitats within the delineated subregions in the Bay-Delta shown in Figure K.1-1. Spatial averaging was performed both vertically over depth and horizontally over the area of each subregion. The temporal averaging was performed biweekly from June to November. The HSI is based on the four abiotic variables discussed above: salinity, temperature, turbidity, and current speed. Turbidity (NTU) was used instead of Secchi depth with a threshold of 12 NTU, based on Sommer and Mejia (2013). A temperature threshold of 22ºC was used based on sub-lethal physiological and behavioral effects described in Komoroske et al. (2015, 2021), Davis et al. (2019, 2022), Lewis et al. (2021), and Hammock et al. (2022).

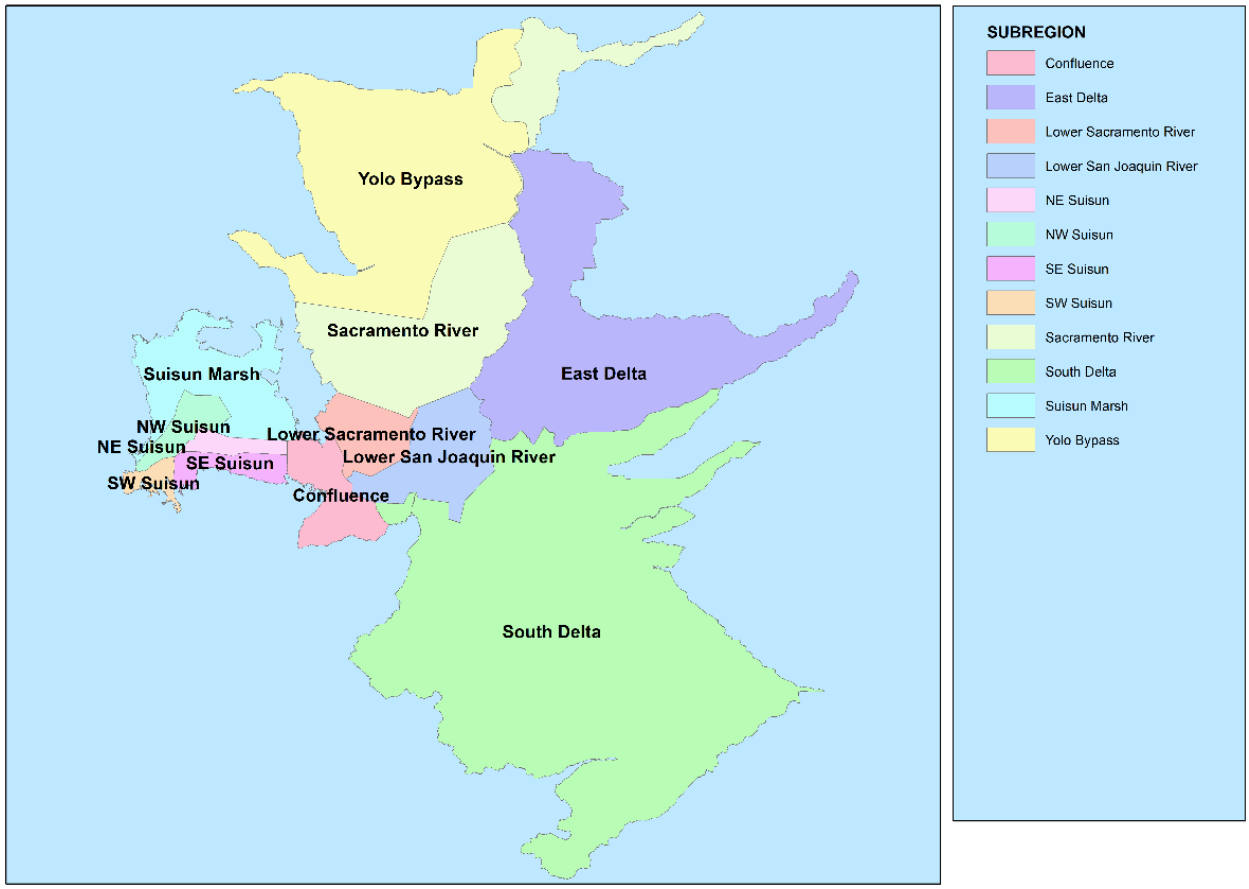

Figure K.1-1. Subregions over which the Habitat Suitability Index was calculated

K.1.2 Model Development

K.1.2.1 Methods

Two of the HSI variables, salinity and current speed, are readily calculated from results from the 3D Bay-Delta SCHISM model. The model results are regarded to be spatially detailed and sufficiently accurate to inform the decision-making process for specified flow boundary conditions ported from CalSim 3 output and DSM2 for the various alternatives. Porting of the boundary conditions in this analysis was done using scripts developed by DWR and available at https://github.com/dwr-rhoang/schism_boundary_porter.

Temperature and turbidity, by contrast, are highly dependent on atmospheric forcing within the model domain, including air temperature, solar radiation, and wind. In hindcasts, they are known and can be used directly in the Bever at al. (2016) and RMA (2021) formulas with accuracy. For projections, however, this is not the case and uncertainty in the weather may dominate the calculation. Temperature was modeled with SCHISM using historic atmospheric forcing datasets perturbated to the 2022 median climate consistent with the method used for the CalSim 3 analyses. Corresponding water temperatures at the main flow boundaries were also derived from the climate datasets using methods artificial neural network methods described in DWR's Delta

Modeling Section's 2022 annual report, available at https://data.cnra.ca.gov/dataset/methodology-for-flow-and-salinity-estimates-in-the-sacramento-san-joaquin-delta-and-suisun-marsh. See Chapter 3 of the 2022 report.

For turbidity, a method was developed that used historical quantiles, interpolated over space, to provide the probability of the threshold being exceeded (or not) at a given location on a given day. First, we computed windowed (0.05, 0.25, 0.5, 0.75) quantiles at continuous stations for each day of the year, using the available record and a 19-day window around each date of interest. We verified that this produced results that were sensible with relatively low noise over time. We then interpolated the quantiles spatially using the method of Sangalli et al. (2013), a regularized spline method which respects islands and irregular domains. The interpolated quantiles consider only the distribution of the data, not the mixed distribution of the data and of the interpolation. The interpolator is based on unstructured meshes but is coarser (1km) than the Bay-Delta SCHISM mesh. Nearest neighbor interpolation was used to interpolate to the much more resolved SCHISM mesh.

To compute the HSI at each mesh cell, we followed the Bever et al. (2016) approach to first calculate a salinity suitability index, S, based on the fraction of time salinity < 6 PSU and a current speed suitability index, V, based on the maximum current speed (m/s). The conventional Bever et al. approach then requires the use of one of the following equations to compute the combined suitability index, S_i, depending on the turbidity level:

$$S_i = 0.67S + 0.33V, \text{ turbidity} \geq 12 \text{ NTU} \quad (1a)$$

$$S_i = (0.67S + 0.33V)c_t, \text{ turbidity} < 12 \text{ NTU} \quad (1b)$$

where $c_t = 0.42$ is a penalty associated with low turbidity. However, in our approach, to reconcile the formula with the turbidity quantiles for a given day, the quantile corresponding to the 12 NTU threshold was used to create a roughly discretized marginal probability and the two equations weighted accordingly. For instance, if q_{75} was the quantile just under 12 NTU for a given date and location, the formula would be weighted with a 0.75 weight on the penalized value (Equation 1b) and a 0.25 weight on the unpenalized value (Equation 1a), reflecting the assumption;

$$S_i = 0.75\times[\ (0.67S + 0.33V)\times 0.42\ ] + 0.25\times[0.67S + 0.33V] \quad (2)$$

Finally, the temperature suitability adjustment was applied to S_i to determine the HSI_c at the mesh cell for the given day using the RMA (2021) approach:

$$HSI_c = S_i \times T \quad (3)$$

where T is the fraction of time the temperature is below the 22ºC threshold at that location.

The daily depth-averaged suitability indices computed at the mesh cells were aggregated over subregion area and on a bi-weekly basis from July to November to calculate each subregion's HSI_R (also identified in figures as *HSI*) using the equation:

$$HSI_R = \frac{\sum_{c=1}^{k}(HSI_c * A_c)}{A_r} \quad (4)$$

Where A_c is the area of the cell (m^2), A_r is the total area of the subregion (m^2), and k is the total number of cells in the subregion.

SCHISM was used to simulate seven LTO alternatives (Table K.1-1) for each representative water year (WY) type. Each simulation was performed under the projected 2022 median climate condition (based on 2008-2037 global climate model results) and an assumed sea level rise of 15 cm. Selection of the representative year to simulate for each WY type was based on the median Sacramento (SAC) River index for the period between 1980 and 2021 from the CALSIM/DSM2 datasets. This period was used because of the general availability of weather data. The simulated representative water years based on the CALSIM/DSM2 datasets are summarized in Table K.1-2.

Table K.1-1. Description of alternatives simulated with Bay-Delta SCHISM

Alternative		Description
1	Run-of-the-river (EXP1)	Exploratory alternative with hydrologic conditions in the absence of the operation of projects
2	Non-discretionary obligations (EXP3)	Exploratory alternative in which Reclamation and DWR make releases from reservoir storage to meet D1641, senior water rights and Level 2 Refuges
3	No action (NAA)	Current regulatory environment
4	Water Quality Control Plan (Alt 1)	Operates to D-1641 and tributary specific water right requirements and agreements (including authorizing legislation, water rights, contracts, and agreements like WQCP and COA).
5	Multi-Agency Consensus version 1 (Alt2 without VAs, without TUCP)	Represents actions and tradeoffs made to reach consensus with DWR, USFWS, CDFW, and NMFS: Without voluntary agreements and without TUCP actions.
6	Multi-Agency Consensus version 1 (Alt2 without VAs, with TUCP)	Same as #5 above but with TUCP actions.
7	Multi-Agency Consensus version 1 (Alt2 with Delta VAs, without TUCP)	Same as #5 above but with Delta VA.
8	Multi-Agency Consensus version 1 (Alt2 with All VAs, without TUCP)	Same as #5 above but with All VAs
9	Modified Natural Hydrograph (Alt 3)	Combines additional Delta outflow with measures to improve drought protection and temperature management through increased reservoir carryover storage (informed by discussions with NGOs).
10	Risk Informed Operations (Alt 4)	Provides alternative criteria for Shasta and incorporates improved real-time analytics using real-time information to support Delta water deliveries while minimizing impacts to listed species.

Table K.1-2. Simulated representative water years. Years were selected based on the median SAC river index between 1980 and 2021.

	Water Year Type	CALSIM Year	SAC River Index (MAF)
1	Wet	1997	10.8
2	Above Normal	1993	8.5
3	Below Normal	2012	6.5
4	Dry	2009	5.7
5	Critical	2015	4.0

Atmospheric inputs to SCHISM were perturbated historical data corresponding to the respective water years simulated. Perturbation of the historical data to represent the 2022 median climate was performed by Jacobs on a Reclamation provided grid covering the Bay-Delta SCHISM model domain. For each selected water year, the historical data was perturbed using a quantile mapping approach that generated and applied monthly adjustment factors to precipitation, surface air temperature, short- and longwave radiation, pressure at mean sea level, and specific humidity. The wind speed was not adjusted. The range of adjustment ratios for the atmospheric variables are summarized in Table K.1-3 for each WY. The historical precipitation and radiation data used were obtained from the National Centers for Environmental Prediction's North American Regional Reanalysis (NARR) datasets for all WYs. The remaining variables for WYs D (2009), BN (2012) and C (2015) were obtained from DWR's Bay-Delta SCHISM atmospheric collection. For WYs AN (1993) and W (1997), the Bay-Delta SCHISM atmospheric datasets for 2010 and 2019, were used respectively. The data for 2010 and 2019 were selected for having the closest SAC river index to the representative years. The Bay-Delta SCHISM air datasets are "constructed by DWR based on spatial interpolation from approximately 71 public and private stations around the Bay-Delta". A sensitivity analysis is also presented at the end of this attachment that considers the use of 1997 NARR and 2011 DWR datasets as representative wet year atmospheric inputs, and their impact on HSI prediction.

Table K.1-3. Ranges of climate adjustment factors used to perturbate climate data in this study.

	1993 (AN)	1997 (W)	2009 (D)	2012 (BN)	2015 (C)
Precipitation rate ($kg/m^2/s$)	0.5272–1.2128	0.5765–1.8588	0.6140–1.1872	0.6562–1.2230	0.4259–1.7226
Air temperature (K)	1.0015–1.0054	1.0018–1.0054	1.0009–1.0047	1.0007–1.0047	1.0011–1.0044
Long wave radiation (W/m^2)	1.0096–1.0282	1.0096–1.0290	1.0098–1.0238	1.0074–1.0242	1.0058–1.0220
Short wave radiation (W/m^2)	0.9590–1.0066	0.9602–1.0242	0.9670–1.0116	0.9582–1.0218	0.9704–1.0194
Pressure at mean sea level (Pa)	1.0006–1.1146	0.9887–1.1134	1.0220–1.1143	0.9974–1.0924	0.9739–1.1119
Specific humidity (-)	0.9982–1.1172	0.9882–1.1319	1.0231–1.1135	0.9974–1.0956	0.9713–1.1132

Most input flow and salinity boundary conditions were ported from DSM2 and CALSIM using the DWR porting tool described above. For locations in the SCHISM domain that fall outside of the DSM2 model domain, data from historical years with closest SAC River Indices were used. These included data at the open ocean boundary (from NOAA), as well as data at the Coyote and Napa inflow boundaries (from CDEC/USGS). The major flow and salinity boundary conditions are presented in Figure K.1-7a-f through Figure K.1-31a-f.

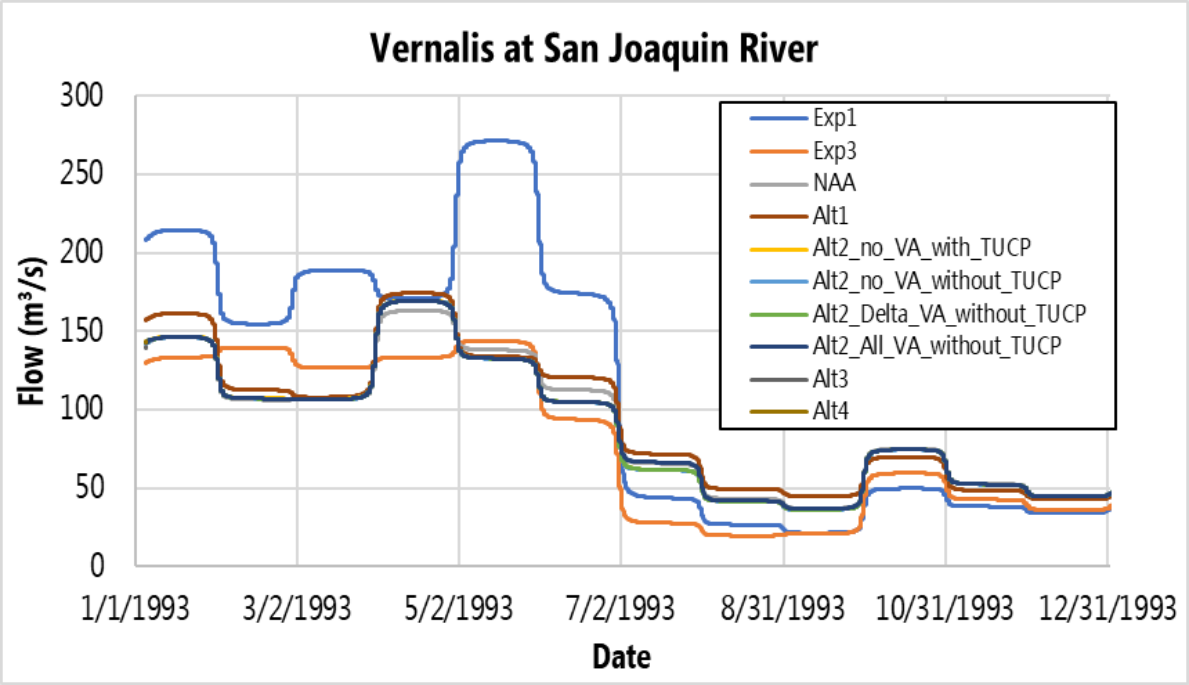

Figure K.1-2a. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at Vernalis at San Joaquin River (inflow)

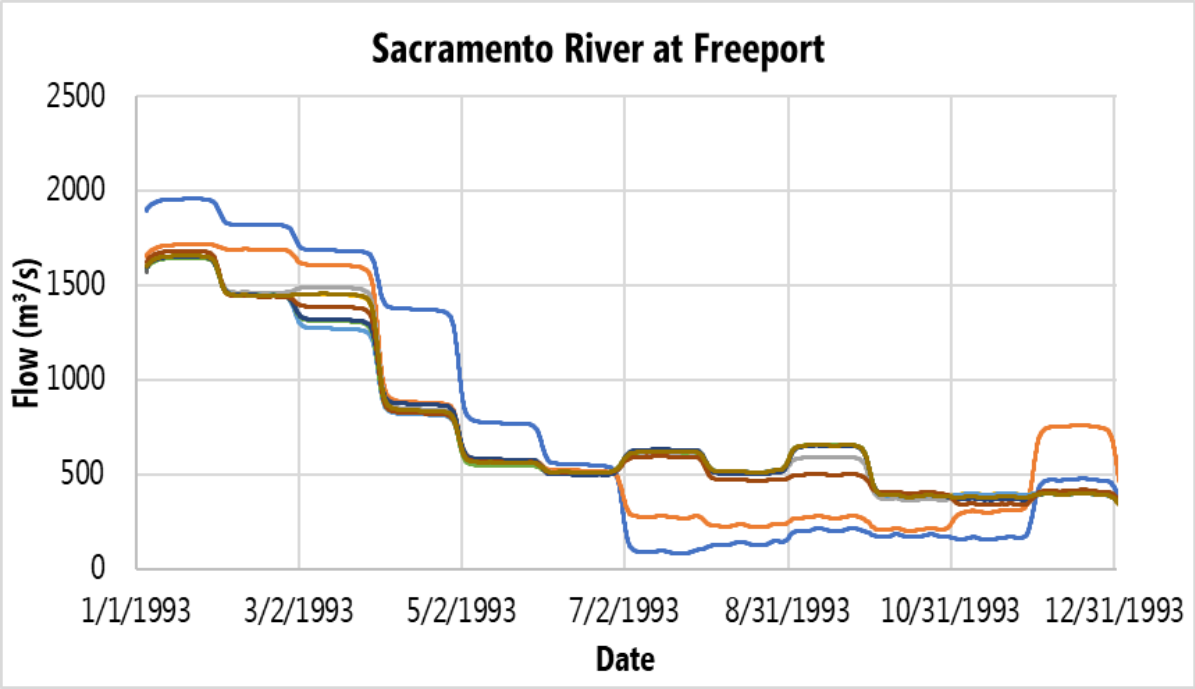

Figure K.1-3b. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at Sacramento River at Freeport (inflow)

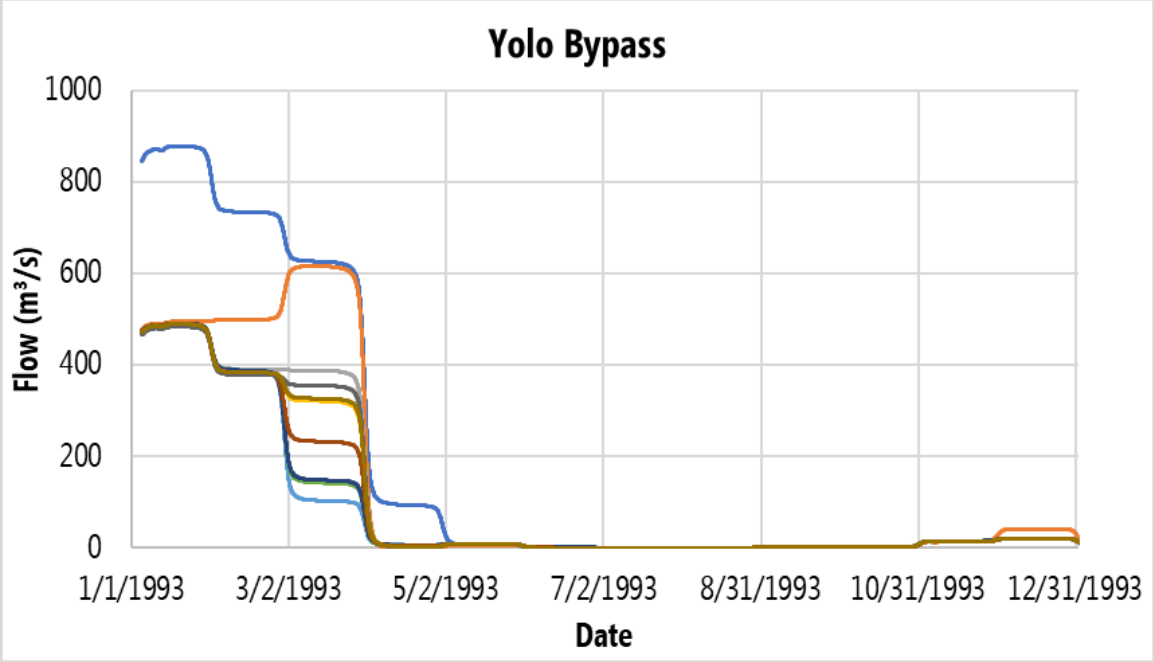

Figure K.1-4c. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at Yolo Bypass (inflow)

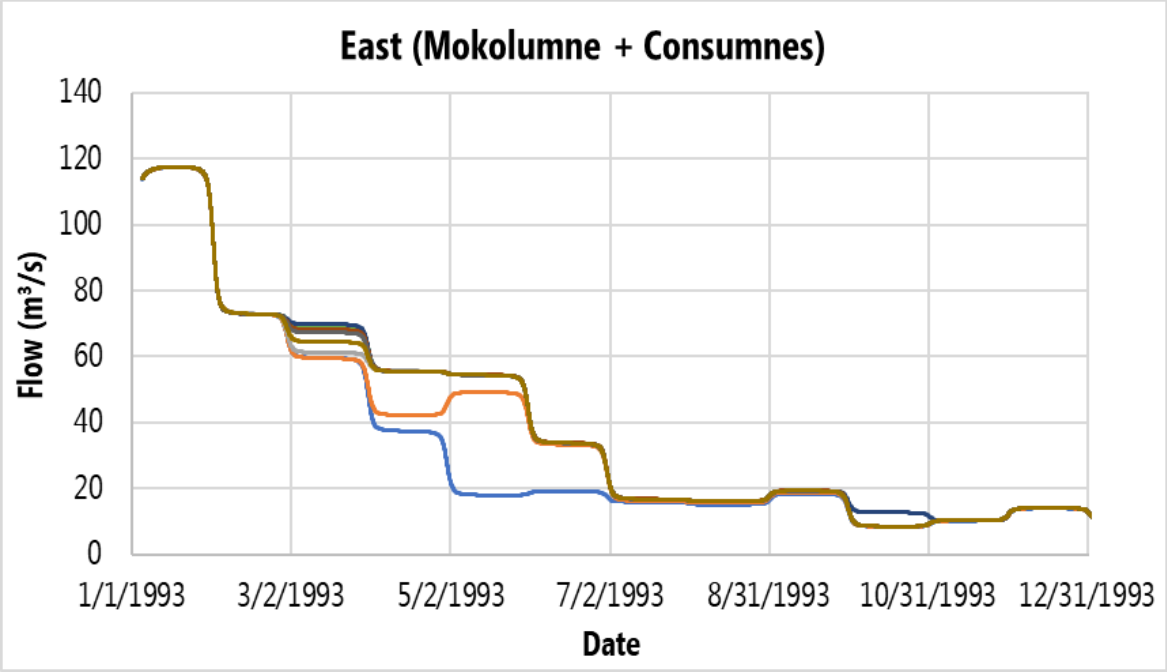

Figure K.1-5d. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at Mokelumne and Consumnes (inflow)

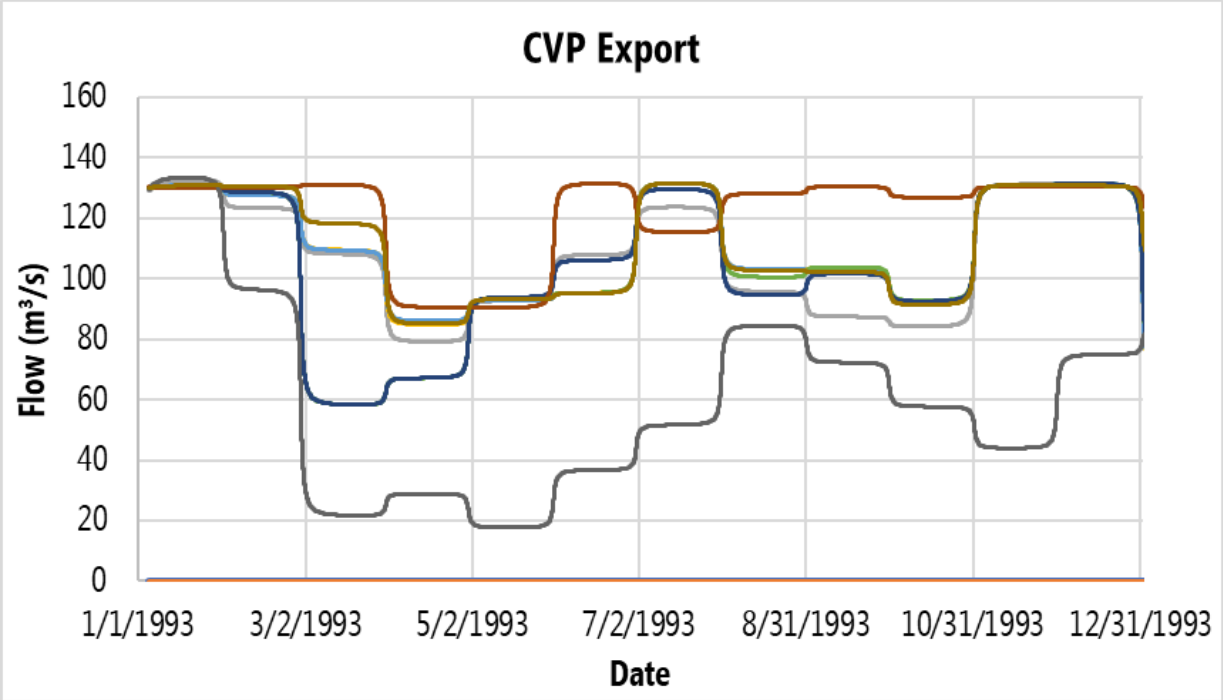

Figure K.1-6e. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at CVP (export)

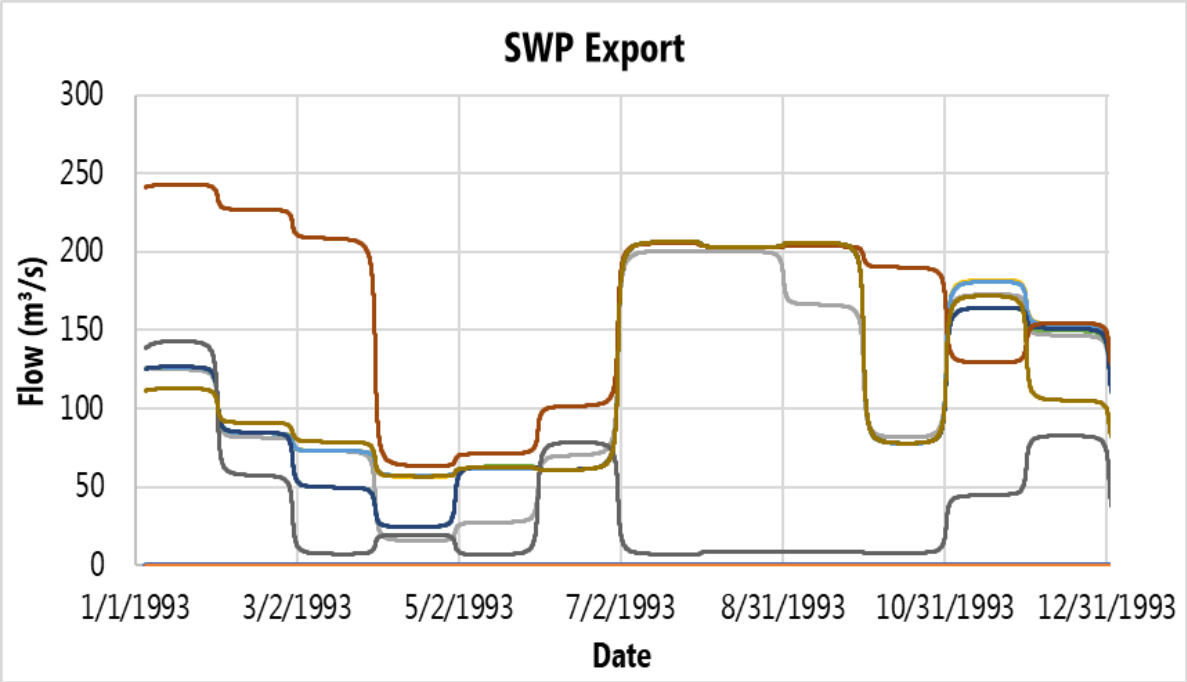

Figure K.1-7f. Summary of major inflow and export boundary conditions for AN year (1993) for all alternatives at SWP (export)

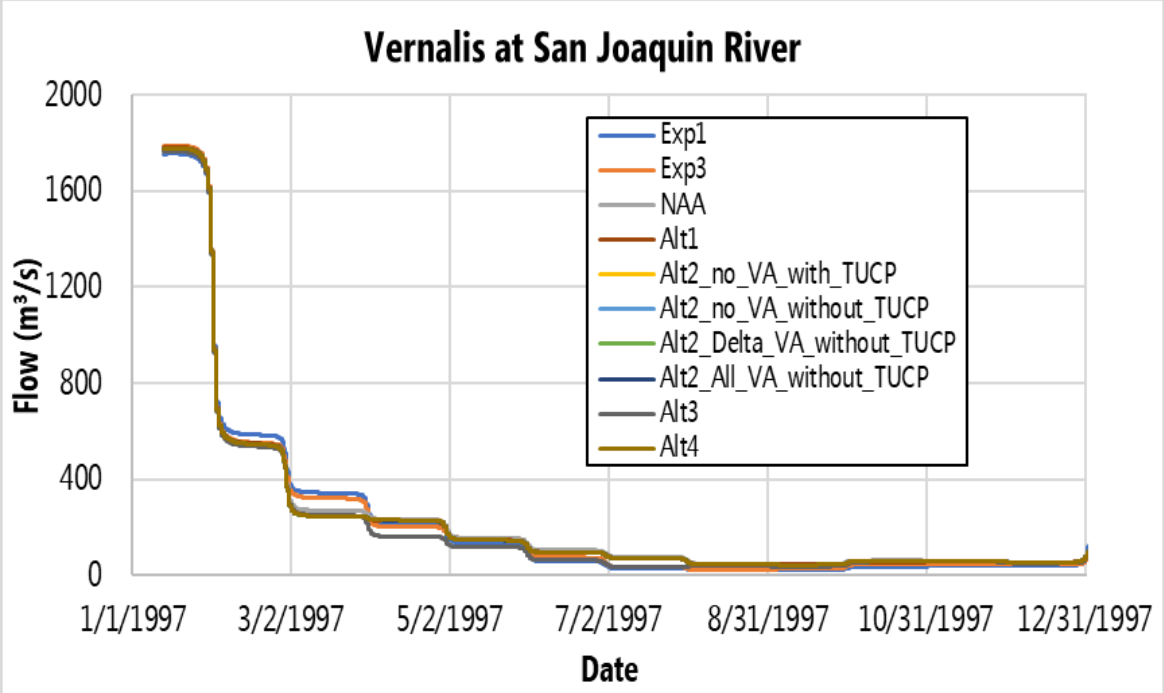

Figure K.1-8a. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at Vernalis at San Joaquin River

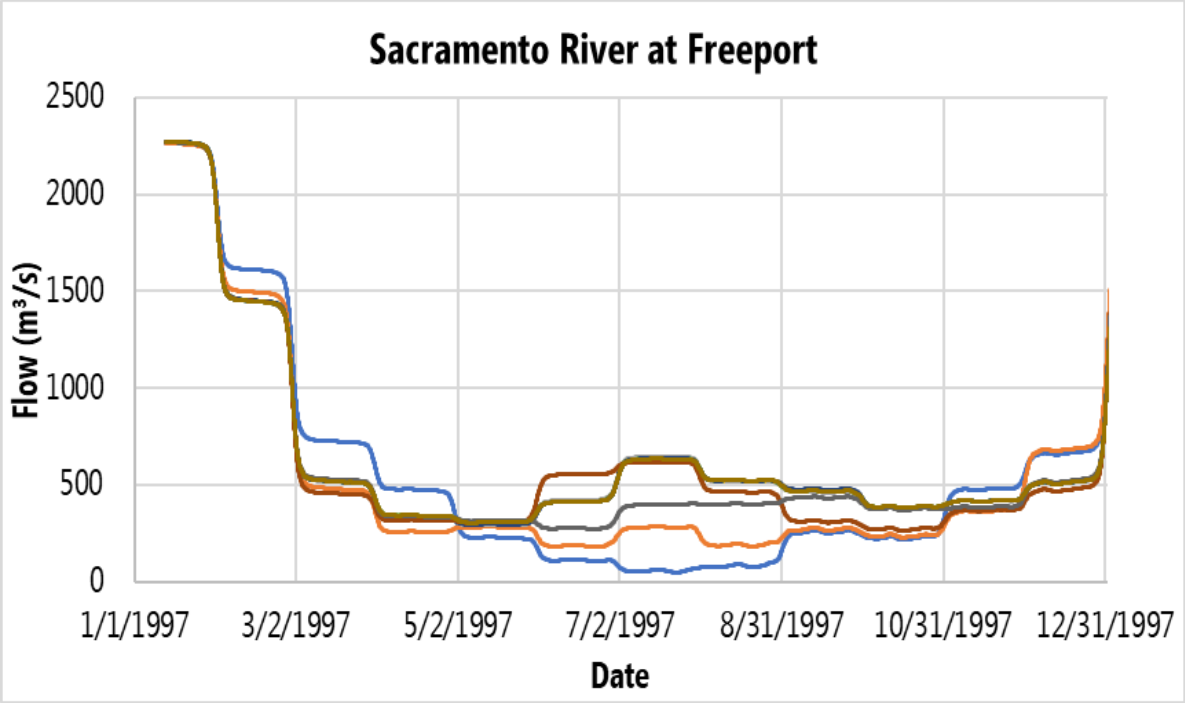

Figure K.1-9b. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at Freeport at Sacramento River

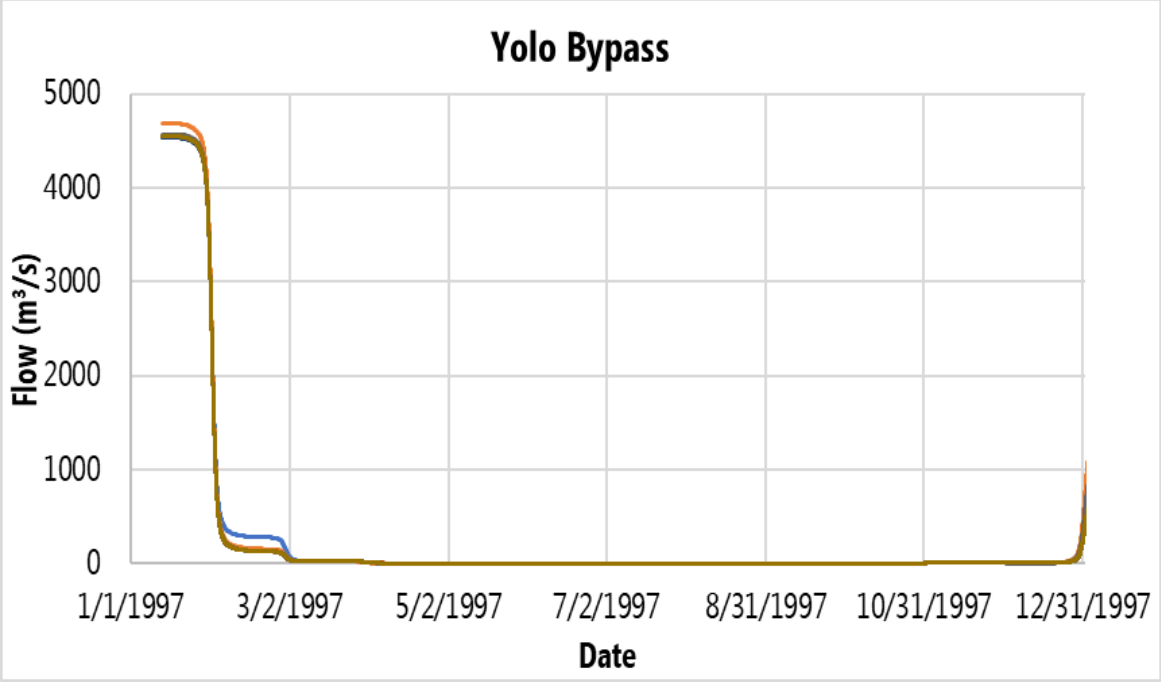

Figure K.1-10c. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at Yolo Bypass

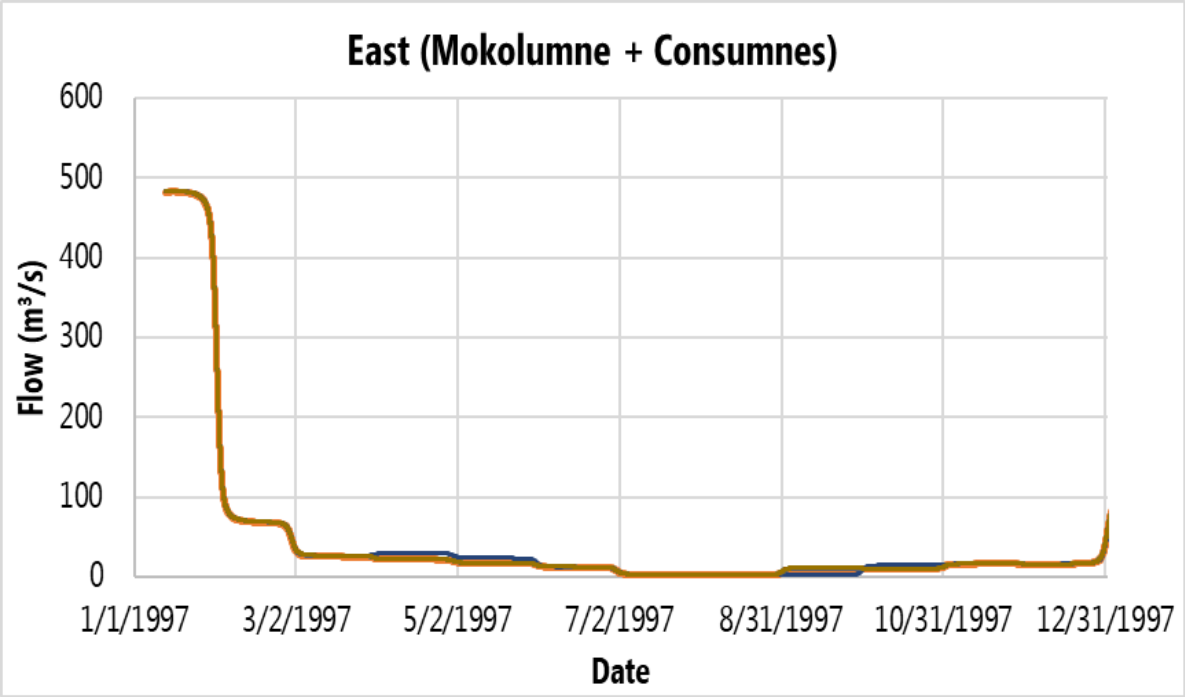

Figure K.1-11d. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at Mokelumne and Consumnes (inflow)

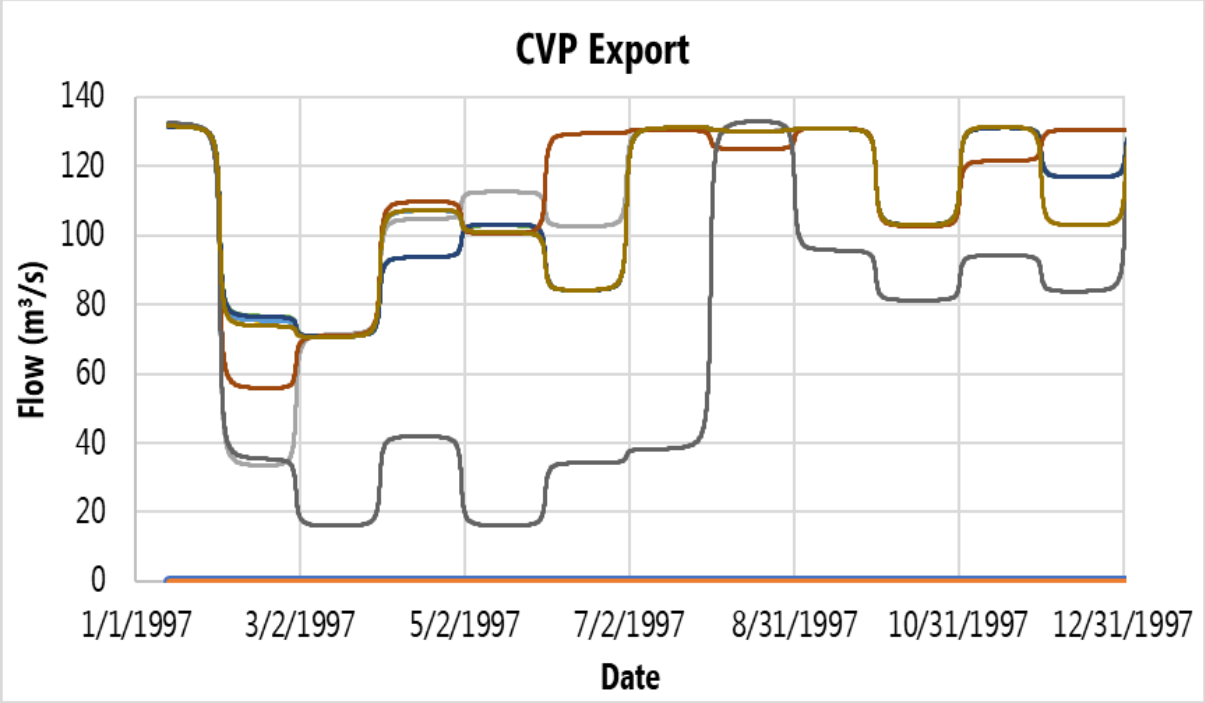

Figure K.1-12e. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at CVP export

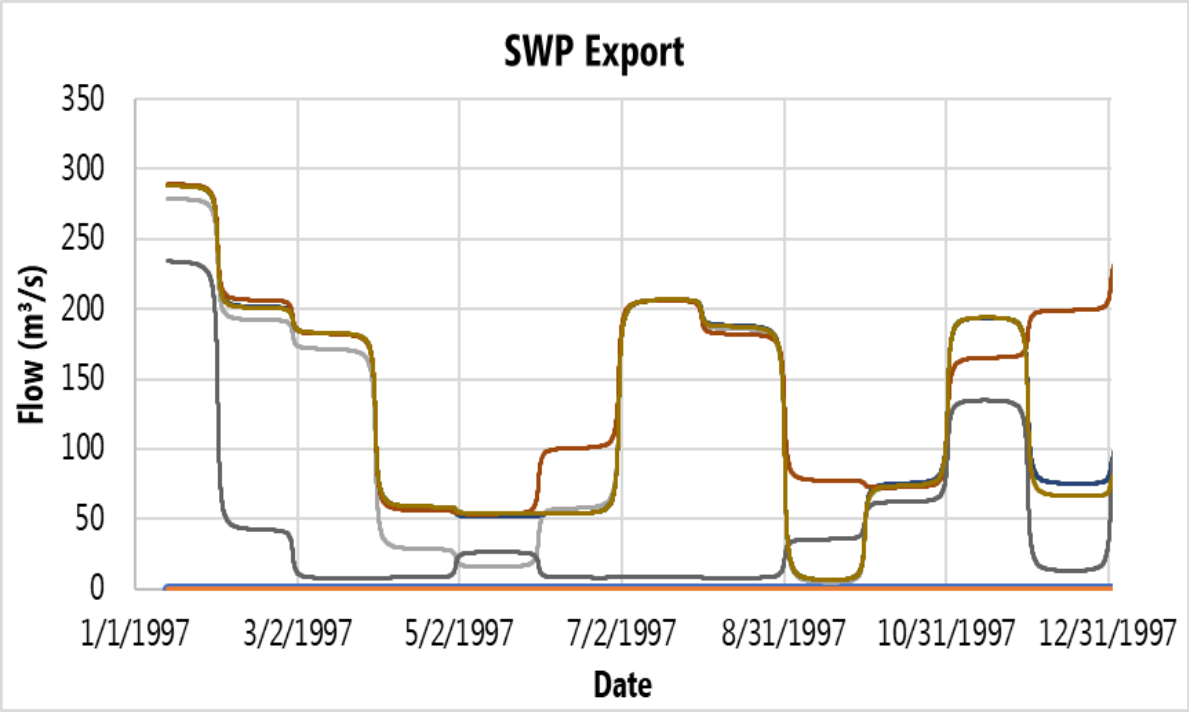

Figure K.1-13f. Summary of major inflow and export boundary conditions for W year (1997) for all alternatives at SWO export

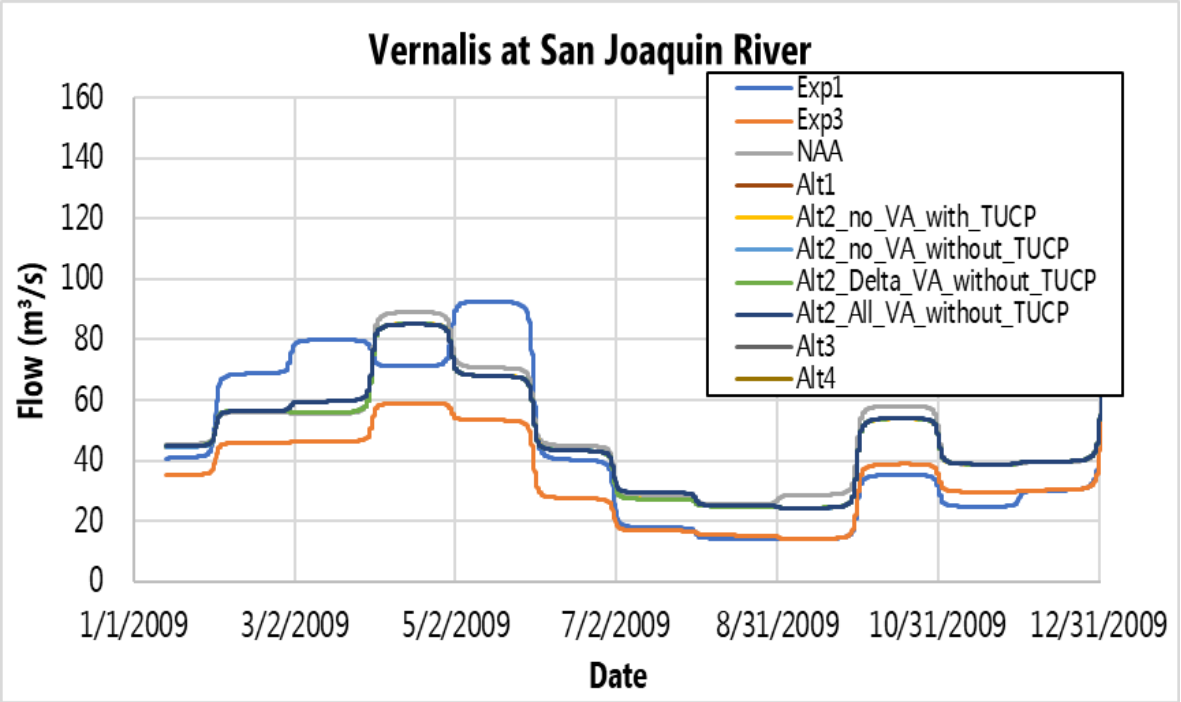

Figure K.1-14a. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at Vernalis at San Joaquin River (inflow)

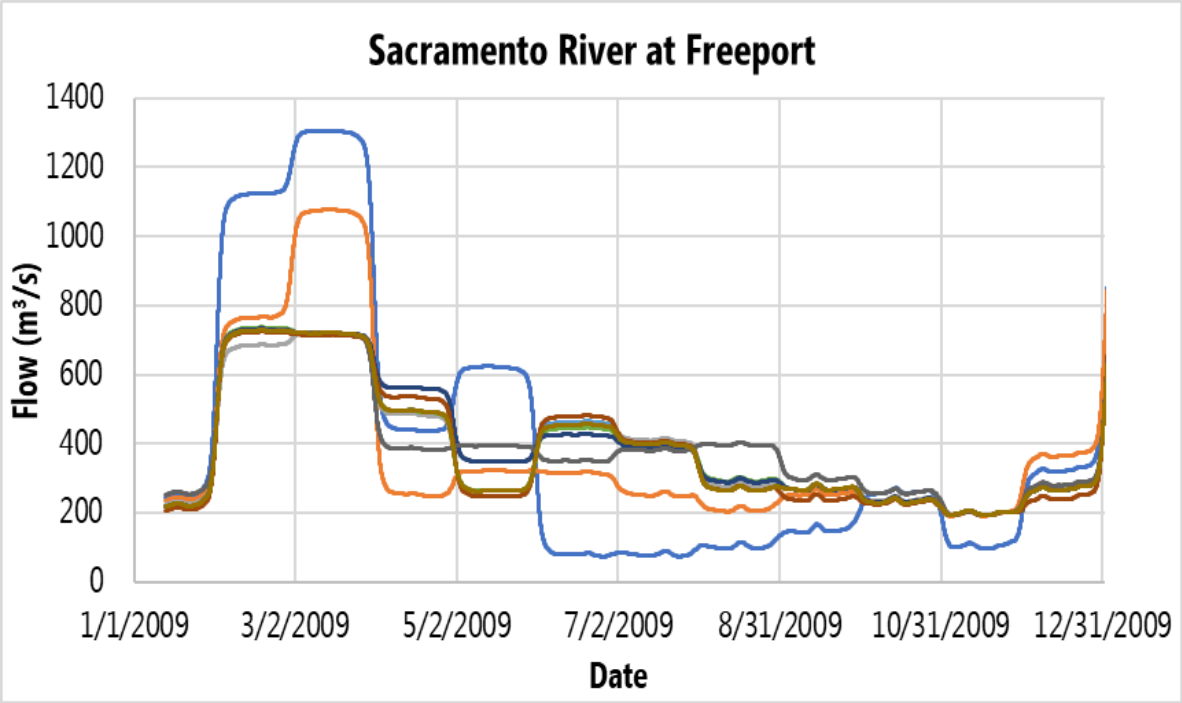

Figure K.1-15b. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at Sacramento River at Freeport (inflow)

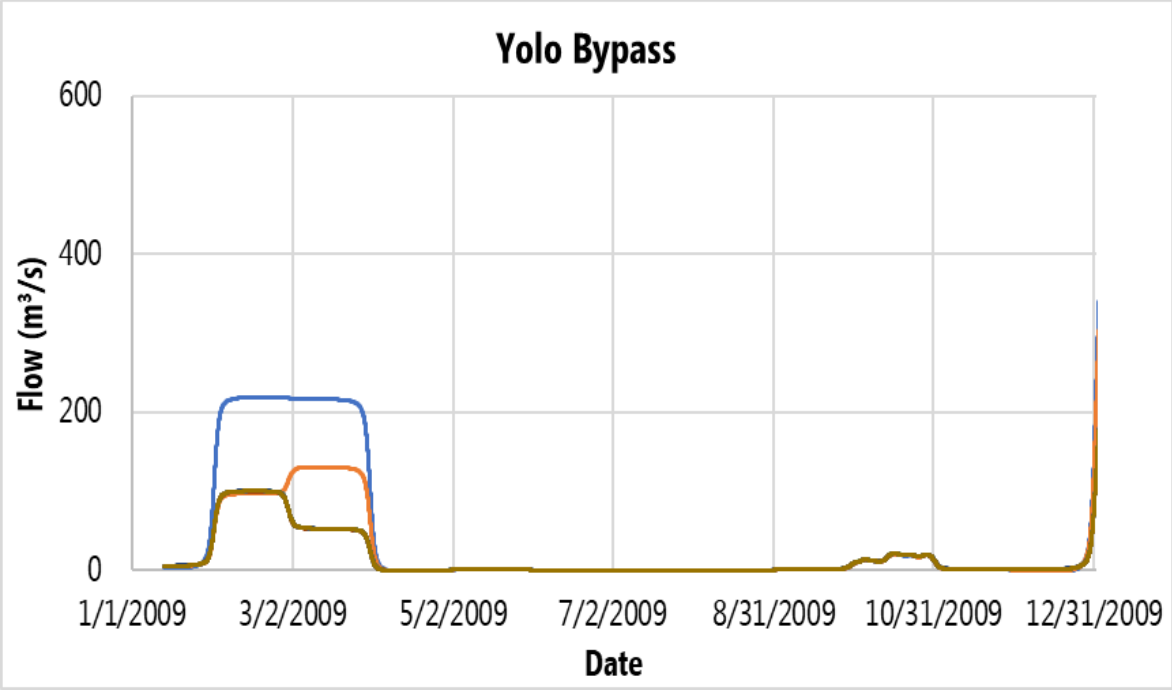

Figure K.1-16c. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at (c) Yolo Bypass (inflow)

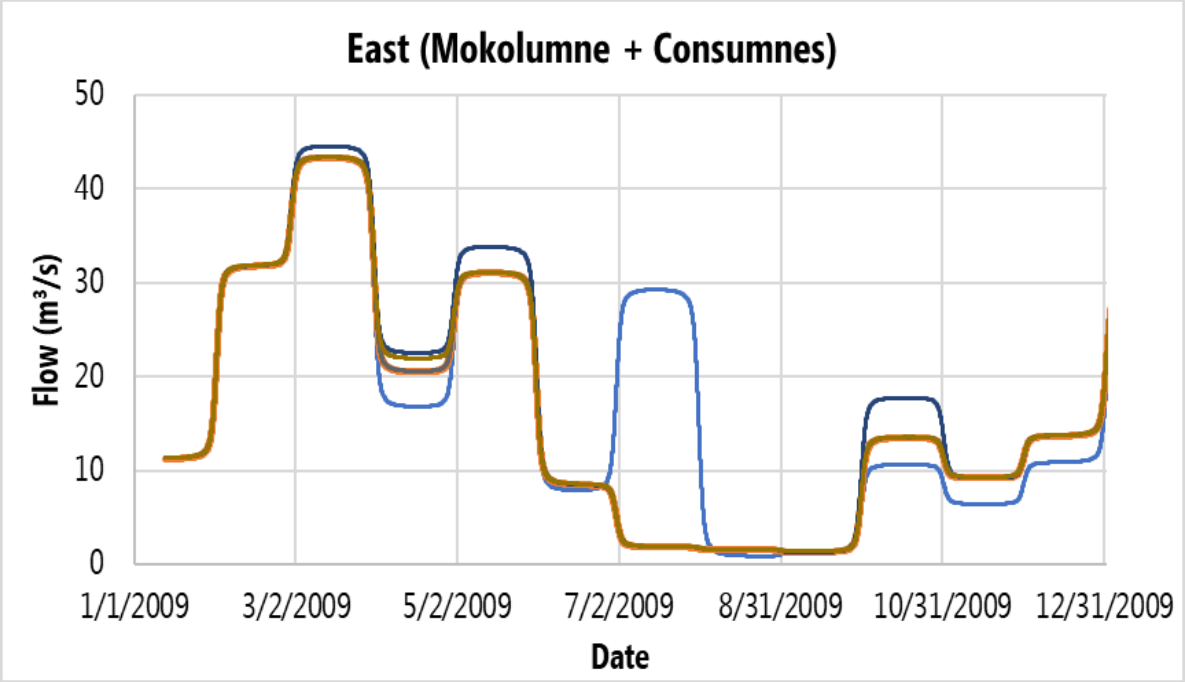

Figure K.1-17d. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at Mokelumne and Consumnes (inflow)

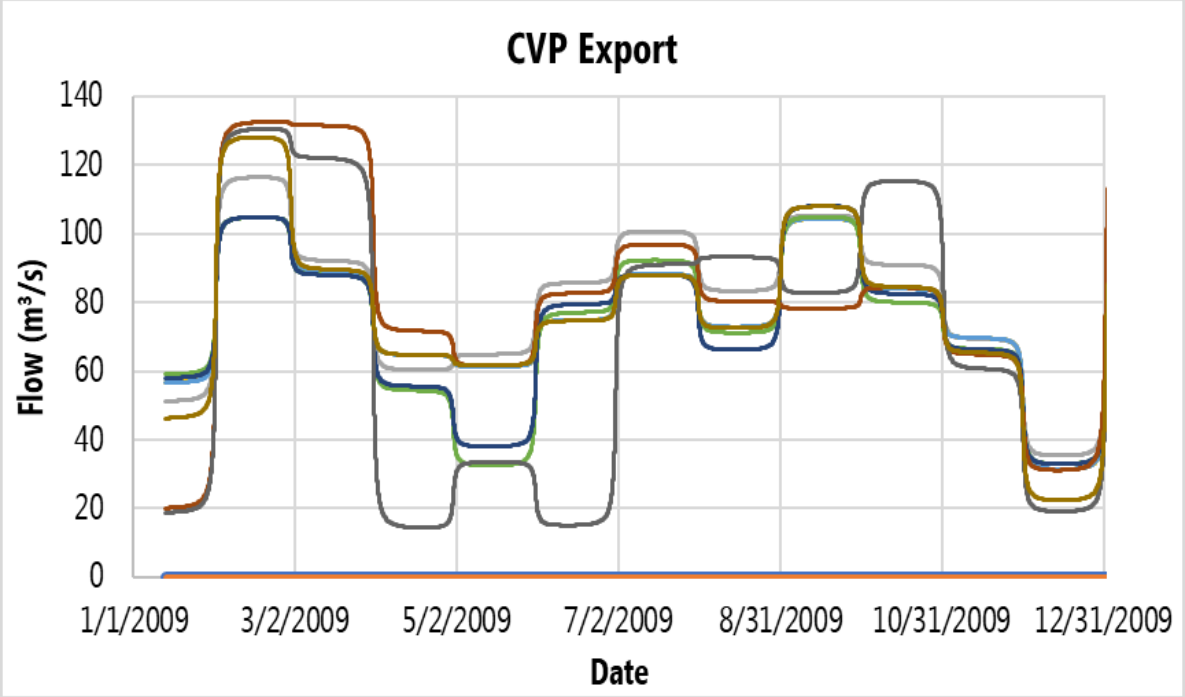

Figure K.1-18e. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at CVP (export)

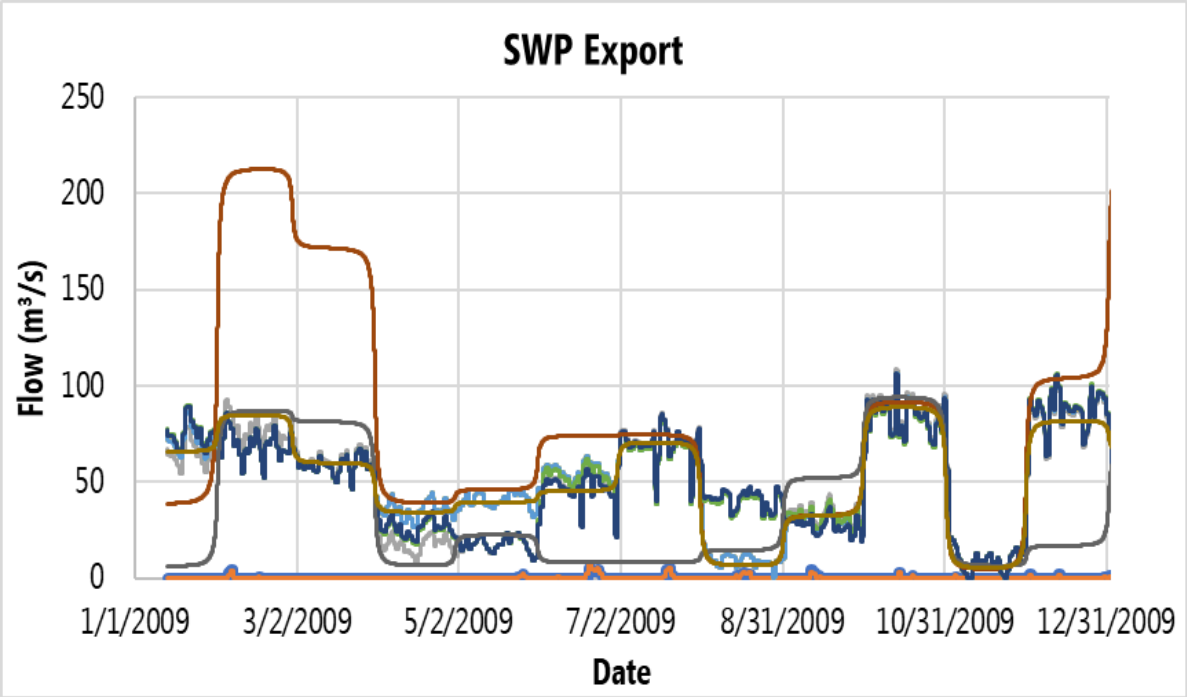

Figure K.1-19f. Summary of major inflow and export boundary conditions for D year (2009) for all alternatives at SWP (export)

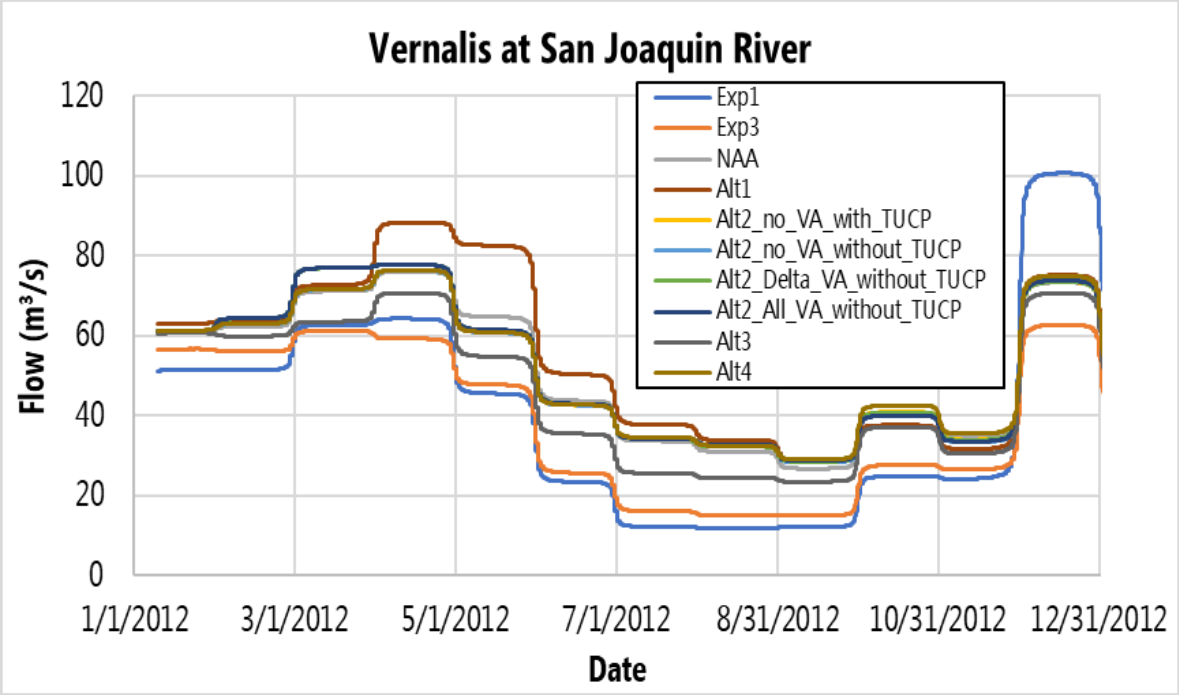

Figure K.1-20a. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at Vernalis at San Joaquin River (inflow)

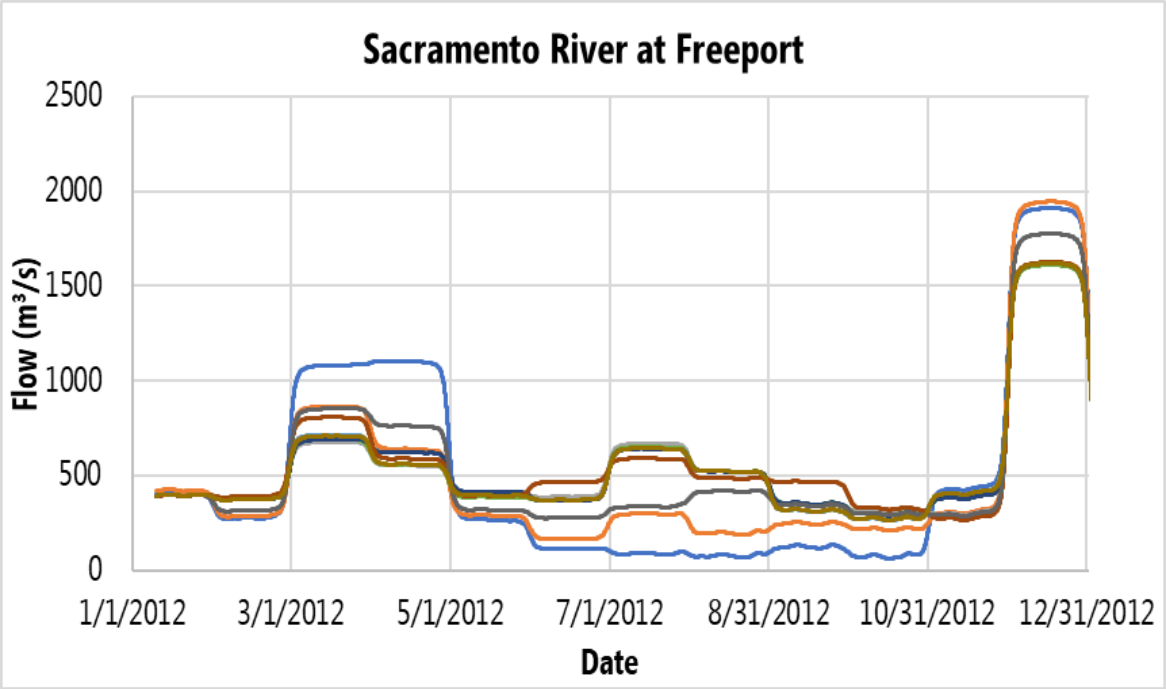

Figure K.1-21b. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at Sacramento River at Freeport (inflow)

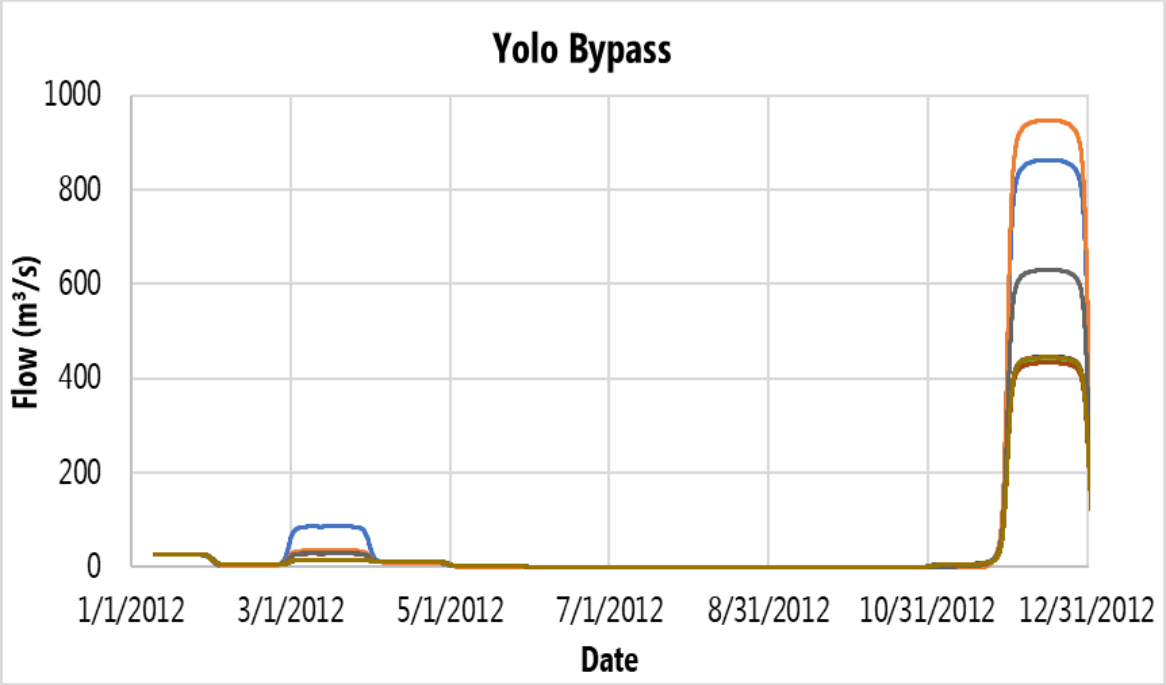

Figure K.1-22c. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at Yolo Bypass (inflow)

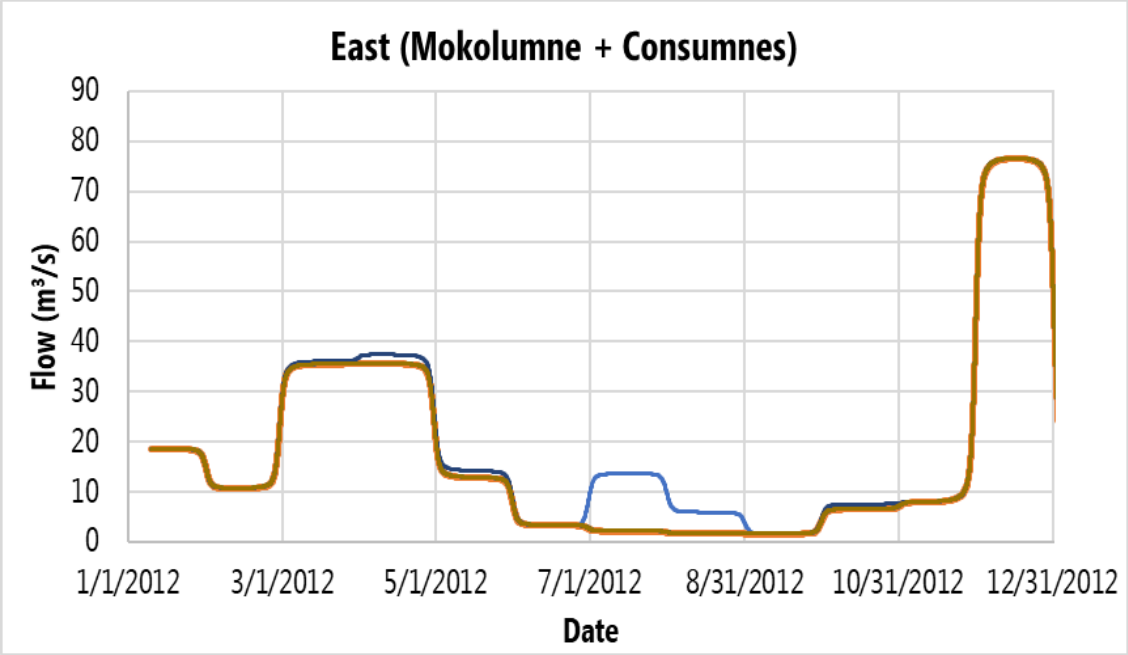

Figure K.1-23d. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at Mokelumne and Consumnes (inflow)

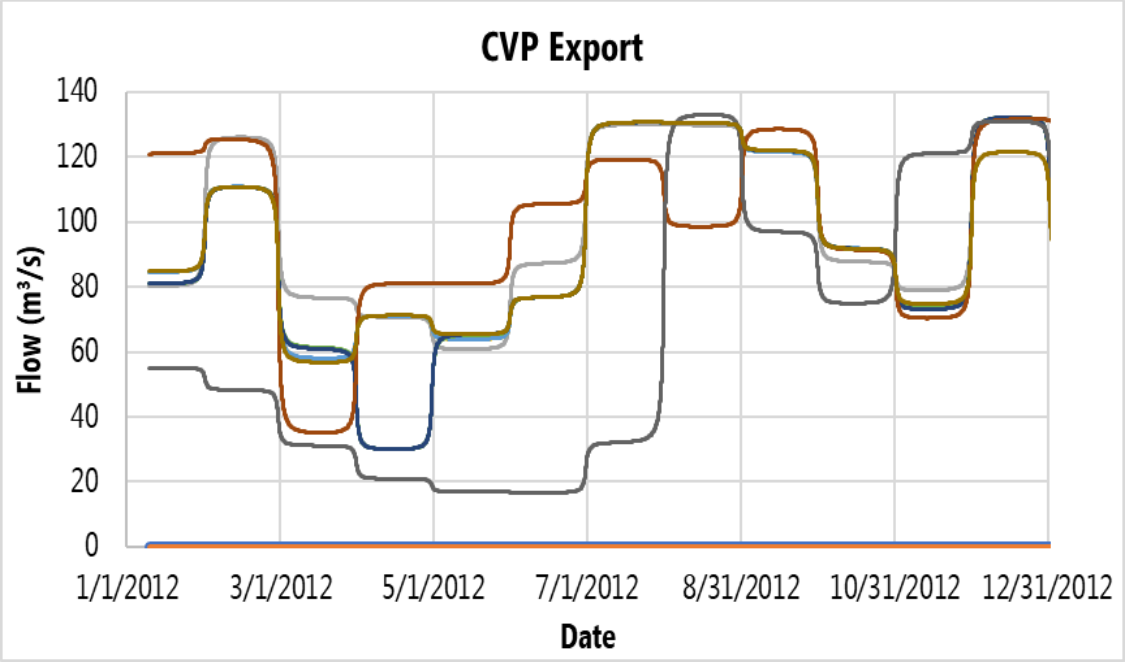

Figure K.1-24e. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at CVP (export)

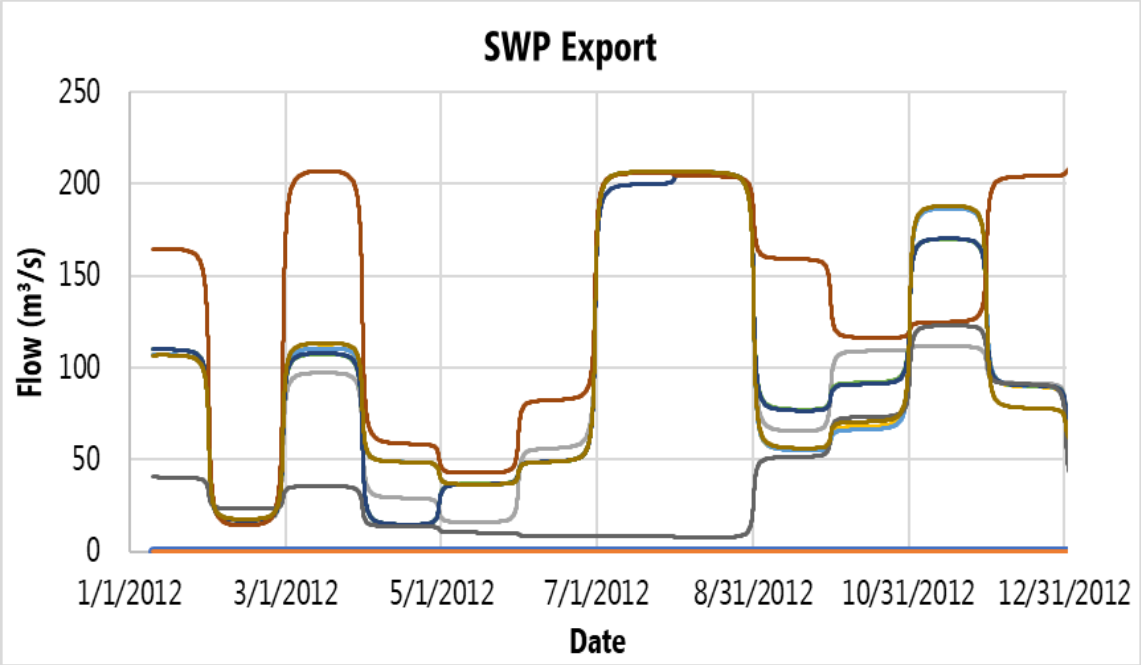

Figure K.1-25f. Summary of major inflow and export boundary conditions for BN year (2012) for all alternatives at SWP (export)

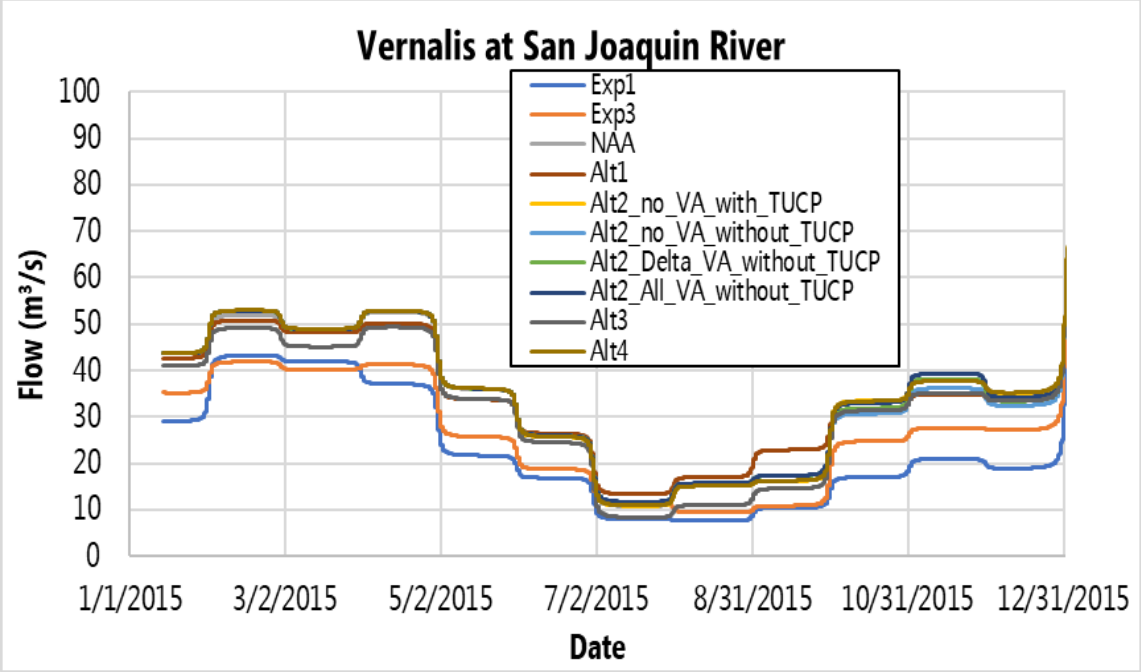

Figure K.1-26a. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at Vernalis at San Joaquin River (inflow)

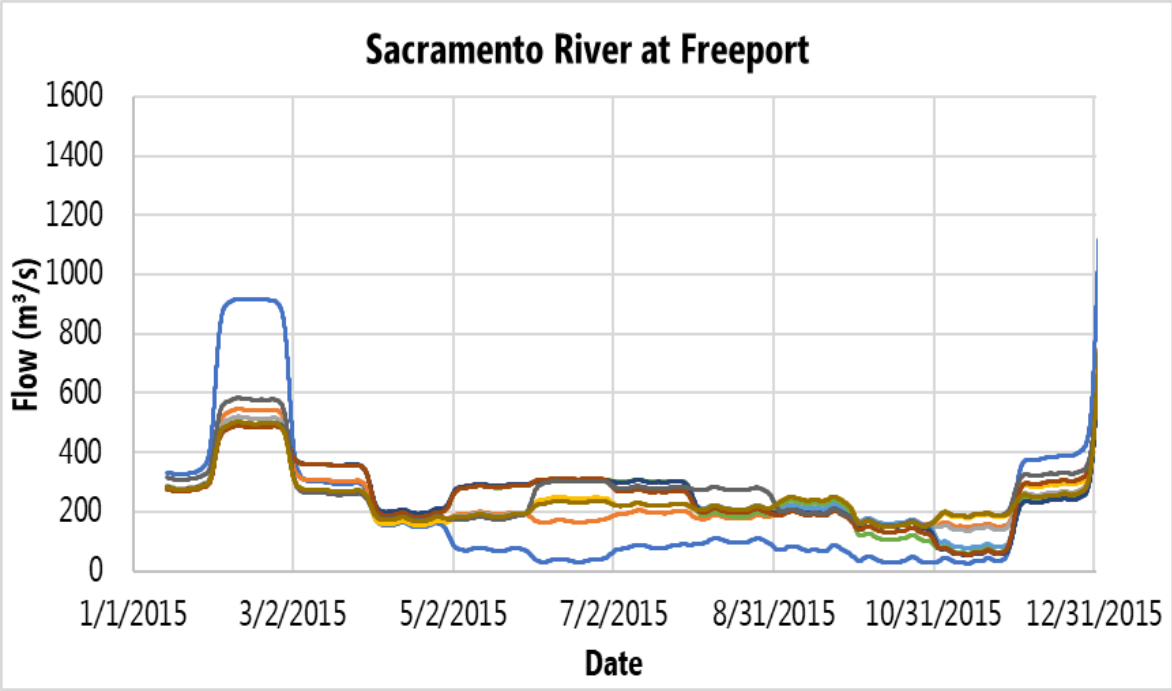

Figure K.1-27b. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at Sacramento River at Freeport (inflow)

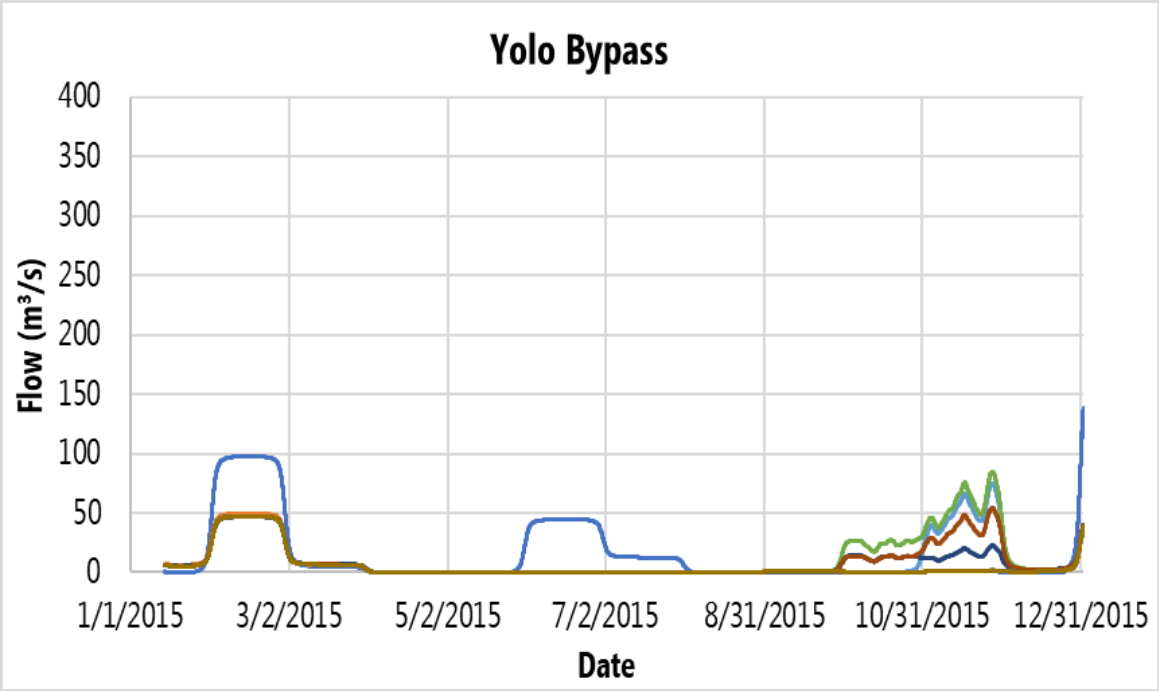

Figure K.1-28c. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at Yolo Bypass (inflow)

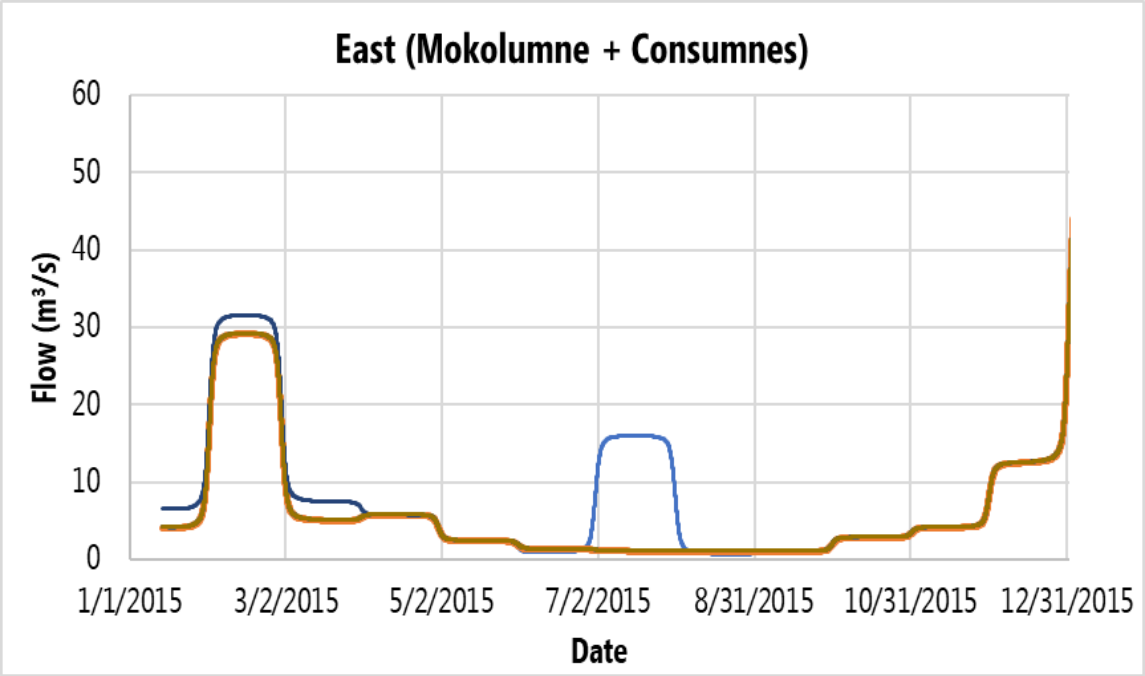

Figure K.1-29d. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at Mokelumne and Consumnes (inflow)

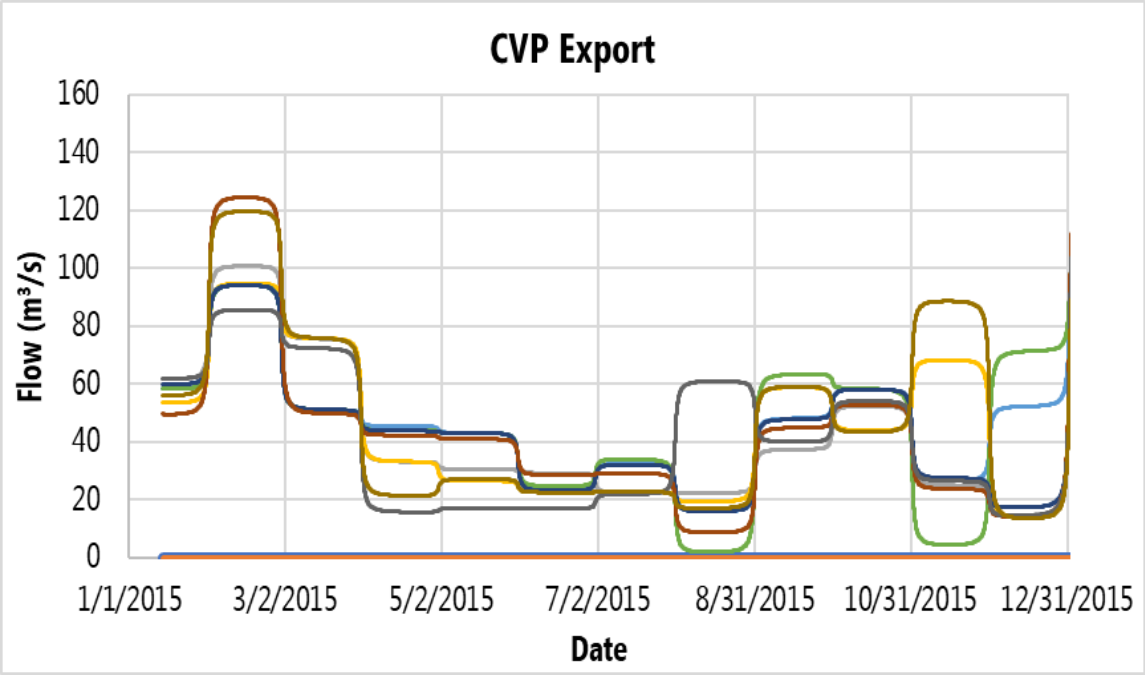

Figure K.1-30e. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at CVP (export)

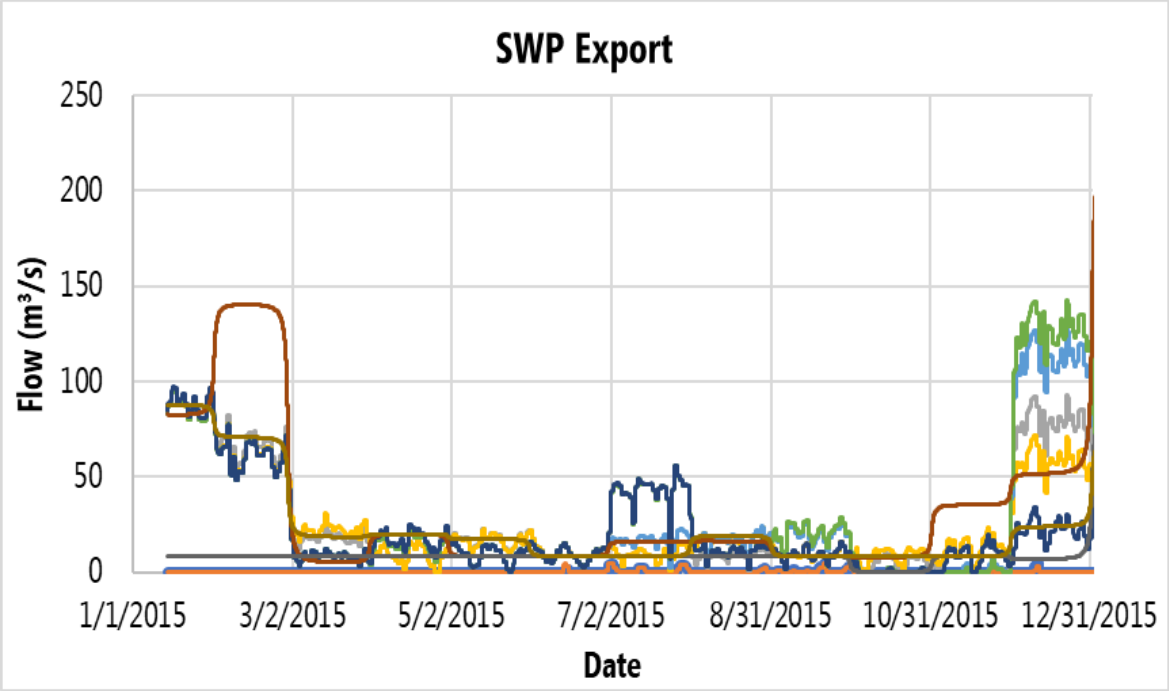

Figure K.1-31f. Summary of major inflow and export boundary conditions for C year (2015) for all alternatives at SWP (export)

Stream water temperature outputs are not available from CALSIM and DSM2. Since the planning model used historical atmospheric forcing perturbated to reflect the 2022 median climate, the perturbated historic atmospheric inputs and an artificial neural networks (ANN) model (relating air temperature, SAC or SAN index, and calendar month to water temperature) were used to generate times series of input water temperatures at the major model boundaries. The ANN performance in predicting water temperature at Sacramento River and San Joaquin model boundaries is shown in Figure K.1-33a and K.1-7b.

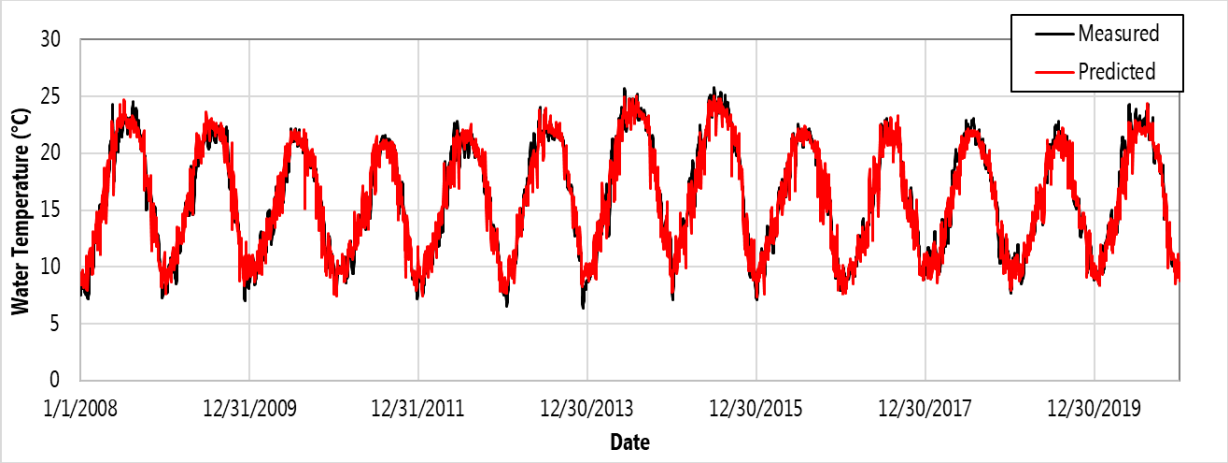

Figure K.1-32a. Measured and ANN-predicted stream water temperatures from 2008 to 2020 at Sacramento River at Freeport

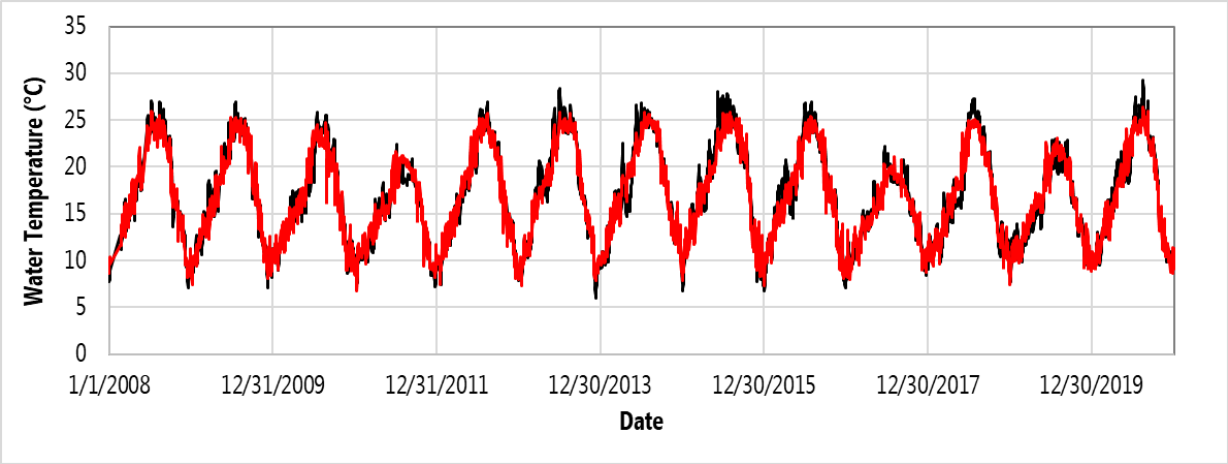

Figure K.1-33b. Measured and ANN-predicted stream water temperatures from 2008 to 2020 at San Joaquin River at Vernalis

The Suisun marsh salinity gates are operated under the various regulatory environments to modulate salinity within the Suisun marsh and bay areas. Gate operations are dependent on the WY and regulations being followed. Below, gate operation patterns ported from the DSM2 model are provided in Figure K.1-38a-f for all the water year types. In the figures, a value of 1 on the vertical axis indicates that the gates are being tidally operated. Patterns are presented for the No-action scenario, Exploratory scenarios and Alternative 2 scenarios analyzed herein.

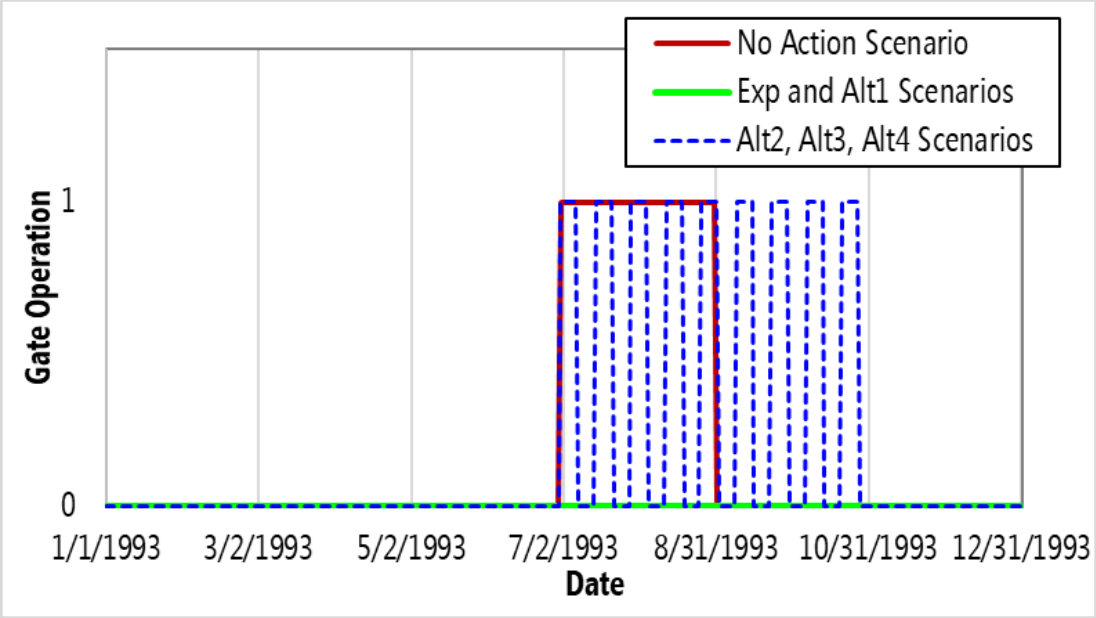

Figure K.1-34a. Suisun Marsh Salinity Control Gate Operation: 1 indicates mode in which gates are being tidally operated and 0 is when the gates are fully open. Plots are shown for Above Normal – 1993.

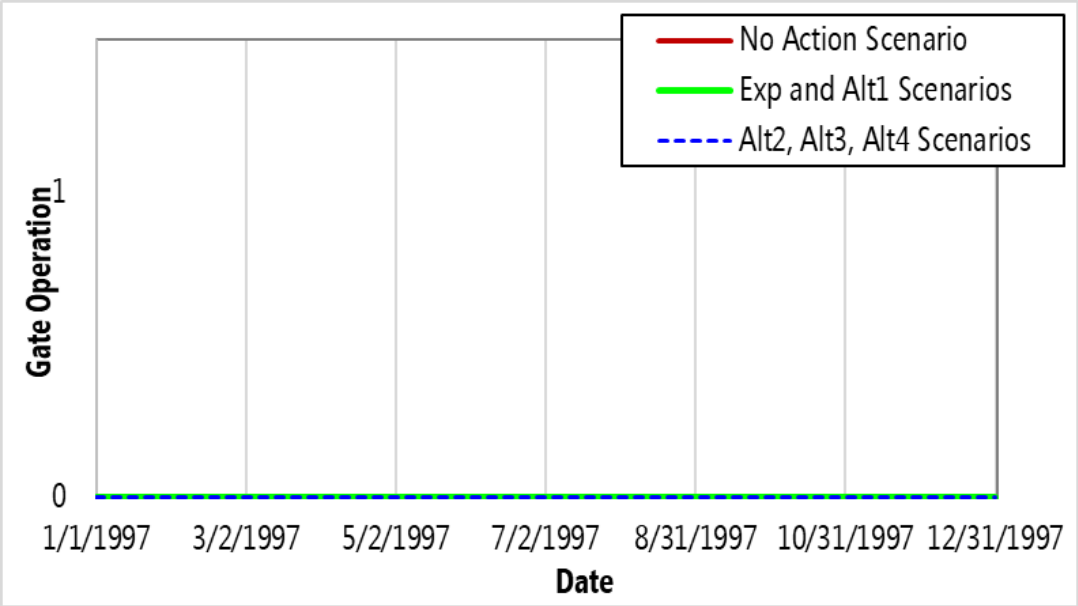

Figure K.1-35b. Suisun Marsh Salinity Control Gate Operation: 1 indicates mode in which gates are being tidally operated and 0 is when the gates are fully open. Plots are shown for Wet – 1997.

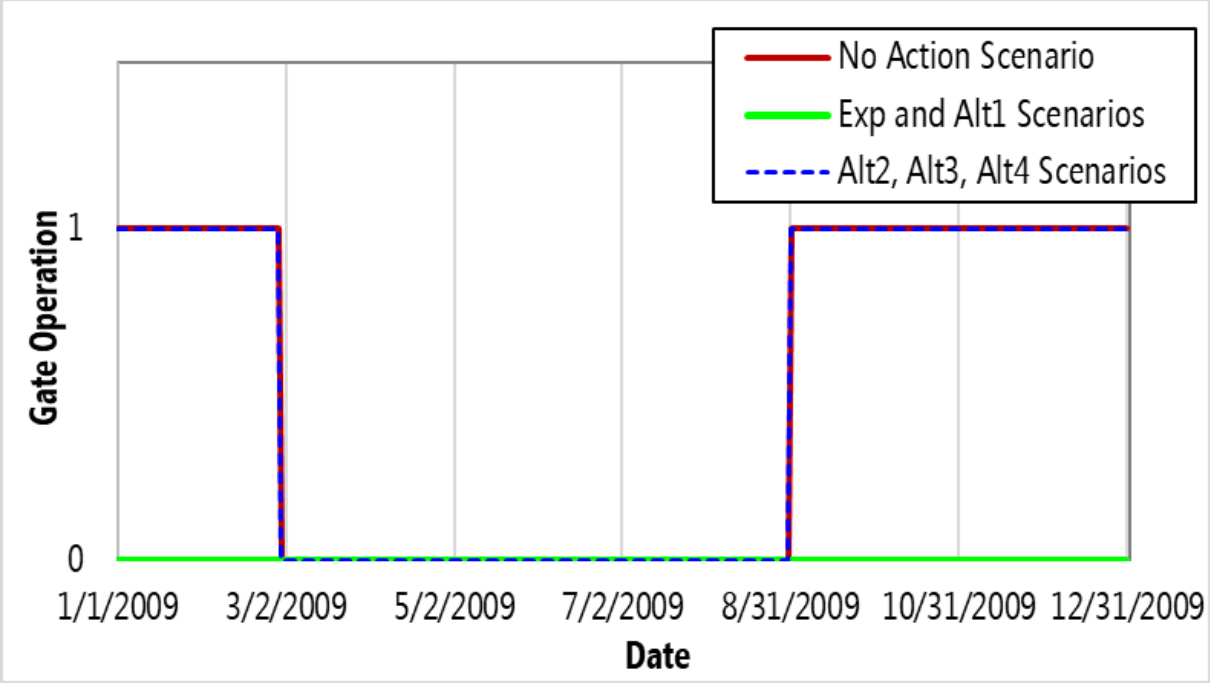

Figure K.1-36c. Suisun Marsh Salinity Control Gate Operation: 1 indicates mode in which gates are being tidally operated and 0 is when the gates are fully open. Plots are shown for Dry – 2009.

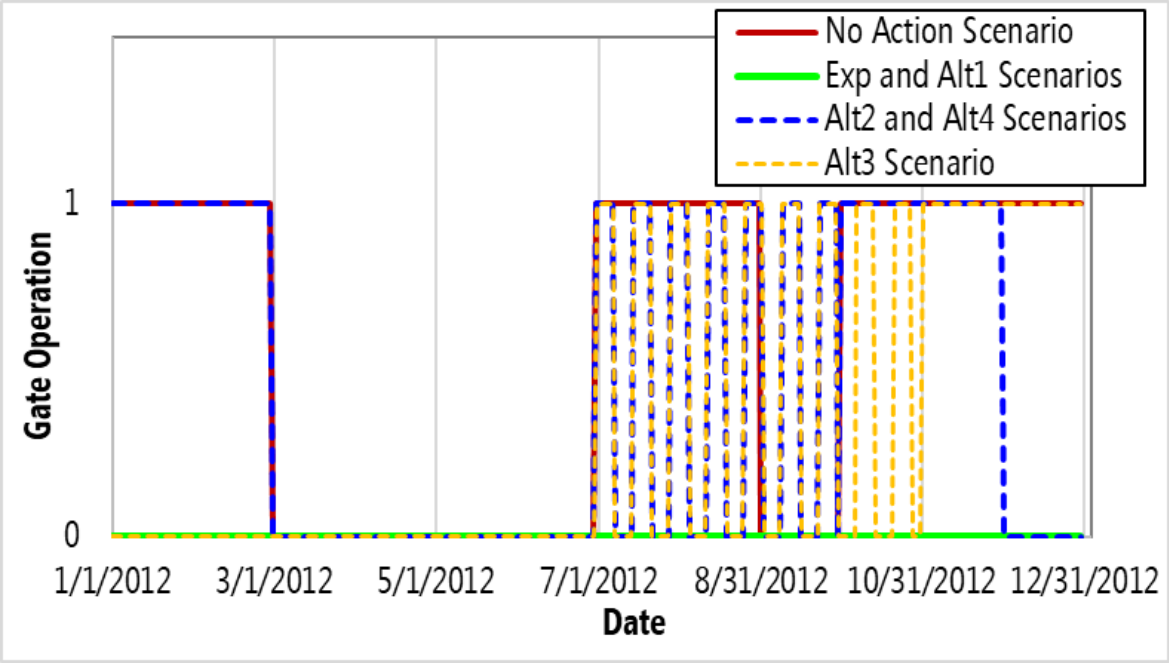

Figure K.1-37d. Suisun Marsh Salinity Control Gate Operation: 1 indicates mode in which gates are being tidally operated and 0 is when the gates are fully open. Plots are shown for Below Normal – 2012.

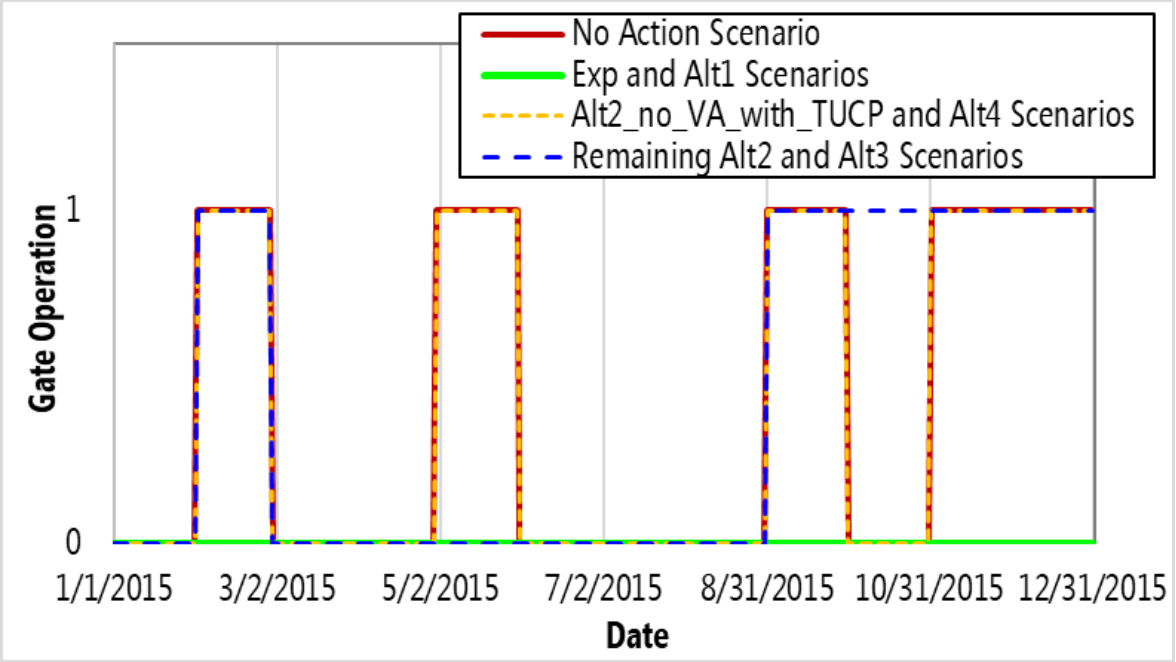

Figure K.1-38e. Suisun Marsh Salinity Control Gate Operation: 1 indicates mode in which gates are being tidally operated and 0 is when the gates are fully open. Plots are shown for Critical water years – 2015.

K.1.2.2 Model Validation

The Bay-Delta SCHISM model has previously been calibrated and validated by Ateljevich et al. (2014). Prior to applying SCHISM to evaluate the different alternatives outlined above, its capability was further validated in this study for three recent historical water years with similar SAC river indices and ample observed data for comparison. These reviewed years are presented in Table K.1-4. Figure K.1-39 through Figure K.1-41 provide visual comparison between predicted and measured tidally-averaged stream temperatures at various stations across the domain, and Figure K.1-42 through Figure K.1-44 provide comparison between tidally-averaged predicted and measured salinity. Ateljevich et al. (2014) provide a detailed summary of quantitative metrics of model performance. The model is generally able to predict magnitudes and trends in both temperature and salinity. There are some local instances of over- and under-prediction, but the bias is within reason and also, uncertainties in measured data are not considered here in.

Table K.1-4. Historical years used for additional model validation in this study

Validation Year	CALSIM SAC River Index (MAF)	Historical SAC River Index (MAF)
2012	6.5	6.9
2009	5.7	5.8
2015	4.0	4.0

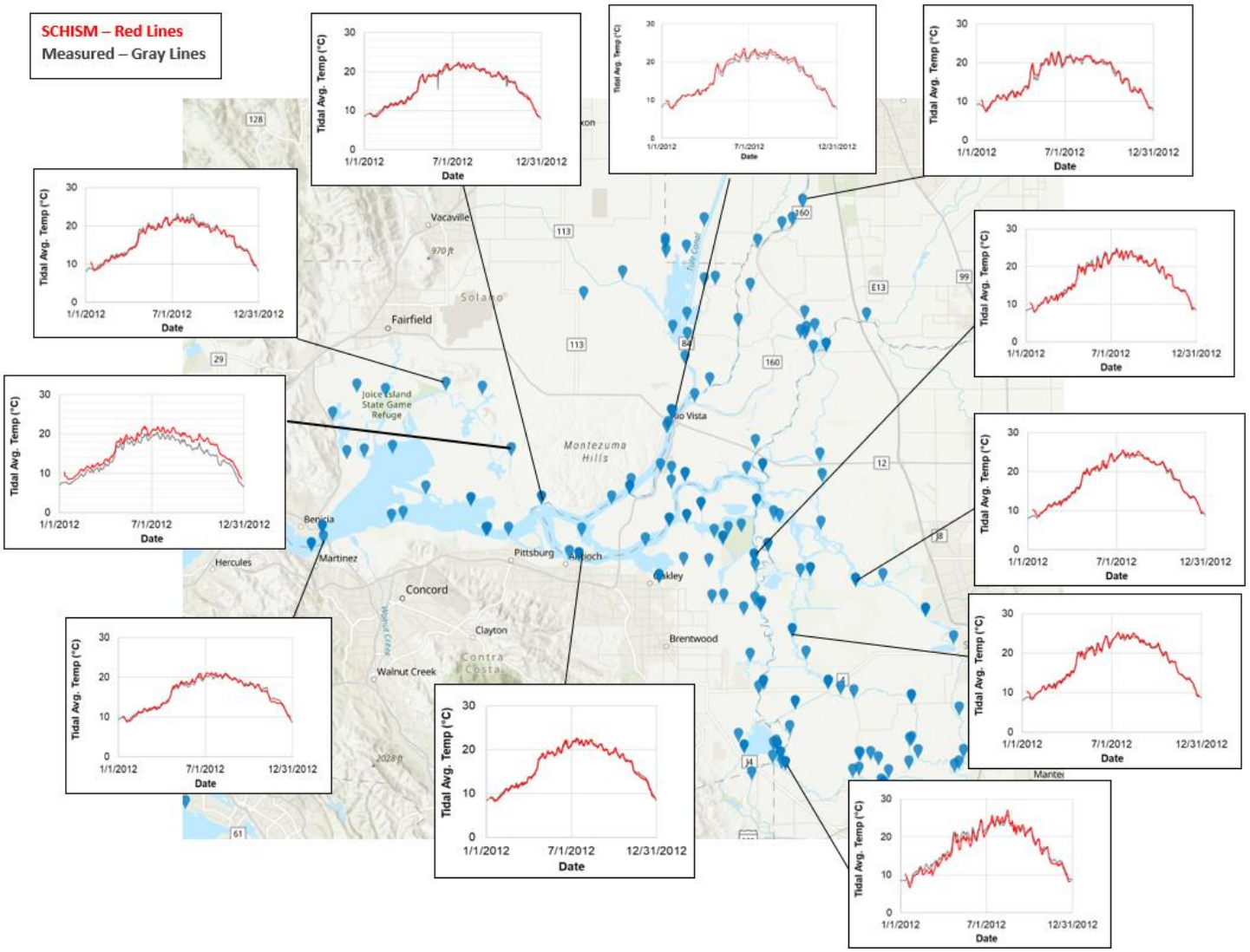

Figure K.1-39. Visual comparison between tidally-averaged measured stream temperatures and tidally-averaged SCHISM-predicted stream temperatures at select monitoring stations across the model domain for 2012.

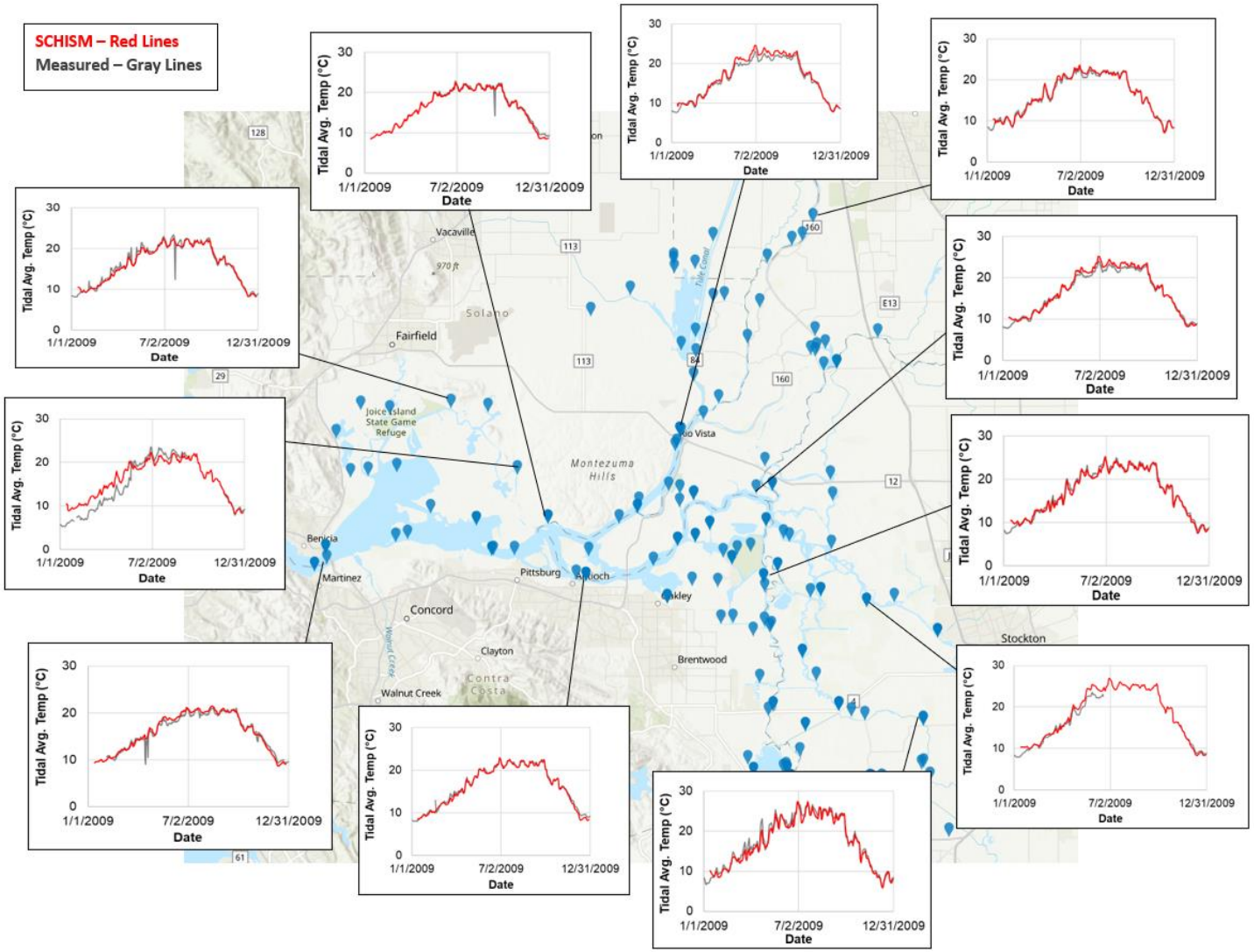

Figure K.1-40. Visual comparison between tidally-averaged measured stream temperatures and tidally-averaged SCHISM-predicted stream temperatures at select monitoring stations across the model domain for 2009.

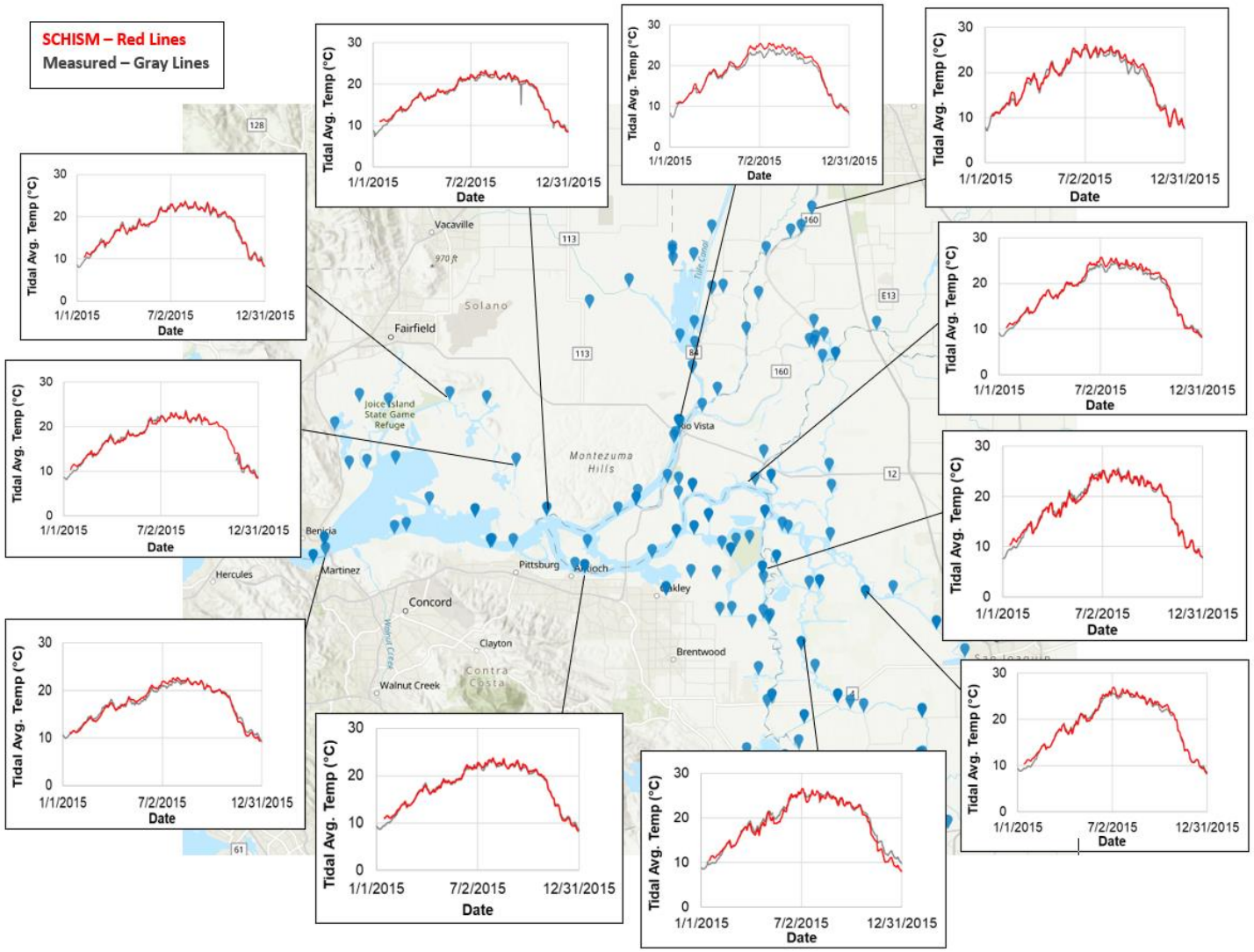

Figure K.1-41. Visual comparison between tidally-averaged measured stream temperature and tidally-averaged SCHISM-predicted stream temperatures at select monitoring stations across the model domain for 2015.

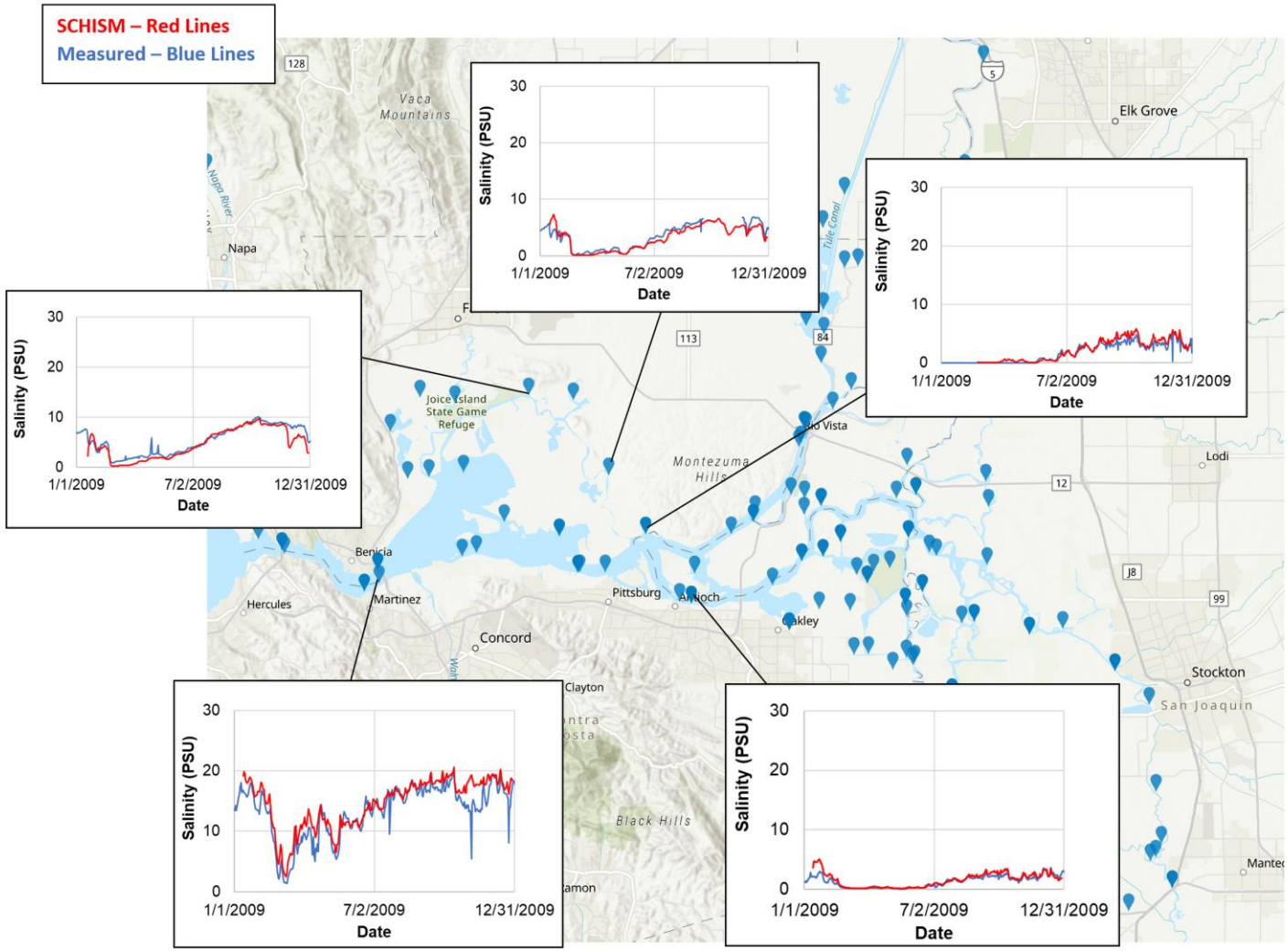

Figure K.1-42. Visual comparison between tidally-averaged measured and SCHISM-predicted stream salinities at select monitoring stations across the model domain for 2009.

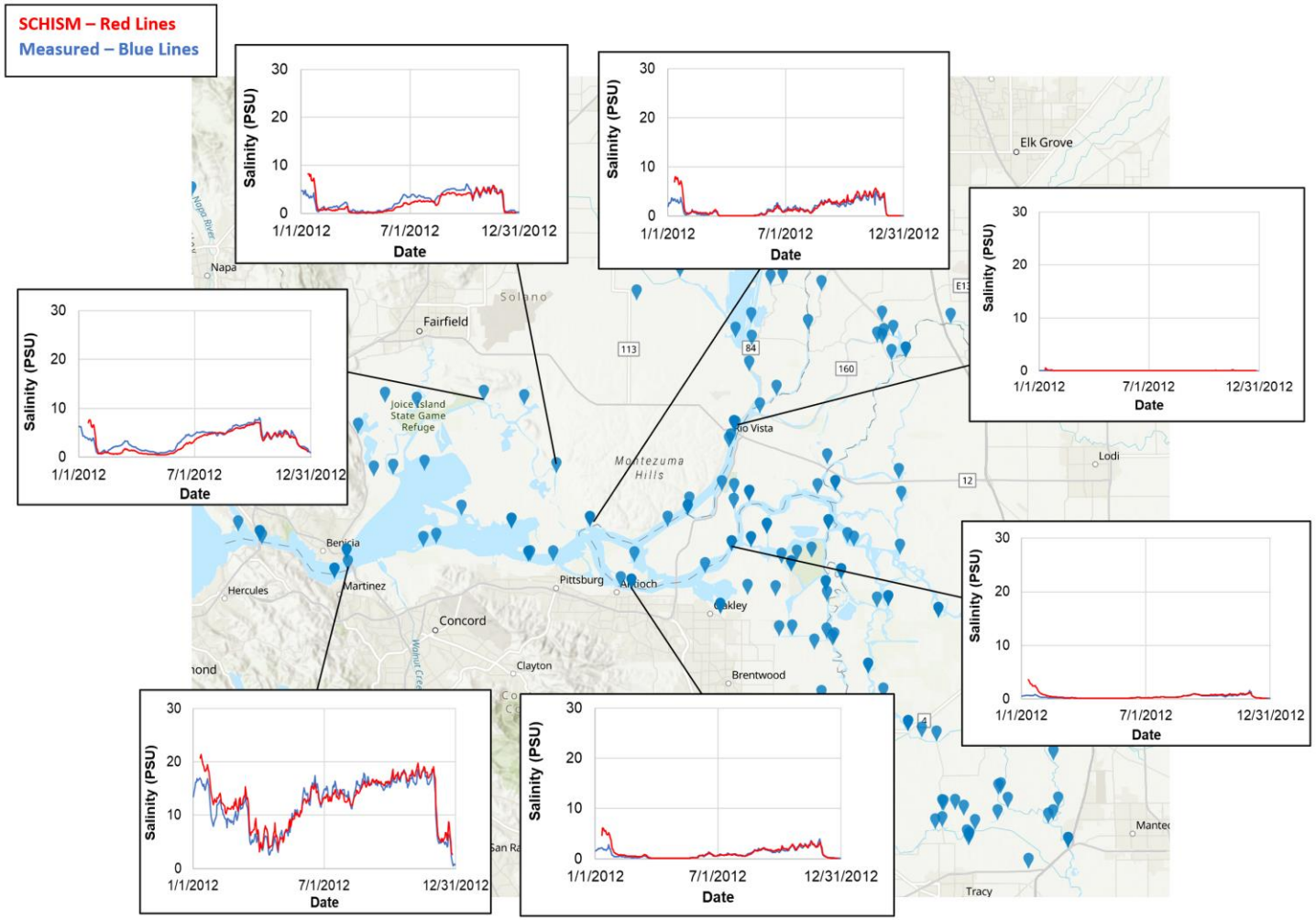

Figure K.1-43. Visual comparison between tidally-averaged measured and SCHISM-predicted stream salinities at select monitoring stations across the model domain for 2012.

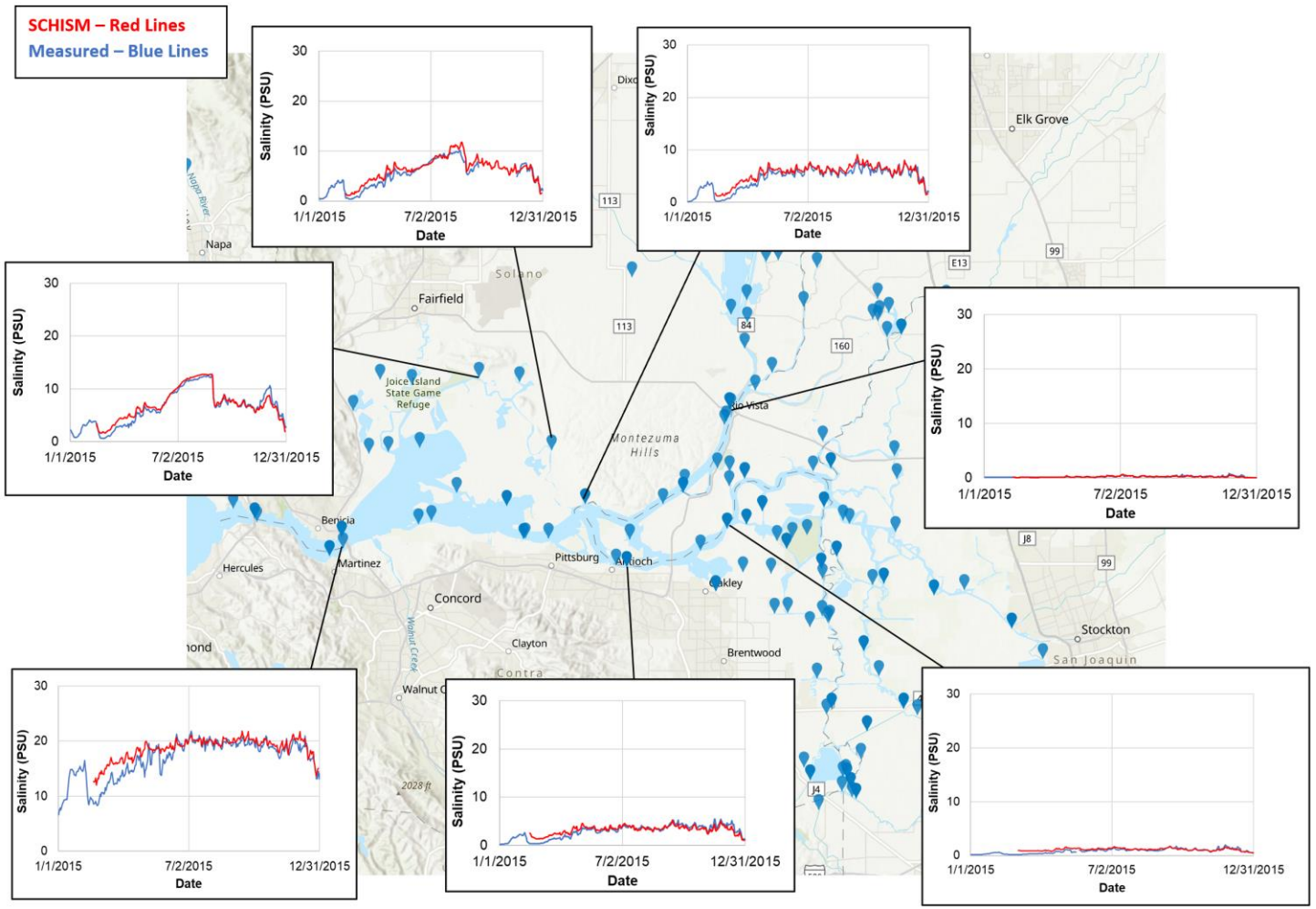

Figure K.1-44. Visual comparison between tidally-averaged measured and SCHISM-predicted stream salinities at select monitoring stations across the model domain for 2015.

K.1.2.3 Code and Data Repository

The hydrodynamic analyses were performed using SCHISM v5.8, which is freely available from GitHub - schism-dev/schism: Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM). The model inputs and outputs for the various alternatives are available from Reclamation upon request. The depth-averaged suitability indices with and without the temperature thresholds were calculated using R; code is available from GitHub at: BDO-Science/LTO_DS_Habitat: Code and processed files for calculating Delta smelt summer and fall habitat suitability using Bever et al. (2016) with and without a water temperature threshold (github.com). The raw files are needed to run the first two scripts; the remaining scripts can be run with the GitHub files.

K.1.3 Results

Mean values for abiotic conditions, the Bever et al. (2016) HSI (henceforth Bever HSI), and the Bever et al. (2016) HSI with a temperature threshold of 22°C (henceforth HSI22) are shown below for each alternative and water year type. Data were aggregated at three different spatial scales: the Delta, which is all subregions combined; the summer-fall habitat arc, which is subregions targeted by the action combined; and subregions, which is individual subregions shown in Figure K.1-1.

K.1.3.1 Abiotic Conditions

Between July and mid-November, median water temperature values and standard deviations were similar across alternatives within a given water year type (Figure K.1-45, Figure K.1-46). Median temperatures ranged from lows of less than 16°C to greater than 26°C. Median temperatures were consistently greater than 22°C in the Yolo Bypass, lower San Joaquin River, and South Delta. Temperatures were warmest during the critically dry, dry, and wet water years (Figure K.1-45, Figure K.1-46). Differences in temperature among WYTs and among subregions were greater than among alternatives.

Median salinity values and standard deviations, from July through mid-November, were similar across the NAA and Alternative 2 components, except in most regions during the critically dry water year (Figure K.1-47, Figure K.1-48). In the critically dry year, median salinities were lower, and variability was higher for the Alt2 Without TUCP Without VA; Alt2 Without TUCP Delta VA; and Alt2 Without TUCP Systemwide VA. Across wet to critically dry WYTs and across alternatives within a WYT, the lowest median salinities were zero and the highest ranged from approximately 10-20 ppt, with lowest salinities occurring in the above normal water year (Figure K.1-47, Figure K.1-48). Median salinities oscillated around or exceeded the 6 ppt threshold in Suisun Marsh and all of the Suisun Bay regions across water years; they oscillated around or exceeded the threshold in the Confluence region in the dry and critical water years only. Differences in salinity among WYTs and among subregions were generally greater than among alternatives.

Median current speeds and standard deviations during July through mid-November were similar across alternatives, ranging from less than 0.25 meters per second (m/s) to a little over 1.00 m/s (Figure K.1-49, Figure K.1-50). Current speeds were consistently lowest in the Yolo Bypass, lower San Joaquin River, Suisun Marsh, East Delta, and South Delta regions, ranging from less than 0.25 to less than 0.40 m/s; they were highest in the SE and SW Suisun Bay regions, ranging from around 0.75 to over 1.00 m/s (Figure K.1-49, Figure K.1-50). Current speed varied more among regions than water years and alternatives.

The spatially-averaged median probabilities of turbidity being greater than 12 NTU and standard deviations are very similar among alternatives and WYTs (Figure K.1-51, Figure K.1-52). Any differences are likely due to differences in wetted area among the alternatives or WYTs. The median probabilities of turbidity greater than 12 NTU were consistently greater than 50% in the Confluence, Suisun Marsh, and each of the Suisun Bay regions; they were consistently less than 25% in the Sacramento River, Yolo Bypass, East Delta, and South Delta regions (Figure K.1-51, Figure K.1-52).

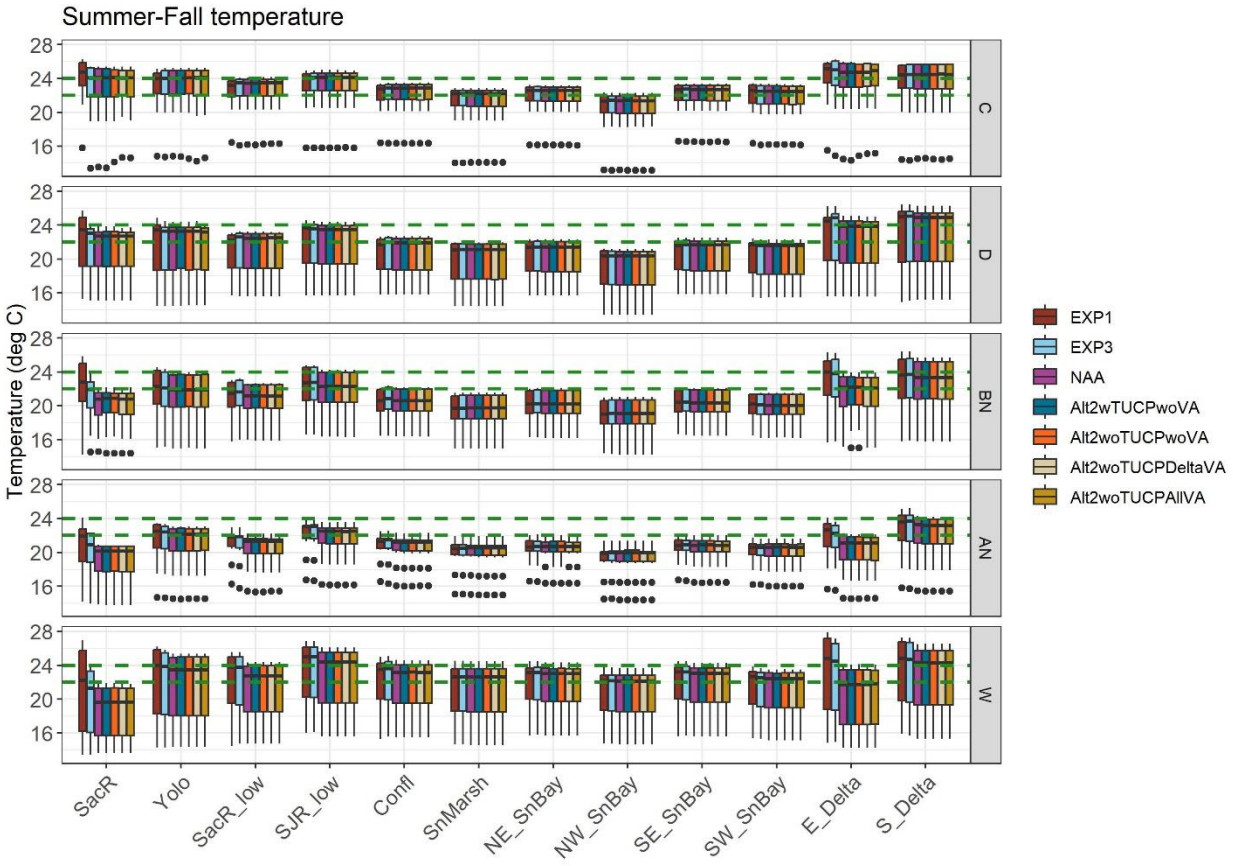

Figure K.1-45. Delta subregion temperatures (degrees Celsius [°C]) from July 1 – November 18 for each alternative and water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The green dashed lines indicate the 22 C and 24 C temperature thresholds that have been used to modify the Bever et al. (2016) Delta Smelt habitat suitability index.

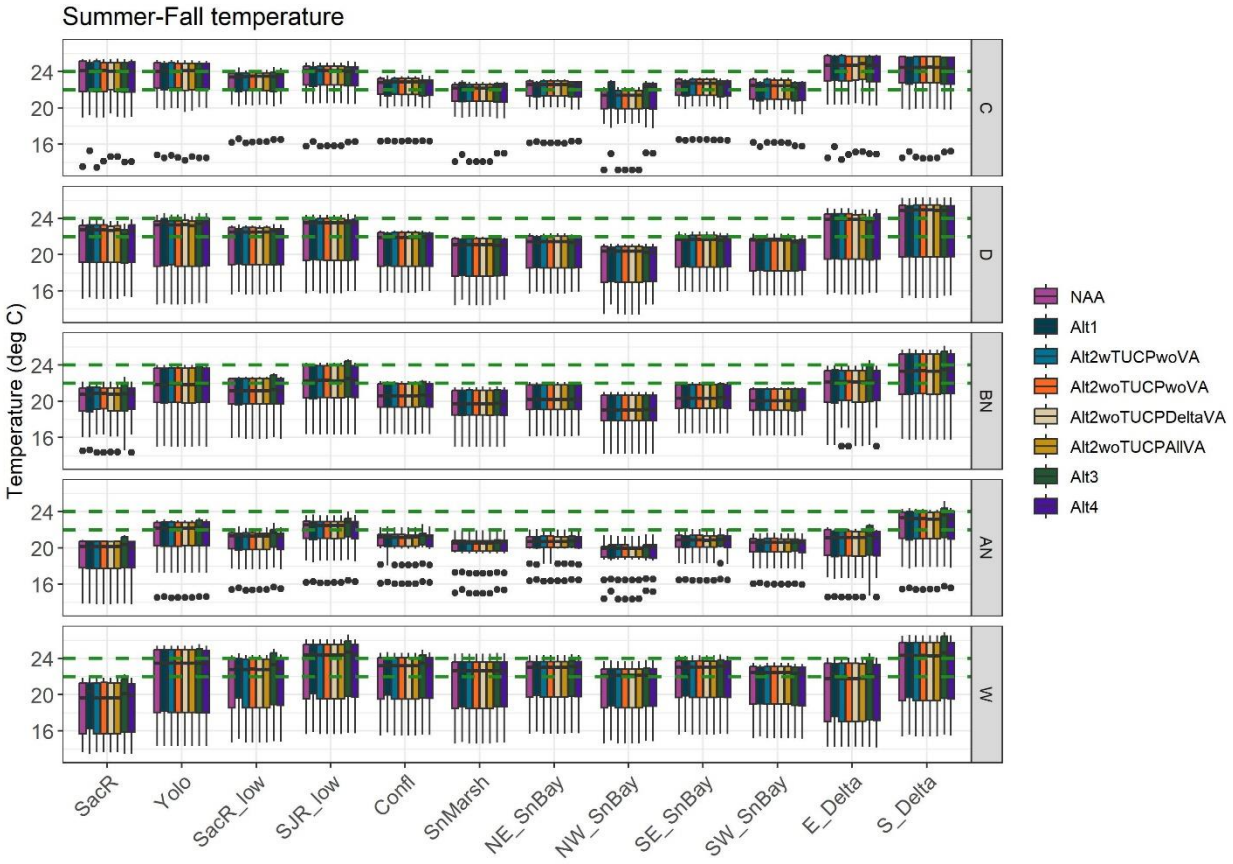

Figure K.1-46. Delta subregion temperatures (degrees Celsius [°C]) from July 1 – November 18 for each alternative and water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); and alternative 4 (Alt4). The green dashed lines indicate the 22 C and 24 C temperature thresholds that have been used to modify the Bever et al. (2016) Delta Smelt habitat suitability index. Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

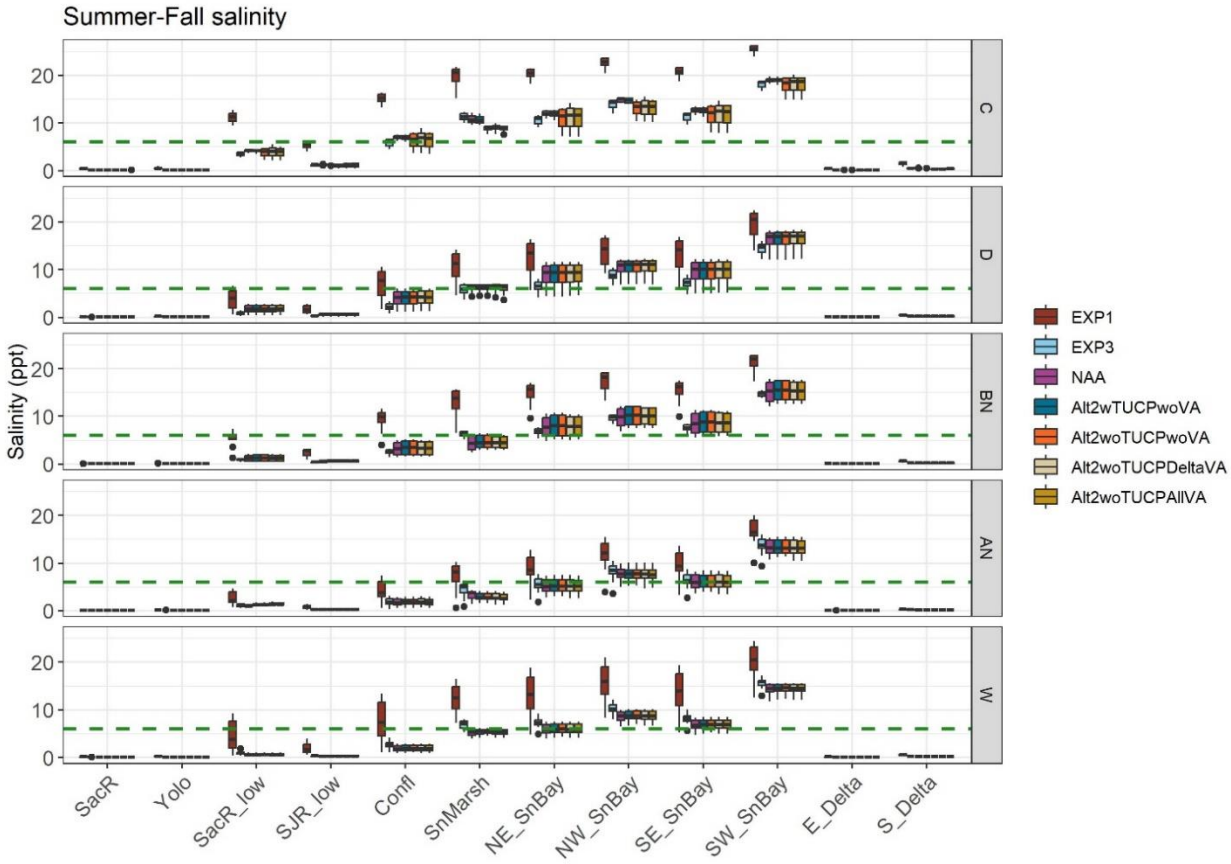

Figure K.1-47. Delta subregion salinity (parts per thousand [ppt]) from July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). The green dashed line indicates the 6 ppt threshold from the Bever et al. (2016) Delta Smelt habitat suitability index. Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

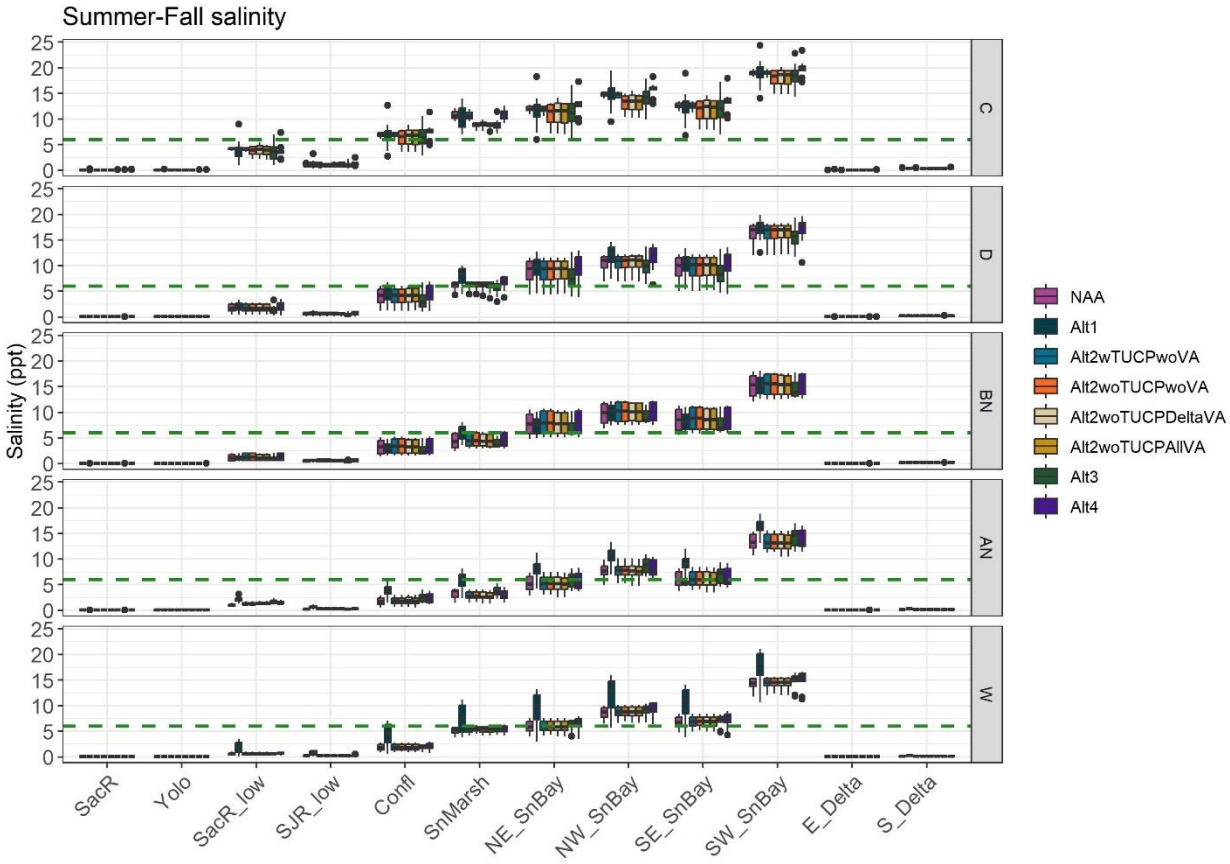

Figure K.1-48. Delta subregion salinity (parts per thousand [ppt]) from July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA), alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4). The green dashed line indicates the 6 ppt threshold from the Bever et al. (2016) Delta Smelt habitat suitability index. Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

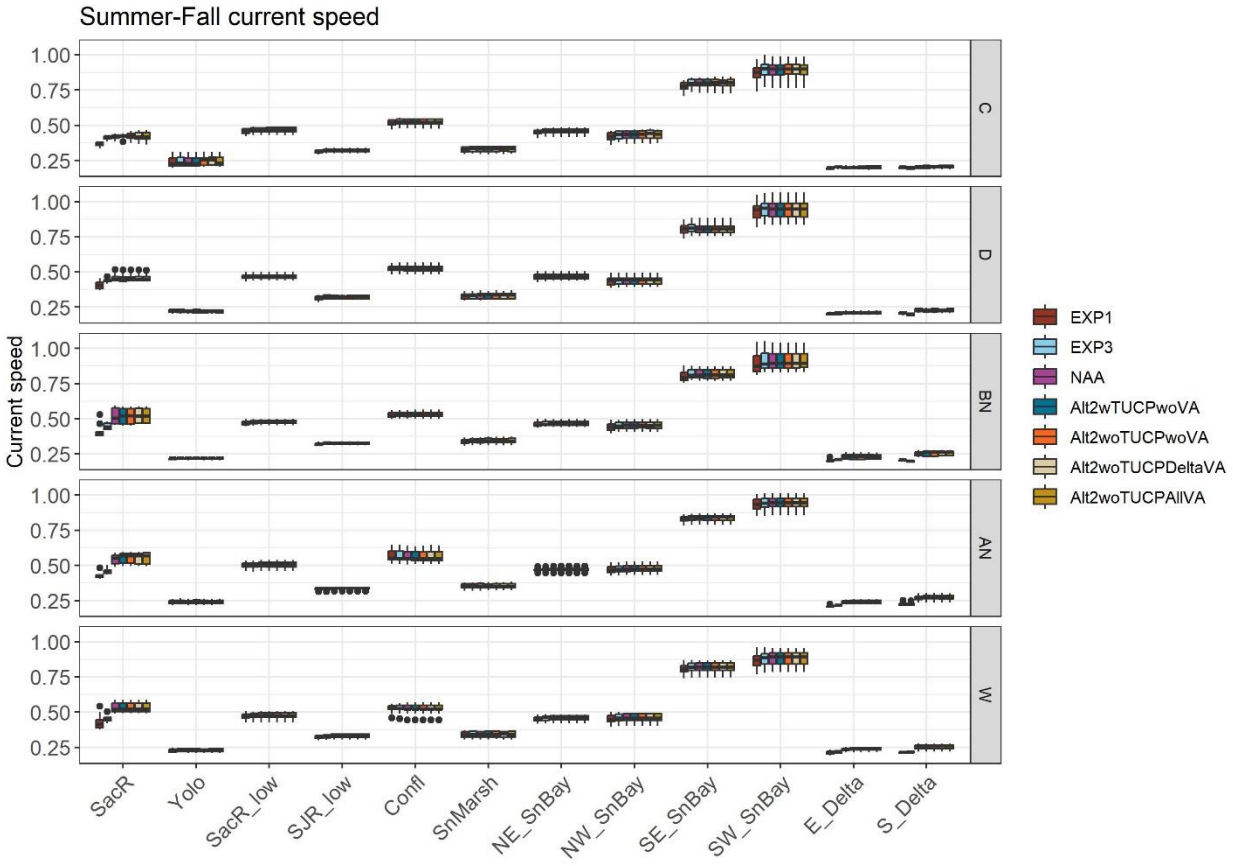

Figure K.1-49. Delta subregion current speed (m/s) from July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

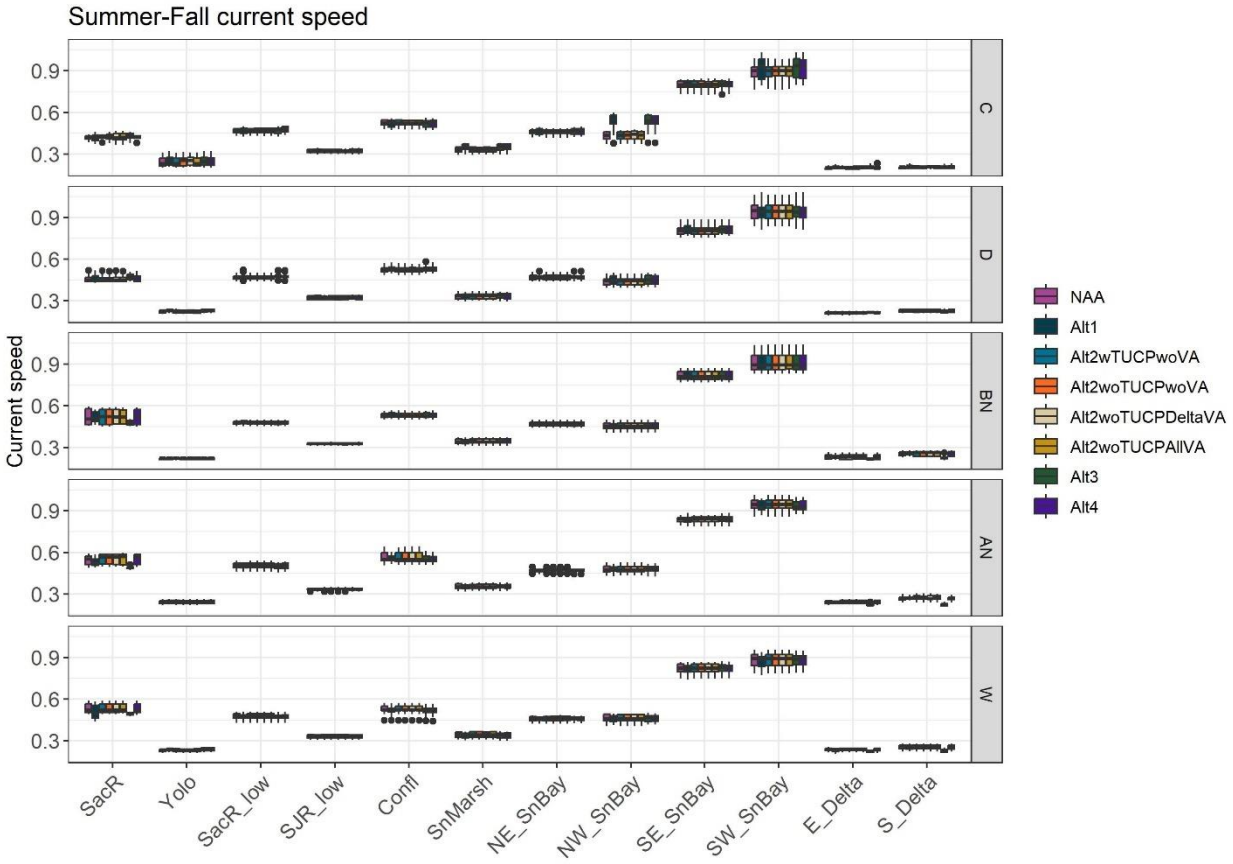

Figure K.1-50. Delta subregion current speed (m/s) from July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

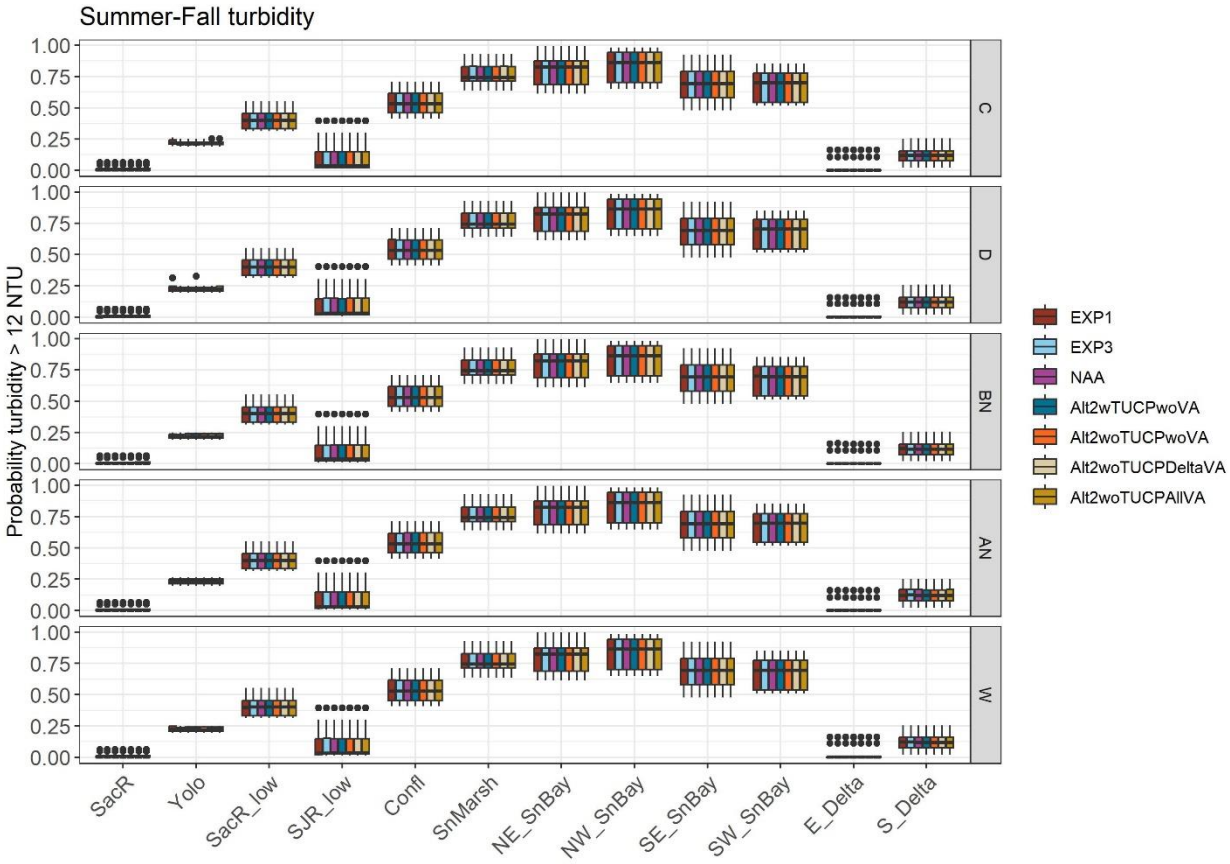

Figure K.1-51. Delta subregion probability of turbidity greater than 12 Nephelometric Units (NTU) from July 1 – November 18. The threshold of 12 NTU is from the Bever et al. (2016) Delta Smelt habitat suitability index. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

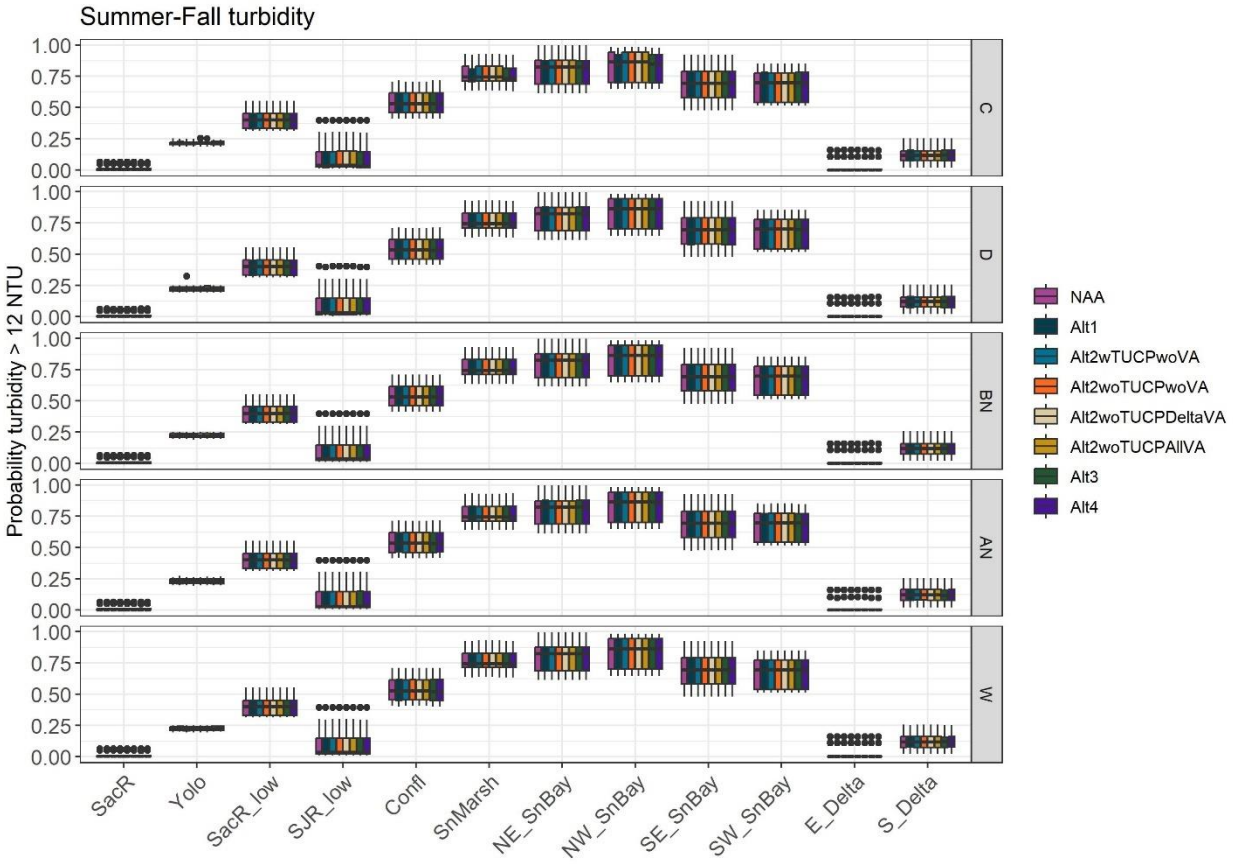

Figure K.1-52. Delta subregion probability of turbidity greater than 12 Nephelometric Units (NTU) from July 1 – November 18. The threshold of 12 NTU is from the Bever et al. (2016) Delta Smelt habitat suitability index. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

K.1.3.2 Bever et al. (2016) HSI

The mean Bever HSI for the Delta (i.e., averaged across all subregions) was highest in the above normal water year across all Alternative 2 components, followed by the wet and below normal water year types (Table K.1-5, Table K.1-6; Figure K.1-53, Figure K.1-54). The mean Bever HSI for subregions targeted by the summer and fall habitat X2 and Suisun Marsh Salinity Control Gate actions (Yolo, Lower Sacramento River, Confluence, Suisun Marsh, NW Suisun) was also highest for the above normal water year type across all alternatives, followed by the below normal and wet water years (Table K.1-5, Table K.1-6; Figure K.1-57, Figure K.1-58). Higher mean Bever HSI values in the above normal water are likely due to operation of the Suisun Marsh Salinity Control Gates and the timing of inflow during the summer. Mean Bever HSI values for the Delta and the summer and fall habitat subregions were lowest across all Alternative 2 components during the critical water year type compared to the other water year types (Table K.1-5, Table K.1-6; Figure K.1-53, Figure K.1-54, Figure K.1-57, and Figure K.1-58). Mean Bever HSI at the subregional spatial scale ranged from about 0.14 to 0.83. Subregions with the highest mean Bever HSI, across alternatives and water year types, were the lower Sacramento River, Confluence, Suisun Marsh, and South Delta (Figure K.1-61, Figure K.1-62). Mean Bever HSI was highest in the lower Sacramento River for critical and dry water years, whereas mean Bever HSI was highest in Suisun Marsh in below normal and above normal water years and in the Confluence in wet water years (Figure K.1-61, Figure K.1-62).

Bever HSI values across the Alternative 2 components were similar to those of the NAA at all levels of spatial organization (Delta, summer and fall habitat subregions together, individual subregions; Table K.1-7, Table K.1-8). For the Delta and summer and fall habitat subregions, percent differences were slightly negative; for each subregion, percent changes generally ranged between -3 to 2, except in the Confluence during the critical water year and in some of the Suisun Bay subregions during the wet, below normal, and critical water year types (Table K.1-7, Table K.1-8). Overall, the percent differences in Bever HSI values were greatest between Alternative 1 and the NAA, with lower HSI values for Alternative 1 across water year types but most notably during wet and above normal water year types. For the Delta and summer and fall habitat subregions together, Bever HSI values for Alternatives 3 and 4 also were similar to NAA values, ranging + 6% (Table K.1-7, Table K.1-8).

Any differences between the Alternative 2 components and the NAA are most likely due to differences in salinity and current speed among alternatives for each water year (Figure K.1-47, Figure K.1-48, Figure K.1-49, and Figure K.1-50). In general, Bever HSI was highest in the subregions targeted by the summer and fall habitat action (Figure K.1-61, Figure K.1-62, and Figure through Figure K.1-114). Bever HSI was also relatively high in the lower San Joaquin River, and the East and South Delta, areas with historically lower frequencies of Delta smelt occurrence (Merz et al. 2011).

Table K.1-5. Means and standard deviations of the Habitat Suitability Index calculated using Bever et al. (2016) for each alternative and water year type (WYT).

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
AN	Confluence	0.515 +/- 0.176	0.666 +/- 0.045	0.666 +/- 0.044	0.665 +/- 0.044	0.665 +/- 0.044	0.665 +/- 0.044	0.666 +/- 0.044
AN	East Delta	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043
AN	Lower Sacramento River	0.616 +/- 0.054	0.637 +/- 0.037	0.635 +/- 0.036	0.635 +/- 0.036	0.635 +/- 0.036	0.635 +/- 0.036	0.635 +/- 0.036
AN	Lower San Joaquin River	0.479 +/- 0.082	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081
AN	NE Suisun	0.378 +/- 0.192	0.572 +/- 0.191	0.602 +/- 0.186	0.595 +/- 0.183	0.595 +/- 0.182	0.601 +/- 0.191	0.611 +/- 0.189
AN	NW Suisun	0.348 +/- 0.139	0.407 +/- 0.174	0.46 +/- 0.155	0.456 +/- 0.148	0.456 +/- 0.148	0.463 +/- 0.157	0.469 +/- 0.159
AN	SE Suisun	0.263 +/- 0.151	0.408 +/- 0.145	0.418 +/- 0.13	0.411 +/- 0.125	0.411 +/- 0.125	0.417 +/- 0.136	0.425 +/- 0.135
AN	SW Suisun	0.148 +/- 0.022	0.149 +/- 0.025	0.144 +/- 0.017	0.143 +/- 0.016	0.143 +/- 0.016	0.145 +/- 0.018	0.145 +/- 0.017
AN	Sacramento River	0.425 +/- 0.018	0.424 +/- 0.017	0.419 +/- 0.016	0.418 +/- 0.017	0.418 +/- 0.017	0.418 +/- 0.017	0.418 +/- 0.017
AN	South Delta	0.482 +/- 0.05	0.481 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05
AN	Suisun Marsh	0.478 +/- 0.222	0.66 +/- 0.18	0.819 +/- 0.092	0.823 +/- 0.082	0.823 +/- 0.081	0.824 +/- 0.082	0.828 +/- 0.08
AN	Yolo Bypass	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013
AN	SummerFall	0.489 +/- 0.182	0.593 +/- 0.165	0.645 +/- 0.158	0.645 +/- 0.158	0.645 +/- 0.158	0.647 +/- 0.158	0.65 +/- 0.157
AN	Delta	0.427 +/- 0.168	0.49 +/- 0.172	0.51 +/- 0.182	0.508 +/- 0.182	0.508 +/- 0.182	0.51 +/- 0.183	0.512 +/- 0.184
BN	Confluence	0.28 +/- 0.105	0.674 +/- 0.05	0.601 +/- 0.136	0.585 +/- 0.148	0.585 +/- 0.149	0.598 +/- 0.136	0.598 +/- 0.136
BN	East Delta	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.043
BN	Lower Sacramento River	0.433 +/- 0.138	0.649 +/- 0.042	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041
BN	Lower San Joaquin River	0.46 +/- 0.084	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08
BN	NE Suisun	0.31 +/- 0.026	0.451 +/- 0.081	0.431 +/- 0.192	0.423 +/- 0.176	0.423 +/- 0.177	0.423 +/- 0.176	0.423 +/- 0.176
BN	NW Suisun	0.305 +/- 0.026	0.305 +/- 0.024	0.366 +/- 0.125	0.336 +/- 0.085	0.336 +/- 0.085	0.336 +/- 0.086	0.336 +/- 0.085
BN	SE Suisun	0.199 +/- 0.017	0.323 +/- 0.053	0.304 +/- 0.147	0.297 +/- 0.14	0.297 +/- 0.14	0.299 +/- 0.139	0.298 +/- 0.139
BN	SW Suisun	0.153 +/- 0.023	0.147 +/- 0.02	0.148 +/- 0.02	0.148 +/- 0.02	0.148 +/- 0.02	0.148 +/- 0.02	0.147 +/- 0.02

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	Sacramento River	0.427 +/- 0.018	0.427 +/- 0.018	0.423 +/- 0.016	0.423 +/- 0.016	0.423 +/- 0.016	0.423 +/- 0.016	0.423 +/- 0.016
BN	South Delta	0.48 +/- 0.05	0.48 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05
BN	Suisun Marsh	0.354 +/- 0.072	0.472 +/- 0.079	0.738 +/- 0.145	0.726 +/- 0.128	0.726 +/- 0.128	0.748 +/- 0.103	0.75 +/- 0.105
BN	Yolo Bypass	0.548 +/- 0.011	0.547 +/- 0.01	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011
BN	SummerFall	0.343 +/- 0.109	0.525 +/- 0.159	0.588 +/- 0.18	0.574 +/- 0.181	0.574 +/- 0.181	0.583 +/- 0.181	0.583 +/- 0.181
BN	Delta	0.366 +/- 0.13	0.45 +/- 0.148	0.467 +/- 0.181	0.461 +/- 0.177	0.461 +/- 0.177	0.464 +/- 0.178	0.464 +/- 0.179
C	Confluence	0.235 +/- 0.019	0.435 +/- 0.07	0.348 +/- 0.057	0.355 +/- 0.065	0.442 +/- 0.188	0.434 +/- 0.195	0.44 +/- 0.191
C	East Delta	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044
C	Lower Sacramento River	0.268 +/- 0.039	0.639 +/- 0.04	0.613 +/- 0.061	0.616 +/- 0.061	0.613 +/- 0.075	0.596 +/- 0.092	0.607 +/- 0.072
C	Lower San Joaquin River	0.385 +/- 0.074	0.483 +/- 0.08	0.483 +/- 0.08	0.483 +/- 0.08	0.483 +/- 0.08	0.482 +/- 0.079	0.483 +/- 0.08
C	NE Suisun	0.313 +/- 0.025	0.309 +/- 0.026	0.309 +/- 0.025	0.309 +/- 0.025	0.318 +/- 0.044	0.32 +/- 0.047	0.323 +/- 0.057
C	NW Suisun	0.309 +/- 0.026	0.307 +/- 0.026	0.307 +/- 0.026	0.307 +/- 0.026	0.307 +/- 0.025	0.307 +/- 0.025	0.307 +/- 0.025
C	SE Suisun	0.206 +/- 0.019	0.201 +/- 0.018	0.199 +/- 0.019	0.199 +/- 0.019	0.215 +/- 0.048	0.216 +/- 0.049	0.218 +/- 0.053
C	SW Suisun	0.165 +/- 0.024	0.156 +/- 0.022	0.157 +/- 0.022	0.157 +/- 0.022	0.156 +/- 0.021	0.156 +/- 0.021	0.156 +/- 0.021
C	Sacramento River	0.411 +/- 0.026	0.429 +/- 0.019	0.429 +/- 0.019	0.429 +/- 0.019	0.429 +/- 0.019	0.429 +/- 0.019	0.428 +/- 0.019
C	South Delta	0.479 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05
C	Suisun Marsh	0.332 +/- 0.016	0.335 +/- 0.016	0.331 +/- 0.017	0.331 +/- 0.017	0.334 +/- 0.022	0.334 +/- 0.022	0.334 +/- 0.022
C	Yolo Bypass	0.55 +/- 0.011	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009
C	SummerFall	0.286 +/- 0.045	0.429 +/- 0.138	0.4 +/- 0.133	0.402 +/- 0.134	0.424 +/- 0.157	0.418 +/- 0.155	0.422 +/- 0.155
C	Delta	0.341 +/- 0.116	0.397 +/- 0.14	0.387 +/- 0.137	0.388 +/- 0.137	0.397 +/- 0.145	0.395 +/- 0.144	0.397 +/- 0.144
D	Confluence	0.382 +/- 0.171	0.674 +/- 0.058	0.542 +/- 0.167	0.541 +/- 0.168	0.541 +/- 0.168	0.54 +/- 0.168	0.541 +/- 0.167
D	East Delta	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043
D	Lower Sacramento River	0.522 +/- 0.138	0.651 +/- 0.044	0.647 +/- 0.047	0.647 +/- 0.047	0.647 +/- 0.047	0.647 +/- 0.048	0.647 +/- 0.047
D	Lower San Joaquin River	0.471 +/- 0.084	0.482 +/- 0.08	0.483 +/- 0.081	0.483 +/- 0.081	0.483 +/- 0.081	0.483 +/- 0.081	0.483 +/- 0.081

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	NE Suisun	0.338 +/- 0.074	0.497 +/- 0.152	0.395 +/- 0.177	0.396 +/- 0.178	0.396 +/- 0.178	0.391 +/- 0.171	0.386 +/- 0.167
D	NW Suisun	0.306 +/- 0.028	0.362 +/- 0.106	0.336 +/- 0.104	0.336 +/- 0.105	0.336 +/- 0.105	0.334 +/- 0.101	0.333 +/- 0.098
D	SE Suisun	0.224 +/- 0.06	0.36 +/- 0.108	0.272 +/- 0.141	0.272 +/- 0.142	0.272 +/- 0.142	0.269 +/- 0.138	0.267 +/- 0.135
D	SW Suisun	0.145 +/- 0.028	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025
D	Sacramento River	0.428 +/- 0.019	0.428 +/- 0.019	0.428 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018
D	South Delta	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05
D	Suisun Marsh	0.381 +/- 0.108	0.563 +/- 0.195	0.536 +/- 0.192	0.531 +/- 0.192	0.529 +/- 0.193	0.531 +/- 0.193	0.54 +/- 0.194
D	Yolo Bypass	0.556 +/- 0.021	0.549 +/- 0.012	0.55 +/- 0.011	0.554 +/- 0.016	0.549 +/- 0.011	0.549 +/- 0.01	0.549 +/- 0.011
D	SummerFall	0.398 +/- 0.142	0.562 +/- 0.168	0.515 +/- 0.176	0.514 +/- 0.176	0.513 +/- 0.176	0.513 +/- 0.176	0.515 +/- 0.176
D	Delta	0.39 +/- 0.141	0.469 +/- 0.163	0.438 +/- 0.168	0.438 +/- 0.168	0.437 +/- 0.168	0.436 +/- 0.167	0.436 +/- 0.167
W	Confluence	0.371 +/- 0.158	0.645 +/- 0.075	0.674 +/- 0.055	0.674 +/- 0.055	0.673 +/- 0.055	0.674 +/- 0.055	0.674 +/- 0.055
W	East Delta	0.442 +/- 0.044	0.442 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044
W	Lower Sacramento River	0.493 +/- 0.161	0.649 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042
W	Lower San Joaquin River	0.461 +/- 0.095	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079
W	NE Suisun	0.343 +/- 0.098	0.408 +/- 0.119	0.553 +/- 0.192	0.541 +/- 0.187	0.535 +/- 0.178	0.542 +/- 0.187	0.542 +/- 0.187
W	NW Suisun	0.316 +/- 0.027	0.314 +/- 0.026	0.387 +/- 0.151	0.378 +/- 0.143	0.373 +/- 0.135	0.379 +/- 0.144	0.379 +/- 0.144
W	SE Suisun	0.227 +/- 0.079	0.29 +/- 0.084	0.391 +/- 0.13	0.383 +/- 0.126	0.379 +/- 0.12	0.384 +/- 0.126	0.384 +/- 0.126
W	SW Suisun	0.163 +/- 0.024	0.157 +/- 0.021	0.157 +/- 0.02	0.157 +/- 0.02	0.156 +/- 0.02	0.157 +/- 0.02	0.157 +/- 0.02
W	Sacramento River	0.423 +/- 0.021	0.426 +/- 0.018	0.422 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016
W	South Delta	0.48 +/- 0.049	0.48 +/- 0.049	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05
W	Suisun Marsh	0.352 +/- 0.042	0.427 +/- 0.086	0.631 +/- 0.203	0.619 +/- 0.202	0.612 +/- 0.202	0.62 +/- 0.203	0.62 +/- 0.203
W	Yolo Bypass	0.549 +/- 0.013	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012
W	SummerFall	0.383 +/- 0.13	0.509 +/- 0.157	0.585 +/- 0.172	0.579 +/- 0.172	0.576 +/- 0.171	0.58 +/- 0.172	0.58 +/- 0.172
W	Delta	0.385 +/- 0.135	0.439 +/- 0.149	0.484 +/- 0.17	0.481 +/- 0.169	0.479 +/- 0.167	0.481 +/- 0.169	0.481 +/- 0.169

Table K.1-6. Means and standard deviations of the Habitat Suitability Index calculated using Bever et al. (2016) for each alternative and water year type (WYT).

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
AN	Confluence	0.666 +/- 0.044	0.592 +/- 0.108	0.665 +/- 0.044	0.665 +/- 0.044	0.665 +/- 0.044	0.666 +/- 0.044	0.653 +/- 0.043	0.658 +/- 0.046
AN	East Delta	0.441 +/- 0.043	0.44 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.44 +/- 0.043
AN	Lower Sacramento River	0.635 +/- 0.036	0.634 +/- 0.034	0.635 +/- 0.036	0.635 +/- 0.036	0.635 +/- 0.036	0.635 +/- 0.036	0.636 +/- 0.036	0.635 +/- 0.035
AN	Lower San Joaquin River	0.479 +/- 0.081	0.48 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.479 +/- 0.081	0.48 +/- 0.081	0.48 +/- 0.081
AN	NE Suisun	0.602 +/- 0.186	0.405 +/- 0.193	0.595 +/- 0.183	0.595 +/- 0.182	0.601 +/- 0.191	0.611 +/- 0.189	0.521 +/- 0.143	0.559 +/- 0.201
AN	NW Suisun	0.46 +/- 0.155	0.362 +/- 0.128	0.456 +/- 0.148	0.456 +/- 0.148	0.463 +/- 0.157	0.469 +/- 0.159	0.386 +/- 0.103	0.448 +/- 0.138
AN	SE Suisun	0.418 +/- 0.13	0.276 +/- 0.136	0.411 +/- 0.125	0.411 +/- 0.125	0.417 +/- 0.136	0.425 +/- 0.135	0.355 +/- 0.09	0.385 +/- 0.129
AN	SW Suisun	0.144 +/- 0.017	0.144 +/- 0.018	0.143 +/- 0.016	0.143 +/- 0.016	0.145 +/- 0.018	0.145 +/- 0.017	0.145 +/- 0.016	0.144 +/- 0.017
AN	Sacramento River	0.419 +/- 0.016	0.42 +/- 0.016	0.418 +/- 0.017	0.418 +/- 0.017	0.418 +/- 0.017	0.418 +/- 0.017	0.423 +/- 0.017	0.418 +/- 0.016
AN	South Delta	0.48 +/- 0.05	0.479 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.481 +/- 0.05	0.48 +/- 0.05
AN	Suisun Marsh	0.819 +/- 0.092	0.578 +/- 0.226	0.823 +/- 0.082	0.823 +/- 0.081	0.824 +/- 0.082	0.828 +/- 0.08	0.777 +/- 0.051	0.812 +/- 0.092
AN	Yolo Bypass	0.55 +/- 0.013	0.55 +/- 0.014	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.013	0.55 +/- 0.014
AN	SummerFall	0.645 +/- 0.158	0.542 +/- 0.173	0.645 +/- 0.158	0.645 +/- 0.158	0.647 +/- 0.158	0.65 +/- 0.157	0.613 +/- 0.156	0.638 +/- 0.156

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
AN	Delta	0.51 +/- 0.182	0.447 +/- 0.171	0.508 +/- 0.182	0.508 +/- 0.182	0.51 +/- 0.183	0.512 +/- 0.184	0.487 +/- 0.169	0.501 +/- 0.181
BN	Confluence	0.601 +/- 0.136	0.632 +/- 0.103	0.585 +/- 0.148	0.585 +/- 0.149	0.598 +/- 0.136	0.598 +/- 0.136	0.644 +/- 0.098	0.584 +/- 0.149
BN	East Delta	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.044	0.441 +/- 0.044
BN	Lower Sacramento River	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.648 +/- 0.041	0.649 +/- 0.042	0.648 +/- 0.041
BN	Lower San Joaquin River	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08	0.482 +/- 0.08
BN	NE Suisun	0.431 +/- 0.192	0.424 +/- 0.177	0.423 +/- 0.176	0.423 +/- 0.177	0.423 +/- 0.176	0.423 +/- 0.176	0.477 +/- 0.171	0.422 +/- 0.175
BN	NW Suisun	0.366 +/- 0.125	0.33 +/- 0.081	0.336 +/- 0.085	0.336 +/- 0.085	0.336 +/- 0.086	0.336 +/- 0.085	0.31 +/- 0.031	0.335 +/- 0.084
BN	SE Suisun	0.304 +/- 0.147	0.306 +/- 0.136	0.297 +/- 0.14	0.297 +/- 0.14	0.299 +/- 0.139	0.298 +/- 0.139	0.339 +/- 0.128	0.296 +/- 0.139
BN	SW Suisun	0.148 +/- 0.02	0.147 +/- 0.02	0.148 +/- 0.02	0.148 +/- 0.02	0.148 +/- 0.02	0.147 +/- 0.02	0.147 +/- 0.02	0.148 +/- 0.02
BN	Sacramento River	0.423 +/- 0.016	0.424 +/- 0.017	0.423 +/- 0.016	0.423 +/- 0.016	0.423 +/- 0.016	0.423 +/- 0.016	0.426 +/- 0.019	0.423 +/- 0.016
BN	South Delta	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.478 +/- 0.05	0.48 +/- 0.05	0.478 +/- 0.05
BN	Suisun Marsh	0.738 +/- 0.145	0.561 +/- 0.205	0.726 +/- 0.128	0.726 +/- 0.128	0.748 +/- 0.103	0.75 +/- 0.105	0.765 +/- 0.077	0.725 +/- 0.127
BN	Yolo Bypass	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011	0.547 +/- 0.011
BN	SummerFall	0.588 +/- 0.18	0.543 +/- 0.175	0.574 +/- 0.181	0.574 +/- 0.181	0.583 +/- 0.181	0.583 +/- 0.181	0.592 +/- 0.184	0.573 +/- 0.181
BN	Delta	0.467 +/- 0.181	0.452 +/- 0.168	0.461 +/- 0.177	0.461 +/- 0.177	0.464 +/- 0.178	0.464 +/- 0.179	0.476 +/- 0.177	0.461 +/- 0.176

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
C	Confluence	0.348 +/- 0.057	0.409 +/- 0.198	0.355 +/- 0.065	0.442 +/- 0.188	0.434 +/- 0.195	0.44 +/- 0.191	0.441 +/- 0.203	0.346 +/- 0.127
C	East Delta	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.043	0.441 +/- 0.043
C	Lower Sacramento River	0.613 +/- 0.061	0.57 +/- 0.129	0.616 +/- 0.061	0.613 +/- 0.075	0.596 +/- 0.092	0.607 +/- 0.072	0.58 +/- 0.115	0.564 +/- 0.104
C	Lower San Joaquin River	0.483 +/- 0.08	0.475 +/- 0.076	0.483 +/- 0.08	0.483 +/- 0.08	0.482 +/- 0.079	0.483 +/- 0.08	0.478 +/- 0.077	0.477 +/- 0.077
C	NE Suisun	0.309 +/- 0.025	0.344 +/- 0.107	0.309 +/- 0.025	0.318 +/- 0.044	0.32 +/- 0.047	0.323 +/- 0.057	0.352 +/- 0.112	0.309 +/- 0.026
C	NW Suisun	0.307 +/- 0.026	0.306 +/- 0.025	0.307 +/- 0.026	0.307 +/- 0.025	0.307 +/- 0.025	0.307 +/- 0.025	0.305 +/- 0.025	0.306 +/- 0.025
C	SE Suisun	0.199 +/- 0.019	0.232 +/- 0.09	0.199 +/- 0.019	0.215 +/- 0.048	0.216 +/- 0.049	0.218 +/- 0.053	0.235 +/- 0.09	0.2 +/- 0.022
C	SW Suisun	0.157 +/- 0.022	0.15 +/- 0.023	0.157 +/- 0.022	0.156 +/- 0.021	0.156 +/- 0.021	0.156 +/- 0.021	0.149 +/- 0.022	0.15 +/- 0.023
C	Sacramento River	0.429 +/- 0.019	0.428 +/- 0.018	0.429 +/- 0.019	0.429 +/- 0.019	0.429 +/- 0.019	0.428 +/- 0.019	0.429 +/- 0.019	0.429 +/- 0.019
C	South Delta	0.48 +/- 0.05	0.481 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.481 +/- 0.05	0.481 +/- 0.05
C	Suisun Marsh	0.331 +/- 0.017	0.332 +/- 0.02	0.331 +/- 0.017	0.334 +/- 0.022	0.334 +/- 0.022	0.334 +/- 0.022	0.335 +/- 0.023	0.331 +/- 0.018
C	Yolo Bypass	0.546 +/- 0.009	0.547 +/- 0.011	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.009	0.546 +/- 0.011	0.547 +/- 0.011
C	SummerFall	0.4 +/- 0.133	0.404 +/- 0.155	0.402 +/- 0.134	0.424 +/- 0.157	0.418 +/- 0.155	0.422 +/- 0.155	0.415 +/- 0.157	0.387 +/- 0.132
C	Delta	0.387 +/- 0.137	0.393 +/- 0.145	0.388 +/- 0.137	0.397 +/- 0.145	0.395 +/- 0.144	0.397 +/- 0.144	0.398 +/- 0.146	0.382 +/- 0.137
D	Confluence	0.542 +/- 0.167	0.513 +/- 0.174	0.541 +/- 0.168	0.541 +/- 0.168	0.54 +/- 0.168	0.541 +/- 0.167	0.597 +/- 0.15	0.501 +/- 0.184

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
D	East Delta	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043	0.441 +/- 0.043
D	Lower Sacramento River	0.647 +/- 0.047	0.639 +/- 0.045	0.647 +/- 0.047	0.647 +/- 0.047	0.647 +/- 0.048	0.647 +/- 0.047	0.642 +/- 0.041	0.633 +/- 0.05
D	Lower San Joaquin River	0.483 +/- 0.081	0.482 +/- 0.079	0.483 +/- 0.081	0.483 +/- 0.081	0.483 +/- 0.081	0.483 +/- 0.081	0.481 +/- 0.08	0.482 +/- 0.079
D	NE Suisun	0.395 +/- 0.177	0.371 +/- 0.161	0.396 +/- 0.178	0.396 +/- 0.178	0.391 +/- 0.171	0.386 +/- 0.167	0.458 +/- 0.2	0.376 +/- 0.172
D	NW Suisun	0.336 +/- 0.104	0.329 +/- 0.09	0.336 +/- 0.105	0.336 +/- 0.105	0.334 +/- 0.101	0.333 +/- 0.098	0.342 +/- 0.114	0.332 +/- 0.1
D	SE Suisun	0.272 +/- 0.141	0.253 +/- 0.132	0.272 +/- 0.142	0.272 +/- 0.142	0.269 +/- 0.138	0.267 +/- 0.135	0.321 +/- 0.16	0.257 +/- 0.143
D	SW Suisun	0.142 +/- 0.025	0.144 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.142 +/- 0.025	0.143 +/- 0.024	0.146 +/- 0.027
D	Sacramento River	0.428 +/- 0.018	0.427 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018	0.428 +/- 0.018	0.427 +/- 0.018	0.427 +/- 0.018
D	South Delta	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05	0.48 +/- 0.05
D	Suisun Marsh	0.536 +/- 0.192	0.44 +/- 0.206	0.531 +/- 0.192	0.529 +/- 0.193	0.531 +/- 0.193	0.54 +/- 0.194	0.596 +/- 0.178	0.466 +/- 0.202
D	Yolo Bypass	0.55 +/- 0.011	0.548 +/- 0.012	0.554 +/- 0.016	0.549 +/- 0.011	0.549 +/- 0.01	0.549 +/- 0.011	0.548 +/- 0.011	0.548 +/- 0.012
D	SummerFall	0.515 +/- 0.176	0.48 +/- 0.179	0.514 +/- 0.176	0.513 +/- 0.176	0.513 +/- 0.176	0.515 +/- 0.176	0.544 +/- 0.174	0.483 +/- 0.179
D	Delta	0.438 +/- 0.168	0.422 +/- 0.164	0.438 +/- 0.168	0.437 +/- 0.168	0.436 +/- 0.167	0.436 +/- 0.167	0.456 +/- 0.17	0.424 +/- 0.165
W	Confluence	0.674 +/- 0.055	0.501 +/- 0.19	0.674 +/- 0.055	0.673 +/- 0.055	0.674 +/- 0.055	0.674 +/- 0.055	0.674 +/- 0.057	0.668 +/- 0.059
W	East Delta	0.441 +/- 0.044	0.442 +/- 0.045	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.441 +/- 0.044	0.442 +/- 0.044	0.441 +/- 0.044

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
W	Lower Sacramento River	0.647 +/- 0.042	0.627 +/- 0.069	0.647 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042	0.647 +/- 0.042	0.649 +/- 0.042	0.648 +/- 0.042
W	Lower San Joaquin River	0.482 +/- 0.079	0.481 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.482 +/- 0.079	0.481 +/- 0.079	0.481 +/- 0.079
W	NE Suisun	0.553 +/- 0.192	0.424 +/- 0.25	0.541 +/- 0.187	0.535 +/- 0.178	0.542 +/- 0.187	0.542 +/- 0.187	0.52 +/- 0.189	0.492 +/- 0.226
W	NW Suisun	0.387 +/- 0.151	0.386 +/- 0.169	0.378 +/- 0.143	0.373 +/- 0.135	0.379 +/- 0.144	0.379 +/- 0.144	0.369 +/- 0.133	0.382 +/- 0.16
W	SE Suisun	0.391 +/- 0.13	0.287 +/- 0.19	0.383 +/- 0.126	0.379 +/- 0.12	0.384 +/- 0.126	0.384 +/- 0.126	0.37 +/- 0.13	0.352 +/- 0.157
W	SW Suisun	0.157 +/- 0.02	0.161 +/- 0.021	0.157 +/- 0.02	0.156 +/- 0.02	0.157 +/- 0.02	0.157 +/- 0.02	0.157 +/- 0.02	0.158 +/- 0.02
W	Sacramento River	0.422 +/- 0.016	0.423 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016	0.422 +/- 0.016	0.425 +/- 0.019	0.422 +/- 0.017
W	South Delta	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.479 +/- 0.05	0.48 +/- 0.049	0.479 +/- 0.05
W	Suisun Marsh	0.631 +/- 0.203	0.533 +/- 0.263	0.619 +/- 0.202	0.612 +/- 0.202	0.62 +/- 0.203	0.62 +/- 0.203	0.617 +/- 0.18	0.615 +/- 0.198
W	Yolo Bypass	0.548 +/- 0.012	0.548 +/- 0.013	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.012	0.548 +/- 0.013	0.548 +/- 0.013
W	SummerFall	0.585 +/- 0.172	0.512 +/- 0.199	0.579 +/- 0.172	0.576 +/- 0.171	0.58 +/- 0.172	0.58 +/- 0.172	0.577 +/- 0.167	0.578 +/- 0.172
W	Delta	0.484 +/- 0.17	0.441 +/- 0.181	0.481 +/- 0.169	0.479 +/- 0.167	0.481 +/- 0.169	0.481 +/- 0.169	0.478 +/- 0.167	0.474 +/- 0.174

Table K.1-7. Means of the Habitat Suitability Index calculated using Bever et al. (2016) for each alternative and water year type (WYT). Percent change of each mean compared to the NAA mean is indicated in parenthesis.

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
AN	Confluence	0.515 (-0.227)	0.666 (0)	0.67	0.665 (-0.002)	0.665 (-0.002)	0.665 (-0.002)	0.666 (0)
AN	East Delta	0.441 (0)	0.441 (0)	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
AN	Lower Sacramento River	0.616 (-0.03)	0.637 (0.003)	0.64	0.635 (0)	0.635 (0)	0.635 (0)	0.635 (0)
AN	Lower San Joaquin River	0.479 (0)	0.479 (0)	0.48	0.479 (0)	0.479 (0)	0.479 (0)	0.479 (0)
AN	NE Suisun	0.378 (-0.372)	0.572 (-0.05)	0.60	0.595 (-0.012)	0.595 (-0.012)	0.601 (-0.002)	0.611 (0.015)
AN	NW Suisun	0.348 (-0.243)	0.407 (-0.115)	0.46	0.456 (-0.009)	0.456 (-0.009)	0.463 (0.007)	0.469 (0.02)
AN	SE Suisun	0.263 (-0.371)	0.408 (-0.024)	0.42	0.411 (-0.017)	0.411 (-0.017)	0.417 (-0.002)	0.425 (0.017)
AN	SW Suisun	0.148 (0.028)	0.149 (0.035)	0.14	0.143 (-0.007)	0.143 (-0.007)	0.145 (0.007)	0.145 (0.007)
AN	Sacramento River	0.425 (0.014)	0.424 (0.012)	0.42	0.418 (-0.002)	0.418 (-0.002)	0.418 (-0.002)	0.418 (-0.002)
AN	South Delta	0.482 (0.004)	0.481 (0.002)	0.48	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)
AN	Suisun Marsh	0.478 (-0.416)	0.66 (-0.194)	0.82	0.823 (0.005)	0.823 (0.005)	0.824 (0.006)	0.828 (0.011)
AN	Yolo Bypass	0.55 (0)	0.55 (0)	0.55	0.55 (0)	0.55 (0)	0.55 (0)	0.55 (0)
AN	SummerFall	0.489 (-0.242)	0.593 (-0.081)	0.64	0.645 (0)	0.645 (0)	0.647 (0.003)	0.65 (0.008)
AN	Delta	0.427 (-0.163)	0.49 (-0.039)	0.51	0.508 (-0.004)	0.508 (-0.004)	0.51 (0)	0.512 (0.004)
BN	Confluence	0.28 (-0.534)	0.674 (0.121)	0.60	0.585 (-0.027)	0.585 (-0.027)	0.598 (-0.005)	0.598 (-0.005)
BN	East Delta	0.441 (0)	0.441 (0)	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
BN	Lower Sacramento River	0.433 (-0.332)	0.649 (0.002)	0.65	0.648 (0)	0.648 (0)	0.648 (0)	0.648 (0)
BN	Lower San Joaquin River	0.46 (-0.046)	0.482 (0)	0.48	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)
BN	NE Suisun	0.31 (-0.281)	0.451 (0.046)	0.43	0.423 (-0.019)	0.423 (-0.019)	0.423 (-0.019)	0.423 (-0.019)
BN	NW Suisun	0.305 (-0.167)	0.305 (-0.167)	0.37	0.336 (-0.082)	0.336 (-0.082)	0.336 (-0.082)	0.336 (-0.082)
BN	SE Suisun	0.199 (-0.345)	0.323 (0.063)	0.30	0.297 (-0.023)	0.297 (-0.023)	0.299 (-0.016)	0.298 (-0.02)
BN	SW Suisun	0.153 (0.034)	0.147 (-0.007)	0.15	0.148 (0)	0.148 (0)	0.148 (0)	0.147 (-0.007)

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	Sacramento River	0.427 (0.009)	0.427 (0.009)	0.42	0.423 (0)	0.423 (0)	0.423 (0)	0.423 (0)
BN	South Delta	0.48 (0.004)	0.48 (0.004)	0.48	0.478 (0)	0.478 (0)	0.478 (0)	0.478 (0)
BN	Suisun Marsh	0.354 (-0.52)	0.472 (-0.36)	0.74	0.726 (-0.016)	0.726 (-0.016)	0.748 (0.014)	0.75 (0.016)
BN	Yolo Bypass	0.548 (0.002)	0.547 (0)	0.55	0.547 (0)	0.547 (0)	0.547 (0)	0.547 (0)
BN	SummerFall	0.343 (-0.417)	0.525 (-0.107)	0.59	0.574 (-0.024)	0.574 (-0.024)	0.583 (-0.009)	0.583 (-0.009)
BN	Delta	0.366 (-0.216)	0.45 (-0.036)	0.47	0.461 (-0.013)	0.461 (-0.013)	0.464 (-0.006)	0.464 (-0.006)
C	Confluence	0.235 (-0.325)	0.435 (0.25)	0.35	0.355 (0.02)	0.442 (0.27)	0.434 (0.247)	0.44 (0.264)
C	East Delta	0.441 (0)	0.441 (0)	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
C	Lower Sacramento River	0.268 (-0.563)	0.639 (0.042)	0.61	0.616 (0.005)	0.613 (0)	0.596 (-0.028)	0.607 (-0.01)
C	Lower San Joaquin River	0.385 (-0.203)	0.483 (0)	0.48	0.483 (0)	0.483 (0)	0.482 (-0.002)	0.483 (0)
C	NE Suisun	0.313 (0.013)	0.309 (0)	0.31	0.309 (0)	0.318 (0.029)	0.32 (0.036)	0.323 (0.045)
C	NW Suisun	0.309 (0.007)	0.307 (0)	0.31	0.307 (0)	0.307 (0)	0.307 (0)	0.307 (0)
C	SE Suisun	0.206 (0.035)	0.201 (0.01)	0.20	0.199 (0)	0.215 (0.08)	0.216 (0.085)	0.218 (0.095)
C	SW Suisun	0.165 (0.051)	0.156 (-0.006)	0.16	0.157 (0)	0.156 (-0.006)	0.156 (-0.006)	0.156 (-0.006)
C	Sacramento River	0.411 (-0.042)	0.429 (0)	0.43	0.429 (0)	0.429 (0)	0.429 (0)	0.428 (-0.002)
C	South Delta	0.479 (-0.002)	0.48 (0)	0.48	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)
C	Suisun Marsh	0.332 (0.003)	0.335 (0.012)	0.33	0.331 (0)	0.334 (0.009)	0.334 (0.009)	0.334 (0.009)
C	Yolo Bypass	0.55 (0.007)	0.546 (0)	0.55	0.546 (0)	0.546 (0)	0.546 (0)	0.546 (0)
C	SummerFall	0.286 (-0.285)	0.429 (0.072)	0.40	0.402 (0.005)	0.424 (0.06)	0.418 (0.045)	0.422 (0.055)
C	Delta	0.341 (-0.119)	0.397 (0.026)	0.39	0.388 (0.003)	0.397 (0.026)	0.395 (0.021)	0.397 (0.026)
D	Confluence	0.382 (-0.295)	0.674 (0.244)	0.54	0.541 (-0.002)	0.541 (-0.002)	0.54 (-0.004)	0.541 (-0.002)
D	East Delta	0.441 (0)	0.441 (0)	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
D	Lower Sacramento River	0.522 (-0.193)	0.651 (0.006)	0.65	0.647 (0)	0.647 (0)	0.647 (0)	0.647 (0)
D	Lower San Joaquin River	0.471 (-0.025)	0.482 (-0.002)	0.48	0.483 (0)	0.483 (0)	0.483 (0)	0.483 (0)

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA
D	NE Suisun	0.338 (-0.144)	0.497 (0.258)	0.40	0.396 (0.003)	0.396 (0.003)	0.391 (-0.01)	0.386 (-0.023)
D	NW Suisun	0.306 (-0.089)	0.362 (0.077)	0.34	0.336 (0)	0.336 (0)	0.334 (-0.006)	0.333 (-0.009)
D	SE Suisun	0.224 (-0.176)	0.36 (0.324)	0.27	0.272 (0)	0.272 (0)	0.269 (-0.011)	0.267 (-0.018)
D	SW Suisun	0.145 (0.021)	0.142 (0)	0.14	0.142 (0)	0.142 (0)	0.142 (0)	0.142 (0)
D	Sacramento River	0.428 (0)	0.428 (0)	0.43	0.428 (0)	0.428 (0)	0.428 (0)	0.428 (0)
D	South Delta	0.48 (0)	0.48 (0)	0.48	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)
D	Suisun Marsh	0.381 (-0.289)	0.563 (0.05)	0.54	0.531 (-0.009)	0.529 (-0.013)	0.531 (-0.009)	0.54 (0.007)
D	Yolo Bypass	0.556 (0.011)	0.549 (-0.002)	0.55	0.554 (0.007)	0.549 (-0.002)	0.549 (-0.002)	0.549 (-0.002)
D	SummerFall	0.398 (-0.227)	0.562 (0.091)	0.52	0.514 (-0.002)	0.513 (-0.004)	0.513 (-0.004)	0.515 (0)
D	Delta	0.39 (-0.11)	0.469 (0.071)	0.44	0.438 (0)	0.437 (-0.002)	0.436 (-0.005)	0.436 (-0.005)
W	Confluence	0.371 (-0.45)	0.645 (-0.043)	0.67	0.674 (0)	0.673 (-0.001)	0.674 (0)	0.674 (0)
W	East Delta	0.442 (0.002)	0.442 (0.002)	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
W	Lower Sacramento River	0.493 (-0.238)	0.649 (0.003)	0.65	0.647 (0)	0.647 (0)	0.647 (0)	0.647 (0)
W	Lower San Joaquin River	0.461 (-0.044)	0.482 (0)	0.48	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)
W	NE Suisun	0.343 (-0.38)	0.408 (-0.262)	0.55	0.541 (-0.022)	0.535 (-0.033)	0.542 (-0.02)	0.542 (-0.02)
W	NW Suisun	0.316 (-0.183)	0.314 (-0.189)	0.39	0.378 (-0.023)	0.373 (-0.036)	0.379 (-0.021)	0.379 (-0.021)
W	SE Suisun	0.227 (-0.419)	0.29 (-0.258)	0.39	0.383 (-0.02)	0.379 (-0.031)	0.384 (-0.018)	0.384 (-0.018)
W	SW Suisun	0.163 (0.038)	0.157 (0)	0.16	0.157 (0)	0.156 (-0.006)	0.157 (0)	0.157 (0)
W	Sacramento River	0.423 (0.002)	0.426 (0.009)	0.42	0.422 (0)	0.422 (0)	0.422 (0)	0.422 (0)
W	South Delta	0.48 (0.002)	0.48 (0.002)	0.48	0.479 (0)	0.479 (0)	0.479 (0)	0.479 (0)
W	Suisun Marsh	0.352 (-0.442)	0.427 (-0.323)	0.63	0.619 (-0.019)	0.612 (-0.03)	0.62 (-0.017)	0.62 (-0.017)
W	Yolo Bypass	0.549 (0.002)	0.548 (0)	0.55	0.548 (0)	0.548 (0)	0.548 (0)	0.548 (0)
W	SummerFall	0.383 (-0.345)	0.509 (-0.13)	0.58	0.579 (-0.01)	0.576 (-0.015)	0.58 (-0.009)	0.58 (-0.009)
W	Delta	0.385 (-0.205)	0.439 (-0.093)	0.48	0.481 (-0.006)	0.479 (-0.01)	0.481 (-0.006)	0.481 (-0.006)

Table K.1-8. Means of the Habitat Suitability Index calculated using Bever et al. (2016) for each alternative and water year type (WYT). Percent change of each mean compared to the NAA mean is indicated in parenthesis.

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
AN	Confluence	0.67	0.592 (-0.111)	0.665 (-0.002)	0.665 (-0.002)	0.665 (-0.002)	0.666 (0)	0.653 (-0.02)	0.658 (-0.012)
AN	East Delta	0.44	0.44 (-0.002)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.44 (-0.002)
AN	Lower Sacramento River	0.64	0.634 (-0.002)	0.635 (0)	0.635 (0)	0.635 (0)	0.635 (0)	0.636 (0.002)	0.635 (0)
AN	Lower San Joaquin River	0.48	0.48 (0.002)	0.479 (0)	0.479 (0)	0.479 (0)	0.479 (0)	0.48 (0.002)	0.48 (0.002)
AN	NE Suisun	0.60	0.405 (-0.327)	0.595 (-0.012)	0.595 (-0.012)	0.601 (-0.002)	0.611 (0.015)	0.521 (-0.135)	0.559 (-0.071)
AN	NW Suisun	0.46	0.362 (-0.213)	0.456 (-0.009)	0.456 (-0.009)	0.463 (0.007)	0.469 (0.02)	0.386 (-0.161)	0.448 (-0.026)
AN	SE Suisun	0.42	0.276 (-0.34)	0.411 (-0.017)	0.411 (-0.017)	0.417 (-0.002)	0.425 (0.017)	0.355 (-0.151)	0.385 (-0.079)
AN	SW Suisun	0.14	0.144 (0)	0.143 (-0.007)	0.143 (-0.007)	0.145 (0.007)	0.145 (0.007)	0.145 (0.007)	0.144 (0)
AN	Sacramento River	0.42	0.42 (0.002)	0.418 (-0.002)	0.418 (-0.002)	0.418 (-0.002)	0.418 (-0.002)	0.423 (0.01)	0.418 (-0.002)
AN	South Delta	0.48	0.479 (-0.002)	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)	0.481 (0.002)	0.48 (0)
AN	Suisun Marsh	0.82	0.578 (-0.294)	0.823 (0.005)	0.823 (0.005)	0.824 (0.006)	0.828 (0.011)	0.777 (-0.051)	0.812 (-0.009)
AN	Yolo Bypass	0.55	0.55 (0)	0.55 (0)	0.55 (0)	0.55 (0)	0.55 (0)	0.55 (0)	0.55 (0)
AN	SummerFall	0.64	0.542 (-0.16)	0.645 (0)	0.645 (0)	0.647 (0.003)	0.65 (0.008)	0.613 (-0.05)	0.638 (-0.011)
AN	Delta	0.51	0.447 (-0.124)	0.508 (-0.004)	0.508 (-0.004)	0.51 (0)	0.512 (0.004)	0.487 (-0.045)	0.501 (-0.018)
BN	Confluence	0.60	0.632 (0.052)	0.585 (-0.027)	0.585 (-0.027)	0.598 (-0.005)	0.598 (-0.005)	0.644 (0.072)	0.584 (-0.028)
BN	East Delta	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
BN	Lower Sacramento River	0.65	0.648 (0)	0.648 (0)	0.648 (0)	0.648 (0)	0.648 (0)	0.649 (0.002)	0.648 (0)
BN	Lower San Joaquin River	0.48	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)
BN	NE Suisun	0.43	0.424 (-0.016)	0.423 (-0.019)	0.423 (-0.019)	0.423 (-0.019)	0.423 (-0.019)	0.477 (0.107)	0.422 (-0.021)
BN	NW Suisun	0.37	0.33 (-0.098)	0.336 (-0.082)	0.336 (-0.082)	0.336 (-0.082)	0.336 (-0.082)	0.31 (-0.153)	0.335 (-0.085)
BN	SE Suisun	0.30	0.306 (0.007)	0.297 (-0.023)	0.297 (-0.023)	0.299 (-0.016)	0.298 (-0.02)	0.339 (0.115)	0.296 (-0.026)
BN	SW Suisun	0.15	0.147 (-0.007)	0.148 (0)	0.148 (0)	0.148 (0)	0.147 (-0.007)	0.147 (-0.007)	0.148 (0)

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
BN	Sacramento River	0.42	0.424 (0.002)	0.423 (0)	0.423 (0)	0.423 (0)	0.423 (0)	0.426 (0.007)	0.423 (0)
BN	South Delta	0.48	0.478 (0)	0.478 (0)	0.478 (0)	0.478 (0)	0.478 (0)	0.48 (0.004)	0.478 (0)
BN	Suisun Marsh	0.74	0.561 (-0.24)	0.726 (-0.016)	0.726 (-0.016)	0.748 (0.014)	0.75 (0.016)	0.765 (0.037)	0.725 (-0.018)
BN	Yolo Bypass	0.55	0.547 (0)	0.547 (0)	0.547 (0)	0.547 (0)	0.547 (0)	0.547 (0)	0.547 (0)
BN	SummerFall	0.59	0.543 (-0.077)	0.574 (-0.024)	0.574 (-0.024)	0.583 (-0.009)	0.583 (-0.009)	0.592 (0.007)	0.573 (-0.026)
BN	Delta	0.47	0.452 (-0.032)	0.461 (-0.013)	0.461 (-0.013)	0.464 (-0.006)	0.464 (-0.006)	0.476 (0.019)	0.461 (-0.013)
C	Confluence	0.35	0.409 (0.175)	0.355 (0.02)	0.442 (0.27)	0.434 (0.247)	0.44 (0.264)	0.441 (0.267)	0.346 (-0.006)
C	East Delta	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
C	Lower Sacramento River	0.61	0.57 (-0.07)	0.616 (0.005)	0.613 (0)	0.596 (-0.028)	0.607 (-0.01)	0.58 (-0.054)	0.564 (-0.08)
C	Lower San Joaquin River	0.48	0.475 (-0.017)	0.483 (0)	0.483 (0)	0.482 (-0.002)	0.483 (0)	0.478 (-0.01)	0.477 (-0.012)
C	NE Suisun	0.31	0.344 (0.113)	0.309 (0)	0.318 (0.029)	0.32 (0.036)	0.323 (0.045)	0.352 (0.139)	0.309 (0)
C	NW Suisun	0.31	0.306 (-0.003)	0.307 (0)	0.307 (0)	0.307 (0)	0.307 (0)	0.305 (-0.007)	0.306 (-0.003)
C	SE Suisun	0.20	0.232 (0.166)	0.199 (0)	0.215 (0.08)	0.216 (0.085)	0.218 (0.095)	0.235 (0.181)	0.2 (0.005)
C	SW Suisun	0.16	0.15 (-0.045)	0.157 (0)	0.156 (-0.006)	0.156 (-0.006)	0.156 (-0.006)	0.149 (-0.051)	0.15 (-0.045)
C	Sacramento River	0.43	0.428 (-0.002)	0.429 (0)	0.429 (0)	0.429 (0)	0.428 (-0.002)	0.429 (0)	0.429 (0)
C	South Delta	0.48	0.481 (0.002)	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)	0.481 (0.002)	0.481 (0.002)
C	Suisun Marsh	0.33	0.332 (0.003)	0.331 (0)	0.334 (0.009)	0.334 (0.009)	0.334 (0.009)	0.335 (0.012)	0.331 (0)
C	Yolo Bypass	0.55	0.547 (0.002)	0.546 (0)	0.546 (0)	0.546 (0)	0.546 (0)	0.546 (0)	0.547 (0.002)
C	SummerFall	0.40	0.404 (0.01)	0.402 (0.005)	0.424 (0.06)	0.418 (0.045)	0.422 (0.055)	0.415 (0.037)	0.387 (-0.033)
C	Delta	0.39	0.393 (0.016)	0.388 (0.003)	0.397 (0.026)	0.395 (0.021)	0.397 (0.026)	0.398 (0.028)	0.382 (-0.013)
D	Confluence	0.54	0.513 (-0.054)	0.541 (-0.002)	0.541 (-0.002)	0.54 (-0.004)	0.541 (-0.002)	0.597 (0.101)	0.501 (-0.076)
D	East Delta	0.44	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)
D	Lower Sacramento River	0.65	0.639 (-0.012)	0.647 (0)	0.647 (0)	0.647 (0)	0.647 (0)	0.642 (-0.008)	0.633 (-0.022)
D	Lower San Joaquin River	0.48	0.482 (-0.002)	0.483 (0)	0.483 (0)	0.483 (0)	0.483 (0)	0.481 (-0.004)	0.482 (-0.002)

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
D	NE Suisun	0.40	0.371 (-0.061)	0.396 (0.003)	0.396 (0.003)	0.391 (-0.01)	0.386 (-0.023)	0.458 (0.159)	0.376 (-0.048)
D	NW Suisun	0.34	0.329 (-0.021)	0.336 (0)	0.336 (0)	0.334 (-0.006)	0.333 (-0.009)	0.342 (0.018)	0.332 (-0.012)
D	SE Suisun	0.27	0.253 (-0.07)	0.272 (0)	0.272 (0)	0.269 (-0.011)	0.267 (-0.018)	0.321 (0.18)	0.257 (-0.055)
D	SW Suisun	0.14	0.144 (0.014)	0.142 (0)	0.142 (0)	0.142 (0)	0.142 (0)	0.143 (0.007)	0.146 (0.028)
D	Sacramento River	0.43	0.427 (-0.002)	0.428 (0)	0.428 (0)	0.428 (0)	0.428 (0)	0.427 (-0.002)	0.427 (-0.002)
D	South Delta	0.48	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)	0.48 (0)
D	Suisun Marsh	0.54	0.44 (-0.179)	0.531 (-0.009)	0.529 (-0.013)	0.531 (-0.009)	0.54 (0.007)	0.596 (0.112)	0.466 (-0.131)
D	Yolo Bypass	0.55	0.548 (-0.004)	0.554 (0.007)	0.549 (-0.002)	0.549 (-0.002)	0.549 (-0.002)	0.548 (-0.004)	0.548 (-0.004)
D	SummerFall	0.52	0.48 (-0.068)	0.514 (-0.002)	0.513 (-0.004)	0.513 (-0.004)	0.515 (0)	0.544 (0.056)	0.483 (-0.062)
D	Delta	0.44	0.422 (-0.037)	0.438 (0)	0.437 (-0.002)	0.436 (-0.005)	0.436 (-0.005)	0.456 (0.041)	0.424 (-0.032)
W	Confluence	0.67	0.501 (-0.257)	0.674 (0)	0.673 (-0.001)	0.674 (0)	0.674 (0)	0.674 (0)	0.668 (-0.009)
W	East Delta	0.44	0.442 (0.002)	0.441 (0)	0.441 (0)	0.441 (0)	0.441 (0)	0.442 (0.002)	0.441 (0)
W	Lower Sacramento River	0.65	0.627 (-0.031)	0.647 (0)	0.647 (0)	0.647 (0)	0.647 (0)	0.649 (0.003)	0.648 (0.002)
W	Lower San Joaquin River	0.48	0.481 (-0.002)	0.482 (0)	0.482 (0)	0.482 (0)	0.482 (0)	0.481 (-0.002)	0.481 (-0.002)
W	NE Suisun	0.55	0.424 (-0.233)	0.541 (-0.022)	0.535 (-0.033)	0.542 (-0.02)	0.542 (-0.02)	0.52 (-0.06)	0.492 (-0.11)
W	NW Suisun	0.39	0.386 (-0.003)	0.378 (-0.023)	0.373 (-0.036)	0.379 (-0.021)	0.379 (-0.021)	0.369 (-0.047)	0.382 (-0.013)
W	SE Suisun	0.39	0.287 (-0.266)	0.383 (-0.02)	0.379 (-0.031)	0.384 (-0.018)	0.384 (-0.018)	0.37 (-0.054)	0.352 (-0.1)
W	SW Suisun	0.16	0.161 (0.025)	0.157 (0)	0.156 (-0.006)	0.157 (0)	0.157 (0)	0.157 (0)	0.158 (0.006)
W	Sacramento River	0.42	0.423 (0.002)	0.422 (0)	0.422 (0)	0.422 (0)	0.422 (0)	0.425 (0.007)	0.422 (0)
W	South Delta	0.48	0.479 (0)	0.479 (0)	0.479 (0)	0.479 (0)	0.479 (0)	0.48 (0.002)	0.479 (0)
W	Suisun Marsh	0.63	0.533 (-0.155)	0.619 (-0.019)	0.612 (-0.03)	0.62 (-0.017)	0.62 (-0.017)	0.617 (-0.022)	0.615 (-0.025)
W	Yolo Bypass	0.55	0.548 (0)	0.548 (0)	0.548 (0)	0.548 (0)	0.548 (0)	0.548 (0)	0.548 (0)
W	SummerFall	0.58	0.512 (-0.125)	0.579 (-0.01)	0.576 (-0.015)	0.58 (-0.009)	0.58 (-0.009)	0.577 (-0.014)	0.578 (-0.012)
W	Delta	0.48	0.441 (-0.089)	0.481 (-0.006)	0.479 (-0.01)	0.481 (-0.006)	0.481 (-0.006)	0.478 (-0.012)	0.474 (-0.021)

K.1.3.3 Bever et al. (2016) HSI Modified with 22°C Temperature Threshold

The mean Bever HSI modified with a 22°C temperature threshold (henceforth 22°C HSI) for the Delta (i.e., averaged across all subregions) was highest in the above normal water year across all alternatives, followed by the below normal water year type (Table K.1-9, Table K.1-10; Figure K.1-55, Figure K.1-56). The mean 22°C HSI for subregions targeted by the summer and fall habitat X2 and Suisun Marsh Salinity Control Gate actions (Yolo, Lower Sacramento River, Confluence, Suisun Marsh, NW Suisun) was also highest for the above normal water year type across Alternative 2 components, followed by the below normal water year (Table K.1-9, Table K.1-10; Figure K.1-59, Figure K.1-60). The mean 22°C HSI values for the Delta and the summer and fall habitat subregions were lowest across Alternative 2 components during the critical water year type (Table K.1-9, Table K.1-10; Figure K.1-55, Figure K.1-56, Figure K.1-59, and Figure K.1-60). Mean 22°C HSI at the subregional spatial scale ranged from about 0.06 to 0.68. Subregions with the highest mean 22°C HSI across alternatives varied by water year type. The highest mean 22°C HSI in the dry, below normal, and above normal years was Suisun Marsh; in the critical year it was the lower Sacramento River and Yolo Bypass; and in the wet year it was the Sacramento River (Table K.1-9, Table K.1-10; Figure K.1-63, Figure K.1-64). The mean 22°C HSI values were also relatively high, compared to other subregions within the same water year, in the Confluence, northeast Suisun Bay, and lower Sacramento River (Table K.1-9, Table K.1-10; Figure K.1-63, Figure K.1-64). Differences in mean 22°C HSI were small across alternatives within a region, ranging from 0 to 0.03 (Table K.1-9, Table K.1-10).

For the Delta and the summer and fall habitat subregions together, the 22°C HSI values across the Alternative 2 components were similar to or slightly lower than those of the NAA, ranging from percent changes of 2 to -2.5% and 2 to -5.8%, respectively, across water year types; Table K.1-11, Table K.1-12). The largest percent decreases occurred during the below normal and critically dry water years. Across subregions, percent changes ranged from approximately 3 to -12.8% (Table K.1-11, Table K.1-12). Alternative 2 with TUCP without VAs did not differ from the NAA (Table K.1-11, Table K.1-12). Across Alternative 2 components, the largest (negative) percent changes tended to occur in the Lower Sacramento River and some of the Suisun Bay regions (Table K.1-11, Table K.1-12). Overall, the percent differences in HSI values were greatest between Alternative 1 and the NAA, with lower Alternative 1 HSI values compared to the NAA in wet and above normal water years, in particular. For the Delta and summer and fall habitat subregions together, Bever HSI values for Alternatives 3 and 4 also were comparable to NAA values, ranging + 6% in most water year types (Table K.1-11, Table K.1-12).

Any differences between the Alternative 2 components and the NAA are most likely due to small differences in salinity and water temperature among the NAA and Alternative 2 components for each water year (Figure K.1-45 through Figure K.1-48, Figure K.1-63, and Figure K.1-64). Small differences in salinity likely resulted in small differences in 22°C HSI in subregions in which salinities are close to the 6 ppt suitability threshold, including the different Suisun Bay regions and Suisun Marsh as well as, in dry and critical WYTs, the Confluence region. Similarly, small temperature effects to 22°C HSI among Alternative 2 components likely occurred in subregions and during WYTs in which temperatures ranged around the 22°C threshold. This was more common in the Yolo Bypass, lower Sacramento and San Joaquin rivers, the Confluence, and East and South Delta. Although temperature didn't have a large effect across Alternative 2 components, its effect was more noticeable across WYTs and when to compared to Bever HSI

values. In general, 22°C HSI was lower by between 3% and 80% compared to Bever HSI, depending on subregion and WYT, due to temperatures exceeding the temperature suitability threshold (Figure K.1-63 through Figure K.1-114). This was particularly the case for the South Delta and Yolo Bypass across water year types. Warm temperatures in the lower Sacramento and San Joaquin rivers, the East Delta, and Sacramento River limited suitable habitat in critical, dry, and wet water year types. As explained above, air temperatures were relatively warm in 2019, which was used to model the wet water year.

Table K.1-9. Means and standard deviations of the Habitat Suitability Index calculated using Bever et al. (2016) modified with a 22°C temperature threshold for each alternative and water year type (WYT).

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
AN	Confluence	0.401 +/- 0.206	0.482 +/- 0.188	0.518 +/- 0.171	0.521 +/- 0.171	0.521 +/- 0.171	0.526 +/- 0.169	0.524 +/- 0.17
AN	East Delta	0.186 +/- 0.18	0.199 +/- 0.177	0.315 +/- 0.12	0.321 +/- 0.114	0.321 +/- 0.114	0.322 +/- 0.114	0.322 +/- 0.114
AN	Lower Sacramento River	0.369 +/- 0.206	0.376 +/- 0.212	0.464 +/- 0.168	0.472 +/- 0.161	0.472 +/- 0.162	0.48 +/- 0.157	0.479 +/- 0.159
AN	Lower San Joaquin River	0.194 +/- 0.221	0.194 +/- 0.223	0.248 +/- 0.204	0.253 +/- 0.203	0.253 +/- 0.203	0.254 +/- 0.202	0.253 +/- 0.203
AN	NE Suisun	0.323 +/- 0.166	0.503 +/- 0.205	0.531 +/- 0.184	0.515 +/- 0.174	0.515 +/- 0.174	0.536 +/- 0.196	0.546 +/- 0.197
AN	NW Suisun	0.298 +/- 0.124	0.357 +/- 0.171	0.404 +/- 0.158	0.394 +/- 0.146	0.394 +/- 0.146	0.408 +/- 0.163	0.415 +/- 0.167
AN	SE Suisun	0.222 +/- 0.12	0.349 +/- 0.142	0.361 +/- 0.122	0.352 +/- 0.117	0.352 +/- 0.117	0.366 +/- 0.132	0.373 +/- 0.134
AN	SW Suisun	0.136 +/- 0.018	0.139 +/- 0.019	0.136 +/- 0.014	0.132 +/- 0.017	0.132 +/- 0.017	0.137 +/- 0.015	0.137 +/- 0.015
AN	Sacramento River	0.219 +/- 0.172	0.284 +/- 0.133	0.378 +/- 0.042	0.382 +/- 0.035	0.382 +/- 0.035	0.384 +/- 0.034	0.384 +/- 0.035
AN	South Delta	0.163 +/- 0.205	0.162 +/- 0.207	0.188 +/- 0.206	0.192 +/- 0.205	0.192 +/- 0.205	0.193 +/- 0.205	0.193 +/- 0.205
AN	Suisun Marsh	0.387 +/- 0.181	0.542 +/- 0.197	0.668 +/- 0.183	0.673 +/- 0.175	0.673 +/- 0.176	0.681 +/- 0.174	0.684 +/- 0.176
AN	Yolo Bypass	0.243 +/- 0.167	0.253 +/- 0.164	0.267 +/- 0.156	0.267 +/- 0.156	0.267 +/- 0.156	0.267 +/- 0.156	0.267 +/- 0.156
AN	SummerFall	0.364 +/- 0.18	0.439 +/- 0.2	0.513 +/- 0.191	0.515 +/- 0.188	0.515 +/- 0.188	0.524 +/- 0.189	0.525 +/- 0.19
AN	Delta	0.262 +/- 0.186	0.32 +/- 0.215	0.373 +/- 0.21	0.373 +/- 0.207	0.373 +/- 0.207	0.38 +/- 0.212	0.381 +/- 0.213
BN	Confluence	0.208 +/- 0.129	0.442 +/- 0.227	0.403 +/- 0.144	0.386 +/- 0.132	0.388 +/- 0.13	0.401 +/- 0.137	0.401 +/- 0.138
BN	East Delta	0.146 +/- 0.207	0.147 +/- 0.207	0.242 +/- 0.17	0.237 +/- 0.17	0.239 +/- 0.168	0.244 +/- 0.169	0.244 +/- 0.17
BN	Lower Sacramento River	0.235 +/- 0.203	0.333 +/- 0.273	0.38 +/- 0.264	0.377 +/- 0.264	0.378 +/- 0.263	0.381 +/- 0.264	0.38 +/- 0.265
BN	Lower San Joaquin River	0.204 +/- 0.23	0.213 +/- 0.235	0.239 +/- 0.238	0.237 +/- 0.237	0.237 +/- 0.237	0.24 +/- 0.238	0.24 +/- 0.238
BN	NE Suisun	0.252 +/- 0.059	0.36 +/- 0.132	0.308 +/- 0.042	0.304 +/- 0.037	0.305 +/- 0.038	0.305 +/- 0.038	0.304 +/- 0.037
BN	NW Suisun	0.257 +/- 0.049	0.253 +/- 0.055	0.287 +/- 0.057	0.271 +/- 0.051	0.271 +/- 0.051	0.271 +/- 0.051	0.271 +/- 0.05
BN	SE Suisun	0.166 +/- 0.038	0.253 +/- 0.09	0.213 +/- 0.041	0.209 +/- 0.038	0.209 +/- 0.039	0.211 +/- 0.039	0.21 +/- 0.038
BN	SW Suisun	0.147 +/- 0.023	0.14 +/- 0.02	0.14 +/- 0.021	0.141 +/- 0.021	0.141 +/- 0.021	0.14 +/- 0.021	0.14 +/- 0.02

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	Sacramento River	0.181 +/- 0.19	0.231 +/- 0.164	0.331 +/- 0.102	0.329 +/- 0.102	0.331 +/- 0.1	0.334 +/- 0.101	0.333 +/- 0.102
BN	South Delta	0.16 +/- 0.221	0.16 +/- 0.221	0.172 +/- 0.218	0.17 +/- 0.218	0.17 +/- 0.218	0.172 +/- 0.218	0.172 +/- 0.218
BN	Suisun Marsh	0.284 +/- 0.051	0.38 +/- 0.061	0.576 +/- 0.088	0.572 +/- 0.1	0.572 +/- 0.1	0.594 +/- 0.109	0.595 +/- 0.108
BN	Yolo Bypass	0.232 +/- 0.188	0.238 +/- 0.188	0.257 +/- 0.182	0.256 +/- 0.182	0.256 +/- 0.182	0.257 +/- 0.182	0.257 +/- 0.182
BN	SummerFall	0.246 +/- 0.124	0.352 +/- 0.189	0.412 +/- 0.186	0.402 +/- 0.187	0.402 +/- 0.187	0.412 +/- 0.194	0.412 +/- 0.195
BN	Delta	0.206 +/- 0.153	0.262 +/- 0.191	0.296 +/- 0.185	0.291 +/- 0.183	0.291 +/- 0.183	0.296 +/- 0.187	0.296 +/- 0.188
C	Confluence	0.081 +/- 0.101	0.174 +/- 0.229	0.112 +/- 0.14	0.112 +/- 0.138	0.106 +/- 0.13	0.1 +/- 0.12	0.103 +/- 0.123
C	East Delta	0.088 +/- 0.175	0.095 +/- 0.186	0.096 +/- 0.187	0.096 +/- 0.187	0.096 +/- 0.187	0.094 +/- 0.187	0.095 +/- 0.186
C	Lower Sacramento River	0.072 +/- 0.099	0.173 +/- 0.265	0.164 +/- 0.251	0.164 +/- 0.25	0.157 +/- 0.241	0.143 +/- 0.218	0.151 +/- 0.225
C	Lower San Joaquin River	0.097 +/- 0.18	0.127 +/- 0.23	0.128 +/- 0.23	0.128 +/- 0.23	0.129 +/- 0.23	0.128 +/- 0.228	0.129 +/- 0.23
C	NE Suisun	0.116 +/- 0.123	0.113 +/- 0.122	0.115 +/- 0.122	0.115 +/- 0.122	0.117 +/- 0.121	0.118 +/- 0.122	0.118 +/- 0.121
C	NW Suisun	0.124 +/- 0.116	0.124 +/- 0.115	0.124 +/- 0.115	0.124 +/- 0.115	0.125 +/- 0.115	0.125 +/- 0.115	0.125 +/- 0.115
C	SE Suisun	0.071 +/- 0.086	0.069 +/- 0.085	0.068 +/- 0.083	0.068 +/- 0.083	0.07 +/- 0.083	0.07 +/- 0.083	0.07 +/- 0.083
C	SW Suisun	0.062 +/- 0.071	0.06 +/- 0.066	0.061 +/- 0.067	0.061 +/- 0.067	0.062 +/- 0.068	0.062 +/- 0.068	0.062 +/- 0.068
C	Sacramento River	0.079 +/- 0.155	0.121 +/- 0.182	0.121 +/- 0.182	0.121 +/- 0.182	0.122 +/- 0.182	0.116 +/- 0.179	0.122 +/- 0.181
C	South Delta	0.119 +/- 0.2	0.117 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204
C	Suisun Marsh	0.143 +/- 0.12	0.148 +/- 0.125	0.146 +/- 0.12	0.146 +/- 0.12	0.146 +/- 0.12	0.146 +/- 0.12	0.146 +/- 0.12
C	Yolo Bypass	0.168 +/- 0.173	0.159 +/- 0.183	0.159 +/- 0.183	0.159 +/- 0.182	0.158 +/- 0.182	0.162 +/- 0.184	0.161 +/- 0.185
C	SummerFall	0.105 +/- 0.109	0.155 +/- 0.188	0.137 +/- 0.161	0.137 +/- 0.16	0.134 +/- 0.155	0.129 +/- 0.145	0.131 +/- 0.148
C	Delta	0.102 +/- 0.136	0.123 +/- 0.172	0.118 +/- 0.161	0.118 +/- 0.161	0.117 +/- 0.159	0.115 +/- 0.156	0.117 +/- 0.157
D	Confluence	0.26 +/- 0.248	0.332 +/- 0.251	0.258 +/- 0.171	0.257 +/- 0.171	0.257 +/- 0.171	0.259 +/- 0.172	0.26 +/- 0.175
D	East Delta	0.161 +/- 0.206	0.152 +/- 0.213	0.156 +/- 0.212	0.156 +/- 0.212	0.156 +/- 0.212	0.156 +/- 0.212	0.156 +/- 0.212
D	Lower Sacramento River	0.261 +/- 0.274	0.253 +/- 0.276	0.257 +/- 0.268	0.257 +/- 0.268	0.257 +/- 0.268	0.257 +/- 0.268	0.258 +/- 0.269
D	Lower San Joaquin River	0.183 +/- 0.241	0.182 +/- 0.241	0.185 +/- 0.24	0.185 +/- 0.24	0.185 +/- 0.24	0.185 +/- 0.24	0.185 +/- 0.24

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
D	NE Suisun	0.234 +/- 0.132	0.36 +/- 0.213	0.269 +/- 0.163	0.269 +/- 0.163	0.269 +/- 0.163	0.265 +/- 0.159	0.262 +/- 0.156
D	NW Suisun	0.207 +/- 0.069	0.262 +/- 0.14	0.237 +/- 0.113	0.237 +/- 0.114	0.237 +/- 0.113	0.235 +/- 0.111	0.235 +/- 0.11
D	SE Suisun	0.154 +/- 0.102	0.248 +/- 0.159	0.176 +/- 0.125	0.176 +/- 0.126	0.176 +/- 0.126	0.174 +/- 0.124	0.173 +/- 0.123
D	SW Suisun	0.1 +/- 0.033	0.105 +/- 0.03	0.106 +/- 0.029	0.106 +/- 0.029	0.106 +/- 0.029	0.106 +/- 0.029	0.106 +/- 0.03
D	Sacramento River	0.156 +/- 0.195	0.155 +/- 0.195	0.165 +/- 0.188	0.165 +/- 0.188	0.165 +/- 0.188	0.167 +/- 0.186	0.166 +/- 0.187
D	South Delta	0.166 +/- 0.224	0.165 +/- 0.225	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224
D	Suisun Marsh	0.241 +/- 0.132	0.371 +/- 0.227	0.34 +/- 0.198	0.337 +/- 0.197	0.335 +/- 0.196	0.338 +/- 0.2	0.345 +/- 0.205
D	Yolo Bypass	0.234 +/- 0.202	0.237 +/- 0.199	0.232 +/- 0.203	0.234 +/- 0.207	0.232 +/- 0.204	0.227 +/- 0.207	0.23 +/- 0.205
D	SummerFall	0.242 +/- 0.193	0.305 +/- 0.226	0.273 +/- 0.192	0.272 +/- 0.192	0.272 +/- 0.191	0.272 +/- 0.193	0.274 +/- 0.195
D	Delta	0.196 +/- 0.184	0.235 +/- 0.214	0.212 +/- 0.19	0.212 +/- 0.19	0.212 +/- 0.189	0.211 +/- 0.19	0.212 +/- 0.19
W	Confluence	0.188 +/- 0.273	0.217 +/- 0.296	0.223 +/- 0.294	0.223 +/- 0.294	0.223 +/- 0.294	0.223 +/- 0.294	0.224 +/- 0.294
W	East Delta	0.164 +/- 0.209	0.167 +/- 0.208	0.256 +/- 0.178	0.256 +/- 0.178	0.256 +/- 0.178	0.256 +/- 0.178	0.255 +/- 0.178
W	Lower Sacramento River	0.223 +/- 0.296	0.228 +/- 0.297	0.267 +/- 0.296	0.267 +/- 0.296	0.267 +/- 0.296	0.267 +/- 0.296	0.268 +/- 0.296
W	Lower San Joaquin River	0.168 +/- 0.247	0.168 +/- 0.246	0.178 +/- 0.245	0.178 +/- 0.245	0.178 +/- 0.245	0.178 +/- 0.245	0.177 +/- 0.245
W	NE Suisun	0.134 +/- 0.204	0.152 +/- 0.215	0.161 +/- 0.203	0.16 +/- 0.202	0.16 +/- 0.202	0.16 +/- 0.202	0.16 +/- 0.202
W	NW Suisun	0.111 +/- 0.141	0.111 +/- 0.14	0.113 +/- 0.128	0.112 +/- 0.127	0.111 +/- 0.127	0.112 +/- 0.127	0.112 +/- 0.128
W	SE Suisun	0.091 +/- 0.146	0.108 +/- 0.157	0.106 +/- 0.138	0.106 +/- 0.137	0.106 +/- 0.137	0.106 +/- 0.138	0.106 +/- 0.138
W	SW Suisun	0.054 +/- 0.063	0.056 +/- 0.064	0.058 +/- 0.063	0.058 +/- 0.063	0.058 +/- 0.063	0.058 +/- 0.063	0.058 +/- 0.063
W	Sacramento River	0.202 +/- 0.199	0.228 +/- 0.181	0.332 +/- 0.089	0.332 +/- 0.089	0.331 +/- 0.09	0.332 +/- 0.089	0.332 +/- 0.089
W	South Delta	0.168 +/- 0.22	0.169 +/- 0.22	0.18 +/- 0.215	0.181 +/- 0.215	0.181 +/- 0.215	0.181 +/- 0.215	0.181 +/- 0.215
W	Suisun Marsh	0.147 +/- 0.146	0.172 +/- 0.176	0.216 +/- 0.199	0.214 +/- 0.198	0.212 +/- 0.197	0.214 +/- 0.198	0.214 +/- 0.198
W	Yolo Bypass	0.221 +/- 0.219	0.221 +/- 0.221	0.229 +/- 0.218	0.229 +/- 0.218	0.229 +/- 0.218	0.229 +/- 0.219	0.229 +/- 0.218
W	SummerFall	0.167 +/- 0.221	0.182 +/- 0.233	0.205 +/- 0.237	0.204 +/- 0.237	0.203 +/- 0.237	0.204 +/- 0.237	0.204 +/- 0.237
W	Delta	0.156 +/- 0.203	0.166 +/- 0.208	0.193 +/- 0.206	0.193 +/- 0.206	0.193 +/- 0.206	0.193 +/- 0.206	0.193 +/- 0.206

Table K.1-10. Means and standard deviations of the Habitat Suitability Index calculated using Bever et al. (2016) modified with a 22°C temperature threshold for each alternative and water year type (WYT).

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
AN	Confluence	0.518 +/- 0.171	0.462 +/- 0.16	0.521 +/- 0.171	0.521 +/- 0.171	0.526 +/- 0.169	0.524 +/- 0.17	0.476 +/- 0.178	0.519 +/- 0.167
AN	East Delta	0.315 +/- 0.12	0.322 +/- 0.109	0.321 +/- 0.114	0.321 +/- 0.114	0.322 +/- 0.114	0.322 +/- 0.114	0.276 +/- 0.148	0.329 +/- 0.105
AN	Lower Sacramento River	0.464 +/- 0.168	0.46 +/- 0.179	0.472 +/- 0.161	0.472 +/- 0.162	0.48 +/- 0.157	0.479 +/- 0.159	0.393 +/- 0.213	0.481 +/- 0.16
AN	Lower San Joaquin River	0.248 +/- 0.204	0.247 +/- 0.204	0.253 +/- 0.203	0.253 +/- 0.203	0.254 +/- 0.202	0.253 +/- 0.203	0.21 +/- 0.22	0.252 +/- 0.204
AN	NE Suisun	0.531 +/- 0.184	0.358 +/- 0.185	0.515 +/- 0.174	0.515 +/- 0.174	0.536 +/- 0.196	0.546 +/- 0.197	0.453 +/- 0.164	0.495 +/- 0.194
AN	NW Suisun	0.404 +/- 0.158	0.32 +/- 0.132	0.394 +/- 0.146	0.394 +/- 0.146	0.408 +/- 0.163	0.415 +/- 0.167	0.337 +/- 0.12	0.395 +/- 0.144
AN	SE Suisun	0.361 +/- 0.122	0.242 +/- 0.125	0.352 +/- 0.117	0.352 +/- 0.117	0.366 +/- 0.132	0.373 +/- 0.134	0.303 +/- 0.109	0.336 +/- 0.126
AN	SW Suisun	0.136 +/- 0.014	0.137 +/- 0.016	0.132 +/- 0.017	0.132 +/- 0.017	0.137 +/- 0.015	0.137 +/- 0.015	0.137 +/- 0.015	0.138 +/- 0.016
AN	Sacramento River	0.378 +/- 0.042	0.377 +/- 0.044	0.382 +/- 0.035	0.382 +/- 0.035	0.384 +/- 0.034	0.384 +/- 0.035	0.337 +/- 0.079	0.385 +/- 0.034
AN	South Delta	0.188 +/- 0.206	0.19 +/- 0.208	0.192 +/- 0.205	0.192 +/- 0.205	0.193 +/- 0.205	0.193 +/- 0.205	0.169 +/- 0.21	0.19 +/- 0.207
AN	Suisun Marsh	0.668 +/- 0.183	0.468 +/- 0.203	0.673 +/- 0.175	0.673 +/- 0.176	0.681 +/- 0.174	0.684 +/- 0.176	0.631 +/- 0.17	0.671 +/- 0.17
AN	Yolo Bypass	0.267 +/- 0.156	0.263 +/- 0.159	0.267 +/- 0.156	0.267 +/- 0.156	0.267 +/- 0.156	0.267 +/- 0.156	0.256 +/- 0.164	0.264 +/- 0.158
AN	SummerFall	0.513 +/- 0.191	0.428 +/- 0.176	0.515 +/- 0.188	0.515 +/- 0.188	0.524 +/- 0.189	0.525 +/- 0.19	0.459 +/- 0.201	0.516 +/- 0.185

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
AN	Delta	0.373 +/- 0.21	0.321 +/- 0.182	0.373 +/- 0.207	0.373 +/- 0.207	0.38 +/- 0.212	0.381 +/- 0.213	0.331 +/- 0.204	0.371 +/- 0.206
BN	Confluence	0.403 +/- 0.144	0.433 +/- 0.16	0.386 +/- 0.132	0.388 +/- 0.13	0.401 +/- 0.137	0.401 +/- 0.138	0.408 +/- 0.205	0.387 +/- 0.13
BN	East Delta	0.242 +/- 0.17	0.251 +/- 0.177	0.237 +/- 0.17	0.239 +/- 0.168	0.244 +/- 0.169	0.244 +/- 0.17	0.218 +/- 0.191	0.239 +/- 0.168
BN	Lower Sacramento River	0.38 +/- 0.264	0.383 +/- 0.264	0.377 +/- 0.264	0.378 +/- 0.263	0.381 +/- 0.264	0.38 +/- 0.265	0.356 +/- 0.284	0.378 +/- 0.263
BN	Lower San Joaquin River	0.239 +/- 0.238	0.247 +/- 0.243	0.237 +/- 0.237	0.237 +/- 0.237	0.24 +/- 0.238	0.24 +/- 0.238	0.229 +/- 0.24	0.237 +/- 0.237
BN	NE Suisun	0.308 +/- 0.042	0.304 +/- 0.029	0.304 +/- 0.037	0.305 +/- 0.038	0.305 +/- 0.038	0.304 +/- 0.037	0.349 +/- 0.118	0.304 +/- 0.037
BN	NW Suisun	0.287 +/- 0.057	0.264 +/- 0.035	0.271 +/- 0.051	0.271 +/- 0.051	0.271 +/- 0.051	0.271 +/- 0.05	0.255 +/- 0.053	0.271 +/- 0.051
BN	SE Suisun	0.213 +/- 0.041	0.217 +/- 0.035	0.209 +/- 0.038	0.209 +/- 0.039	0.211 +/- 0.039	0.21 +/- 0.038	0.241 +/- 0.086	0.209 +/- 0.038
BN	SW Suisun	0.14 +/- 0.021	0.141 +/- 0.02	0.141 +/- 0.021	0.141 +/- 0.021	0.14 +/- 0.021	0.14 +/- 0.02	0.139 +/- 0.02	0.141 +/- 0.021
BN	Sacramento River	0.331 +/- 0.102	0.332 +/- 0.104	0.329 +/- 0.102	0.331 +/- 0.1	0.334 +/- 0.101	0.333 +/- 0.102	0.306 +/- 0.129	0.331 +/- 0.1
BN	South Delta	0.172 +/- 0.218	0.179 +/- 0.217	0.17 +/- 0.218	0.17 +/- 0.218	0.172 +/- 0.218	0.172 +/- 0.218	0.17 +/- 0.218	0.171 +/- 0.218
BN	Suisun Marsh	0.576 +/- 0.088	0.428 +/- 0.044	0.572 +/- 0.1	0.572 +/- 0.1	0.594 +/- 0.109	0.595 +/- 0.108	0.606 +/- 0.138	0.571 +/- 0.1
BN	Yolo Bypass	0.257 +/- 0.182	0.26 +/- 0.183	0.256 +/- 0.182	0.256 +/- 0.182	0.257 +/- 0.182	0.257 +/- 0.182	0.253 +/- 0.185	0.256 +/- 0.182
BN	SummerFall	0.412 +/- 0.186	0.377 +/- 0.166	0.402 +/- 0.187	0.402 +/- 0.187	0.412 +/- 0.194	0.412 +/- 0.195	0.406 +/- 0.224	0.402 +/- 0.186
BN	Delta	0.296 +/- 0.185	0.287 +/- 0.171	0.291 +/- 0.183	0.291 +/- 0.183	0.296 +/- 0.187	0.296 +/- 0.188	0.294 +/- 0.204	0.291 +/- 0.183

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
C	Confluence	0.112 +/- 0.14	0.098 +/- 0.113	0.112 +/- 0.138	0.106 +/- 0.13	0.1 +/- 0.12	0.103 +/- 0.123	0.098 +/- 0.112	0.1 +/- 0.117
C	East Delta	0.096 +/- 0.187	0.097 +/- 0.189	0.096 +/- 0.187	0.096 +/- 0.187	0.094 +/- 0.187	0.095 +/- 0.186	0.098 +/- 0.189	0.098 +/- 0.189
C	Lower Sacramento River	0.164 +/- 0.251	0.121 +/- 0.163	0.164 +/- 0.25	0.157 +/- 0.241	0.143 +/- 0.218	0.151 +/- 0.225	0.127 +/- 0.174	0.13 +/- 0.18
C	Lower San Joaquin River	0.128 +/- 0.23	0.127 +/- 0.217	0.128 +/- 0.23	0.129 +/- 0.23	0.128 +/- 0.228	0.129 +/- 0.23	0.129 +/- 0.223	0.128 +/- 0.222
C	NE Suisun	0.115 +/- 0.122	0.129 +/- 0.116	0.115 +/- 0.122	0.117 +/- 0.121	0.118 +/- 0.122	0.118 +/- 0.121	0.129 +/- 0.116	0.122 +/- 0.118
C	NW Suisun	0.124 +/- 0.115	0.133 +/- 0.111	0.124 +/- 0.115	0.125 +/- 0.115	0.125 +/- 0.115	0.125 +/- 0.115	0.133 +/- 0.111	0.132 +/- 0.111
C	SE Suisun	0.068 +/- 0.083	0.074 +/- 0.08	0.068 +/- 0.083	0.07 +/- 0.083	0.07 +/- 0.083	0.07 +/- 0.083	0.074 +/- 0.08	0.071 +/- 0.081
C	SW Suisun	0.061 +/- 0.067	0.067 +/- 0.067	0.061 +/- 0.067	0.062 +/- 0.068	0.062 +/- 0.068	0.062 +/- 0.068	0.067 +/- 0.067	0.065 +/- 0.067
C	Sacramento River	0.121 +/- 0.182	0.12 +/- 0.178	0.121 +/- 0.182	0.122 +/- 0.182	0.116 +/- 0.179	0.122 +/- 0.181	0.123 +/- 0.181	0.121 +/- 0.182
C	South Delta	0.118 +/- 0.204	0.124 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.118 +/- 0.204	0.123 +/- 0.204	0.123 +/- 0.204
C	Suisun Marsh	0.146 +/- 0.12	0.142 +/- 0.125	0.146 +/- 0.12	0.146 +/- 0.12	0.146 +/- 0.12	0.146 +/- 0.12	0.144 +/- 0.124	0.144 +/- 0.123
C	Yolo Bypass	0.159 +/- 0.183	0.162 +/- 0.182	0.159 +/- 0.182	0.158 +/- 0.182	0.162 +/- 0.184	0.161 +/- 0.185	0.158 +/- 0.181	0.161 +/- 0.181
C	SummerFall	0.137 +/- 0.161	0.124 +/- 0.126	0.137 +/- 0.16	0.134 +/- 0.155	0.129 +/- 0.145	0.131 +/- 0.148	0.126 +/- 0.129	0.126 +/- 0.132
C	Delta	0.118 +/- 0.161	0.116 +/- 0.148	0.118 +/- 0.161	0.117 +/- 0.159	0.115 +/- 0.156	0.117 +/- 0.157	0.117 +/- 0.15	0.116 +/- 0.151
D	Confluence	0.258 +/- 0.171	0.251 +/- 0.156	0.257 +/- 0.171	0.257 +/- 0.171	0.259 +/- 0.172	0.26 +/- 0.175	0.269 +/- 0.15	0.243 +/- 0.151

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
D	East Delta	0.156 +/- 0.212	0.155 +/- 0.213	0.156 +/- 0.212	0.156 +/- 0.212	0.156 +/- 0.212	0.156 +/- 0.212	0.161 +/- 0.209	0.157 +/- 0.212
D	Lower Sacramento River	0.257 +/- 0.268	0.251 +/- 0.257	0.257 +/- 0.268	0.257 +/- 0.268	0.257 +/- 0.268	0.258 +/- 0.269	0.249 +/- 0.263	0.249 +/- 0.254
D	Lower San Joaquin River	0.185 +/- 0.24	0.184 +/- 0.238	0.185 +/- 0.24	0.185 +/- 0.24	0.185 +/- 0.24	0.185 +/- 0.24	0.183 +/- 0.24	0.185 +/- 0.238
D	NE Suisun	0.269 +/- 0.163	0.261 +/- 0.148	0.269 +/- 0.163	0.269 +/- 0.163	0.265 +/- 0.159	0.262 +/- 0.156	0.307 +/- 0.159	0.265 +/- 0.155
D	NW Suisun	0.237 +/- 0.113	0.242 +/- 0.102	0.237 +/- 0.114	0.237 +/- 0.113	0.235 +/- 0.111	0.235 +/- 0.11	0.254 +/- 0.119	0.244 +/- 0.107
D	SE Suisun	0.176 +/- 0.125	0.172 +/- 0.117	0.176 +/- 0.126	0.176 +/- 0.126	0.174 +/- 0.124	0.173 +/- 0.123	0.201 +/- 0.125	0.174 +/- 0.122
D	SW Suisun	0.106 +/- 0.029	0.116 +/- 0.027	0.106 +/- 0.029	0.106 +/- 0.029	0.106 +/- 0.029	0.106 +/- 0.03	0.118 +/- 0.028	0.116 +/- 0.028
D	Sacramento River	0.165 +/- 0.188	0.163 +/- 0.188	0.165 +/- 0.188	0.165 +/- 0.188	0.167 +/- 0.186	0.166 +/- 0.187	0.201 +/- 0.166	0.168 +/- 0.187
D	South Delta	0.168 +/- 0.224	0.167 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.224	0.168 +/- 0.223	0.168 +/- 0.224
D	Suisun Marsh	0.34 +/- 0.198	0.272 +/- 0.152	0.337 +/- 0.197	0.335 +/- 0.196	0.338 +/- 0.2	0.345 +/- 0.205	0.381 +/- 0.199	0.298 +/- 0.172
D	Yolo Bypass	0.232 +/- 0.203	0.221 +/- 0.214	0.234 +/- 0.207	0.232 +/- 0.204	0.227 +/- 0.207	0.23 +/- 0.205	0.221 +/- 0.214	0.22 +/- 0.214
D	SummerFall	0.273 +/- 0.192	0.254 +/- 0.169	0.272 +/- 0.192	0.272 +/- 0.191	0.272 +/- 0.193	0.274 +/- 0.195	0.288 +/- 0.191	0.258 +/- 0.173
D	Delta	0.212 +/- 0.19	0.205 +/- 0.179	0.212 +/- 0.19	0.212 +/- 0.189	0.211 +/- 0.19	0.212 +/- 0.19	0.226 +/- 0.189	0.207 +/- 0.182
W	Confluence	0.223 +/- 0.294	0.114 +/- 0.151	0.223 +/- 0.294	0.223 +/- 0.294	0.223 +/- 0.294	0.224 +/- 0.294	0.221 +/- 0.295	0.22 +/- 0.29
W	East Delta	0.256 +/- 0.178	0.241 +/- 0.175	0.256 +/- 0.178	0.256 +/- 0.178	0.256 +/- 0.178	0.255 +/- 0.178	0.233 +/- 0.194	0.257 +/- 0.174

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
W	Lower Sacramento River	0.267 +/- 0.296	0.21 +/- 0.273	0.267 +/- 0.296	0.267 +/- 0.296	0.267 +/- 0.296	0.268 +/- 0.296	0.25 +/- 0.297	0.26 +/- 0.297
W	Lower San Joaquin River	0.178 +/- 0.245	0.17 +/- 0.246	0.178 +/- 0.245	0.178 +/- 0.245	0.178 +/- 0.245	0.177 +/- 0.245	0.175 +/- 0.246	0.176 +/- 0.245
W	NE Suisun	0.161 +/- 0.203	0.104 +/- 0.128	0.16 +/- 0.202	0.16 +/- 0.202	0.16 +/- 0.202	0.16 +/- 0.202	0.133 +/- 0.166	0.128 +/- 0.157
W	NW Suisun	0.113 +/- 0.128	0.112 +/- 0.125	0.112 +/- 0.127	0.111 +/- 0.127	0.112 +/- 0.127	0.112 +/- 0.128	0.109 +/- 0.126	0.111 +/- 0.125
W	SE Suisun	0.106 +/- 0.138	0.062 +/- 0.08	0.106 +/- 0.137	0.106 +/- 0.137	0.106 +/- 0.138	0.106 +/- 0.138	0.094 +/- 0.122	0.088 +/- 0.112
W	SW Suisun	0.058 +/- 0.063	0.065 +/- 0.064	0.058 +/- 0.063	0.058 +/- 0.063	0.058 +/- 0.063	0.058 +/- 0.063	0.063 +/- 0.063	0.063 +/- 0.063
W	Sacramento River	0.332 +/- 0.089	0.319 +/- 0.086	0.332 +/- 0.089	0.331 +/- 0.09	0.332 +/- 0.089	0.332 +/- 0.089	0.315 +/- 0.105	0.331 +/- 0.089
W	South Delta	0.18 +/- 0.215	0.178 +/- 0.216	0.181 +/- 0.215	0.181 +/- 0.215	0.181 +/- 0.215	0.181 +/- 0.215	0.176 +/- 0.217	0.18 +/- 0.215
W	Suisun Marsh	0.216 +/- 0.199	0.155 +/- 0.124	0.214 +/- 0.198	0.212 +/- 0.197	0.214 +/- 0.198	0.214 +/- 0.198	0.215 +/- 0.206	0.214 +/- 0.201
W	Yolo Bypass	0.229 +/- 0.218	0.225 +/- 0.217	0.229 +/- 0.218	0.229 +/- 0.218	0.229 +/- 0.219	0.229 +/- 0.218	0.229 +/- 0.216	0.23 +/- 0.216
W	SummerFall	0.205 +/- 0.237	0.148 +/- 0.177	0.204 +/- 0.237	0.203 +/- 0.237	0.204 +/- 0.237	0.204 +/- 0.237	0.199 +/- 0.238	0.201 +/- 0.236
W	Delta	0.193 +/- 0.206	0.163 +/- 0.178	0.193 +/- 0.206	0.193 +/- 0.206	0.193 +/- 0.206	0.193 +/- 0.206	0.184 +/- 0.204	0.188 +/- 0.202

Table K.1-11. Means of the Habitat Suitability Index calculated using Bever et al. (2016) modified with a 22°C temperature threshold for each alternative and water year type (WYT). Percent change of each mean compared to the NAA mean is indicated in parenthesis.

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
AN	Confluence	0.401 (-0.226)	0.482 (-0.069)	0.518	0.521 (0.006)	0.521 (0.006)	0.526 (0.015)	0.524 (0.012)
AN	East Delta	0.186 (-0.41)	0.199 (-0.368)	0.315	0.321 (0.019)	0.321 (0.019)	0.322 (0.022)	0.322 (0.022)
AN	Lower Sacramento River	0.369 (-0.205)	0.376 (-0.19)	0.464	0.472 (0.017)	0.472 (0.017)	0.48 (0.034)	0.479 (0.032)
AN	Lower San Joaquin River	0.194 (-0.218)	0.194 (-0.218)	0.248	0.253 (0.02)	0.253 (0.02)	0.254 (0.024)	0.253 (0.02)
AN	NE Suisun	0.323 (-0.392)	0.503 (-0.053)	0.531	0.515 (-0.03)	0.515 (-0.03)	0.536 (0.009)	0.546 (0.028)
AN	NW Suisun	0.298 (-0.262)	0.357 (-0.116)	0.404	0.394 (-0.025)	0.394 (-0.025)	0.408 (0.01)	0.415 (0.027)
AN	SE Suisun	0.222 (-0.385)	0.349 (-0.033)	0.361	0.352 (-0.025)	0.352 (-0.025)	0.366 (0.014)	0.373 (0.033)
AN	SW Suisun	0.136 (0)	0.139 (0.022)	0.136	0.132 (-0.029)	0.132 (-0.029)	0.137 (0.007)	0.137 (0.007)
AN	Sacramento River	0.219 (-0.421)	0.284 (-0.249)	0.378	0.382 (0.011)	0.382 (0.011)	0.384 (0.016)	0.384 (0.016)
AN	South Delta	0.163 (-0.133)	0.162 (-0.138)	0.188	0.192 (0.021)	0.192 (0.021)	0.193 (0.027)	0.193 (0.027)
AN	Suisun Marsh	0.387 (-0.421)	0.542 (-0.189)	0.668	0.673 (0.007)	0.673 (0.007)	0.681 (0.019)	0.684 (0.024)
AN	Yolo Bypass	0.243 (-0.09)	0.253 (-0.052)	0.267	0.267 (0)	0.267 (0)	0.267 (0)	0.267 (0)
AN	SummerFall	0.364 (-0.29)	0.439 (-0.144)	0.513	0.515 (0.004)	0.515 (0.004)	0.524 (0.021)	0.525 (0.023)
AN	Delta	0.262 (-0.298)	0.32 (-0.142)	0.373	0.373 (0)	0.373 (0)	0.38 (0.019)	0.381 (0.021)
BN	Confluence	0.208 (-0.484)	0.442 (0.097)	0.403	0.386 (-0.042)	0.388 (-0.037)	0.401 (-0.005)	0.401 (-0.005)
BN	East Delta	0.146 (-0.397)	0.147 (-0.393)	0.242	0.237 (-0.021)	0.239 (-0.012)	0.244 (0.008)	0.244 (0.008)
BN	Lower Sacramento River	0.235 (-0.382)	0.333 (-0.124)	0.380	0.377 (-0.008)	0.378 (-0.005)	0.381 (0.003)	0.38 (0)
BN	Lower San Joaquin River	0.204 (-0.146)	0.213 (-0.109)	0.239	0.237 (-0.008)	0.237 (-0.008)	0.24 (0.004)	0.24 (0.004)
BN	NE Suisun	0.252 (-0.182)	0.36 (0.169)	0.308	0.304 (-0.013)	0.305 (-0.01)	0.305 (-0.01)	0.304 (-0.013)
BN	NW Suisun	0.257 (-0.105)	0.253 (-0.118)	0.287	0.271 (-0.056)	0.271 (-0.056)	0.271 (-0.056)	0.271 (-0.056)
BN	SE Suisun	0.166 (-0.221)	0.253 (0.188)	0.213	0.209 (-0.019)	0.209 (-0.019)	0.211 (-0.009)	0.21 (-0.014)
BN	SW Suisun	0.147 (0.05)	0.14 (0)	0.140	0.141 (0.007)	0.141 (0.007)	0.14 (0)	0.14 (0)

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA
BN	Sacramento River	0.181 (-0.453)	0.231 (-0.302)	0.331	0.329 (-0.006)	0.331 (0)	0.334 (0.009)	0.333 (0.006)
BN	South Delta	0.16 (-0.07)	0.16 (-0.07)	0.172	0.17 (-0.012)	0.17 (-0.012)	0.172 (0)	0.172 (0)
BN	Suisun Marsh	0.284 (-0.507)	0.38 (-0.34)	0.576	0.572 (-0.007)	0.572 (-0.007)	0.594 (0.031)	0.595 (0.033)
BN	Yolo Bypass	0.232 (-0.097)	0.238 (-0.074)	0.257	0.256 (-0.004)	0.256 (-0.004)	0.257 (0)	0.257 (0)
BN	SummerFall	0.246 (-0.403)	0.352 (-0.146)	0.412	0.402 (-0.024)	0.402 (-0.024)	0.412 (0)	0.412 (0)
BN	Delta	0.206 (-0.304)	0.262 (-0.115)	0.296	0.291 (-0.017)	0.291 (-0.017)	0.296 (0)	0.296 (0)
C	Confluence	0.081 (-0.277)	0.174 (0.554)	0.112	0.112 (0)	0.106 (-0.054)	0.1 (-0.107)	0.103 (-0.08)
C	East Delta	0.088 (-0.083)	0.095 (-0.01)	0.096	0.096 (0)	0.096 (0)	0.094 (-0.021)	0.095 (-0.01)
C	Lower Sacramento River	0.072 (-0.561)	0.173 (0.055)	0.164	0.164 (0)	0.157 (-0.043)	0.143 (-0.128)	0.151 (-0.079)
C	Lower San Joaquin River	0.097 (-0.242)	0.127 (-0.008)	0.128	0.128 (0)	0.129 (0.008)	0.128 (0)	0.129 (0.008)
C	NE Suisun	0.116 (0.009)	0.113 (-0.017)	0.115	0.115 (0)	0.117 (0.017)	0.118 (0.026)	0.118 (0.026)
C	NW Suisun	0.124 (0)	0.124 (0)	0.124	0.124 (0)	0.125 (0.008)	0.125 (0.008)	0.125 (0.008)
C	SE Suisun	0.071 (0.044)	0.069 (0.015)	0.068	0.068 (0)	0.07 (0.029)	0.07 (0.029)	0.07 (0.029)
C	SW Suisun	0.062 (0.016)	0.06 (-0.016)	0.061	0.061 (0)	0.062 (0.016)	0.062 (0.016)	0.062 (0.016)
C	Sacramento River	0.079 (-0.347)	0.121 (0)	0.121	0.121 (0)	0.122 (0.008)	0.116 (-0.041)	0.122 (0.008)
C	South Delta	0.119 (0.008)	0.117 (-0.008)	0.118	0.118 (0)	0.118 (0)	0.118 (0)	0.118 (0)
C	Suisun Marsh	0.143 (-0.021)	0.148 (0.014)	0.146	0.146 (0)	0.146 (0)	0.146 (0)	0.146 (0)
C	Yolo Bypass	0.168 (0.057)	0.159 (0)	0.159	0.159 (0)	0.158 (-0.006)	0.162 (0.019)	0.161 (0.013)
C	SummerFall	0.105 (-0.234)	0.155 (0.131)	0.137	0.137 (0)	0.134 (-0.022)	0.129 (-0.058)	0.131 (-0.044)
C	Delta	0.102 (-0.136)	0.123 (0.042)	0.118	0.118 (0)	0.117 (-0.008)	0.115 (-0.025)	0.117 (-0.008)
D	Confluence	0.26 (0.008)	0.332 (0.287)	0.258	0.257 (-0.004)	0.257 (-0.004)	0.259 (0.004)	0.26 (0.008)
D	East Delta	0.161 (0.032)	0.152 (-0.026)	0.156	0.156 (0)	0.156 (0)	0.156 (0)	0.156 (0)
D	Lower Sacramento River	0.261 (0.016)	0.253 (-0.016)	0.257	0.257 (0)	0.257 (0)	0.257 (0)	0.258 (0.004)
D	Lower San Joaquin River	0.183 (-0.011)	0.182 (-0.016)	0.185	0.185 (0)	0.185 (0)	0.185 (0)	0.185 (0)
D	NE Suisun	0.234 (-0.13)	0.36 (0.338)	0.269	0.269 (0)	0.269 (0)	0.265 (-0.015)	0.262 (-0.026)
D	NW Suisun	0.207 (-0.127)	0.262 (0.105)	0.237	0.237 (0)	0.237 (0)	0.235 (-0.008)	0.235 (-0.008)

WYT	Region	EXP1	EXP3	NAA	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA
D	SE Suisun	0.154 (-0.125)	0.248 (0.409)	0.176	0.176 (0)	0.176 (0)	0.174 (-0.011)	0.173 (-0.017)
D	SW Suisun	0.1 (-0.057)	0.105 (-0.009)	0.106	0.106 (0)	0.106 (0)	0.106 (0)	0.106 (0)
D	Sacramento River	0.156 (-0.055)	0.155 (-0.061)	0.165	0.165 (0)	0.165 (0)	0.167 (0.012)	0.166 (0.006)
D	South Delta	0.166 (-0.012)	0.165 (-0.018)	0.168	0.168 (0)	0.168 (0)	0.168 (0)	0.168 (0)
D	Suisun Marsh	0.241 (-0.291)	0.371 (0.091)	0.340	0.337 (-0.009)	0.335 (-0.015)	0.338 (-0.006)	0.345 (0.015)
D	Yolo Bypass	0.234 (0.009)	0.237 (0.022)	0.232	0.234 (0.009)	0.232 (0)	0.227 (-0.022)	0.23 (-0.009)
D	SummerFall	0.242 (-0.114)	0.305 (0.117)	0.273	0.272 (-0.004)	0.272 (-0.004)	0.272 (-0.004)	0.274 (0.004)
D	Delta	0.196 (-0.075)	0.235 (0.108)	0.212	0.212 (0)	0.212 (0)	0.211 (-0.005)	0.212 (0)
W	Confluence	0.188 (-0.157)	0.217 (-0.027)	0.223	0.223 (0)	0.223 (0)	0.223 (0)	0.224 (0.004)
W	East Delta	0.164 (-0.359)	0.167 (-0.348)	0.256	0.256 (0)	0.256 (0)	0.256 (0)	0.255 (-0.004)
W	Lower Sacramento River	0.223 (-0.165)	0.228 (-0.146)	0.267	0.267 (0)	0.267 (0)	0.267 (0)	0.268 (0.004)
W	Lower San Joaquin River	0.168 (-0.056)	0.168 (-0.056)	0.178	0.178 (0)	0.178 (0)	0.178 (0)	0.177 (-0.006)
W	NE Suisun	0.134 (-0.168)	0.152 (-0.056)	0.161	0.16 (-0.006)	0.16 (-0.006)	0.16 (-0.006)	0.16 (-0.006)
W	NW Suisun	0.111 (-0.018)	0.111 (-0.018)	0.113	0.112 (-0.009)	0.111 (-0.018)	0.112 (-0.009)	0.112 (-0.009)
W	SE Suisun	0.091 (-0.142)	0.108 (0.019)	0.106	0.106 (0)	0.106 (0)	0.106 (0)	0.106 (0)
W	SW Suisun	0.054 (-0.069)	0.056 (-0.034)	0.058	0.058 (0)	0.058 (0)	0.058 (0)	0.058 (0)
W	Sacramento River	0.202 (-0.392)	0.228 (-0.313)	0.332	0.332 (0)	0.331 (-0.003)	0.332 (0)	0.332 (0)
W	South Delta	0.168 (-0.067)	0.169 (-0.061)	0.180	0.181 (0.006)	0.181 (0.006)	0.181 (0.006)	0.181 (0.006)
W	Suisun Marsh	0.147 (-0.319)	0.172 (-0.204)	0.216	0.214 (-0.009)	0.212 (-0.019)	0.214 (-0.009)	0.214 (-0.009)
W	Yolo Bypass	0.221 (-0.035)	0.221 (-0.035)	0.229	0.229 (0)	0.229 (0)	0.229 (0)	0.229 (0)
W	SummerFall	0.167 (-0.185)	0.182 (-0.112)	0.205	0.204 (-0.005)	0.203 (-0.01)	0.204 (-0.005)	0.204 (-0.005)
W	Delta	0.156 (-0.192)	0.166 (-0.14)	0.193	0.193 (0)	0.193 (0)	0.193 (0)	0.193 (0)

Table K.1-12. Means of the Habitat Suitability Index calculated using Bever et al. (2016) modified with a 22°C temperature threshold for each alternative and water year type (WYT). Percent change of each mean compared to the NAA mean is indicated in parenthesis.

WYT	Region	NAA	Alt1	Alt2wTUCP woVA	Alt2woTUCP woVA	Alt2woTUCP DeltaVA	Alt2woTUCP AllVA	Alt3	Alt4
AN	Confluence	0.518	0.462 (-0.108)	0.521 (0.006)	0.521 (0.006)	0.526 (0.015)	0.524 (0.012)	0.476 (-0.081)	0.519 (0.002)
AN	East Delta	0.315	0.322 (0.022)	0.321 (0.019)	0.321 (0.019)	0.322 (0.022)	0.322 (0.022)	0.276 (-0.124)	0.329 (0.044)
AN	Lower Sacramento River	0.464	0.46 (-0.009)	0.472 (0.017)	0.472 (0.017)	0.48 (0.034)	0.479 (0.032)	0.393 (-0.153)	0.481 (0.037)
AN	Lower San Joaquin River	0.248	0.247 (-0.004)	0.253 (0.02)	0.253 (0.02)	0.254 (0.024)	0.253 (0.02)	0.21 (-0.153)	0.252 (0.016)
AN	NE Suisun	0.531	0.358 (-0.326)	0.515 (-0.03)	0.515 (-0.03)	0.536 (0.009)	0.546 (0.028)	0.453 (-0.147)	0.495 (-0.068)
AN	NW Suisun	0.404	0.32 (-0.208)	0.394 (-0.025)	0.394 (-0.025)	0.408 (0.01)	0.415 (0.027)	0.337 (-0.166)	0.395 (-0.022)
AN	SE Suisun	0.361	0.242 (-0.33)	0.352 (-0.025)	0.352 (-0.025)	0.366 (0.014)	0.373 (0.033)	0.303 (-0.161)	0.336 (-0.069)
AN	SW Suisun	0.136	0.137 (0.007)	0.132 (-0.029)	0.132 (-0.029)	0.137 (0.007)	0.137 (0.007)	0.137 (0.007)	0.138 (0.015)
AN	Sacramento River	0.378	0.377 (-0.003)	0.382 (0.011)	0.382 (0.011)	0.384 (0.016)	0.384 (0.016)	0.337 (-0.108)	0.385 (0.019)
AN	South Delta	0.188	0.19 (0.011)	0.192 (0.021)	0.192 (0.021)	0.193 (0.027)	0.193 (0.027)	0.169 (-0.101)	0.19 (0.011)
AN	Suisun Marsh	0.668	0.468 (-0.299)	0.673 (0.007)	0.673 (0.007)	0.681 (0.019)	0.684 (0.024)	0.631 (-0.055)	0.671 (0.004)
AN	Yolo Bypass	0.267	0.263 (-0.015)	0.267 (0)	0.267 (0)	0.267 (0)	0.267 (0)	0.256 (-0.041)	0.264 (-0.011)
AN	SummerFall	0.513	0.428 (-0.166)	0.515 (0.004)	0.515 (0.004)	0.524 (0.021)	0.525 (0.023)	0.459 (-0.105)	0.516 (0.006)
AN	Delta	0.373	0.321 (-0.139)	0.373 (0)	0.373 (0)	0.38 (0.019)	0.381 (0.021)	0.331 (-0.113)	0.371 (-0.005)
BN	Confluence	0.403	0.433 (0.074)	0.386 (-0.042)	0.388 (-0.037)	0.401 (-0.005)	0.401 (-0.005)	0.408 (0.012)	0.387 (-0.04)
BN	East Delta	0.242	0.251 (0.037)	0.237 (-0.021)	0.239 (-0.012)	0.244 (0.008)	0.244 (0.008)	0.218 (-0.099)	0.239 (-0.012)
BN	Lower Sacramento River	0.380	0.383 (0.008)	0.377 (-0.008)	0.378 (-0.005)	0.381 (0.003)	0.38 (0)	0.356 (-0.063)	0.378 (-0.005)
BN	Lower San Joaquin River	0.239	0.247 (0.033)	0.237 (-0.008)	0.237 (-0.008)	0.24 (0.004)	0.24 (0.004)	0.229 (-0.042)	0.237 (-0.008)
BN	NE Suisun	0.308	0.304 (-0.013)	0.304 (-0.013)	0.305 (-0.01)	0.305 (-0.01)	0.304 (-0.013)	0.349 (0.133)	0.304 (-0.013)
BN	NW Suisun	0.287	0.264 (-0.08)	0.271 (-0.056)	0.271 (-0.056)	0.271 (-0.056)	0.271 (-0.056)	0.255 (-0.111)	0.271 (-0.056)
BN	SE Suisun	0.213	0.217 (0.019)	0.209 (-0.019)	0.209 (-0.019)	0.211 (-0.009)	0.21 (-0.014)	0.241 (0.131)	0.209 (-0.019)
BN	SW Suisun	0.140	0.141 (0.007)	0.141 (0.007)	0.141 (0.007)	0.14 (0)	0.14 (0)	0.139 (-0.007)	0.141 (0.007)

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
BN	Sacramento River	0.331	0.332 (0.003)	0.329 (-0.006)	0.331 (0)	0.334 (0.009)	0.333 (0.006)	0.306 (-0.076)	0.331 (0)
BN	South Delta	0.172	0.179 (0.041)	0.17 (-0.012)	0.17 (-0.012)	0.172 (0)	0.172 (0)	0.17 (-0.012)	0.171 (-0.006)
BN	Suisun Marsh	0.576	0.428 (-0.257)	0.572 (-0.007)	0.572 (-0.007)	0.594 (0.031)	0.595 (0.033)	0.606 (0.052)	0.571 (-0.009)
BN	Yolo Bypass	0.257	0.26 (0.012)	0.256 (-0.004)	0.256 (-0.004)	0.257 (0)	0.257 (0)	0.253 (-0.016)	0.256 (-0.004)
BN	SummerFall	0.412	0.377 (-0.085)	0.402 (-0.024)	0.402 (-0.024)	0.412 (0)	0.412 (0)	0.406 (-0.015)	0.402 (-0.024)
BN	Delta	0.296	0.287 (-0.03)	0.291 (-0.017)	0.291 (-0.017)	0.296 (0)	0.296 (0)	0.294 (-0.007)	0.291 (-0.017)
C	Confluence	0.112	0.098 (-0.125)	0.112 (0)	0.106 (-0.054)	0.1 (-0.107)	0.103 (-0.08)	0.098 (-0.125)	0.1 (-0.107)
C	East Delta	0.096	0.097 (0.01)	0.096 (0)	0.096 (0)	0.094 (-0.021)	0.095 (-0.01)	0.098 (0.021)	0.098 (0.021)
C	Lower Sacramento River	0.164	0.121 (-0.262)	0.164 (0)	0.157 (-0.043)	0.143 (-0.128)	0.151 (-0.079)	0.127 (-0.226)	0.13 (-0.207)
C	Lower San Joaquin River	0.128	0.127 (-0.008)	0.128 (0)	0.129 (0.008)	0.128 (0)	0.129 (0.008)	0.129 (0.008)	0.128 (0)
C	NE Suisun	0.115	0.129 (0.122)	0.115 (0)	0.117 (0.017)	0.118 (0.026)	0.118 (0.026)	0.129 (0.122)	0.122 (0.061)
C	NW Suisun	0.124	0.133 (0.073)	0.124 (0)	0.125 (0.008)	0.125 (0.008)	0.125 (0.008)	0.133 (0.073)	0.132 (0.065)
C	SE Suisun	0.068	0.074 (0.088)	0.068 (0)	0.07 (0.029)	0.07 (0.029)	0.07 (0.029)	0.074 (0.088)	0.071 (0.044)
C	SW Suisun	0.061	0.067 (0.098)	0.061 (0)	0.062 (0.016)	0.062 (0.016)	0.062 (0.016)	0.067 (0.098)	0.065 (0.066)
C	Sacramento River	0.121	0.12 (-0.008)	0.121 (0)	0.122 (0.008)	0.116 (-0.041)	0.122 (0.008)	0.123 (0.017)	0.121 (0)
C	South Delta	0.118	0.124 (0.051)	0.118 (0)	0.118 (0)	0.118 (0)	0.118 (0)	0.123 (0.042)	0.123 (0.042)
C	Suisun Marsh	0.146	0.142 (-0.027)	0.146 (0)	0.146 (0)	0.146 (0)	0.146 (0)	0.144 (-0.014)	0.144 (-0.014)
C	Yolo Bypass	0.159	0.162 (0.019)	0.159 (0)	0.158 (-0.006)	0.162 (0.019)	0.161 (0.013)	0.158 (-0.006)	0.161 (0.013)
C	SummerFall	0.137	0.124 (-0.095)	0.137 (0)	0.134 (-0.022)	0.129 (-0.058)	0.131 (-0.044)	0.126 (-0.08)	0.126 (-0.08)
C	Delta	0.118	0.116 (-0.017)	0.118 (0)	0.117 (-0.008)	0.115 (-0.025)	0.117 (-0.008)	0.117 (-0.008)	0.116 (-0.017)
D	Confluence	0.258	0.251 (-0.027)	0.257 (-0.004)	0.257 (-0.004)	0.259 (0.004)	0.26 (0.008)	0.269 (0.043)	0.243 (-0.058)
D	East Delta	0.156	0.155 (-0.006)	0.156 (0)	0.156 (0)	0.156 (0)	0.156 (0)	0.161 (0.032)	0.157 (0.006)
D	Lower Sacramento River	0.257	0.251 (-0.023)	0.257 (0)	0.257 (0)	0.257 (0)	0.258 (0.004)	0.249 (-0.031)	0.249 (-0.031)
D	Lower San Joaquin River	0.185	0.184 (-0.005)	0.185 (0)	0.185 (0)	0.185 (0)	0.185 (0)	0.183 (-0.011)	0.185 (0)
D	NE Suisun	0.269	0.261 (-0.03)	0.269 (0)	0.269 (0)	0.265 (-0.015)	0.262 (-0.026)	0.307 (0.141)	0.265 (-0.015)
D	NW Suisun	0.237	0.242 (0.021)	0.237 (0)	0.237 (0)	0.235 (-0.008)	0.235 (-0.008)	0.254 (0.072)	0.244 (0.03)

WYT	Region	NAA	Alt1	Alt2wTUCPwoVA	Alt2woTUCPwoVA	Alt2woTUCPDeltaVA	Alt2woTUCPAllVA	Alt3	Alt4
D	SE Suisun	0.176	0.172 (-0.023)	0.176 (0)	0.176 (0)	0.174 (-0.011)	0.173 (-0.017)	0.201 (0.142)	0.174 (-0.011)
D	SW Suisun	0.106	0.116 (0.094)	0.106 (0)	0.106 (0)	0.106 (0)	0.106 (0)	0.118 (0.113)	0.116 (0.094)
D	Sacramento River	0.165	0.163 (-0.012)	0.165 (0)	0.165 (0)	0.167 (0.012)	0.166 (0.006)	0.201 (0.218)	0.168 (0.018)
D	South Delta	0.168	0.167 (-0.006)	0.168 (0)	0.168 (0)	0.168 (0)	0.168 (0)	0.168 (0)	0.168 (0)
D	Suisun Marsh	0.340	0.272 (-0.2)	0.337 (-0.009)	0.335 (-0.015)	0.338 (-0.006)	0.345 (0.015)	0.381 (0.121)	0.298 (-0.124)
D	Yolo Bypass	0.232	0.221 (-0.047)	0.234 (0.009)	0.232 (0)	0.227 (-0.022)	0.23 (-0.009)	0.221 (-0.047)	0.22 (-0.052)
D	SummerFall	0.273	0.254 (-0.07)	0.272 (-0.004)	0.272 (-0.004)	0.272 (-0.004)	0.274 (0.004)	0.288 (0.055)	0.258 (-0.055)
D	Delta	0.212	0.205 (-0.033)	0.212 (0)	0.212 (0)	0.211 (-0.005)	0.212 (0)	0.226 (0.066)	0.207 (-0.024)
W	Confluence	0.223	0.114 (-0.489)	0.223 (0)	0.223 (0)	0.223 (0)	0.224 (0.004)	0.221 (-0.009)	0.22 (-0.013)
W	East Delta	0.256	0.241 (-0.059)	0.256 (0)	0.256 (0)	0.256 (0)	0.255 (-0.004)	0.233 (-0.09)	0.257 (0.004)
W	Lower Sacramento River	0.267	0.21 (-0.213)	0.267 (0)	0.267 (0)	0.267 (0)	0.268 (0.004)	0.25 (-0.064)	0.26 (-0.026)
W	Lower San Joaquin River	0.178	0.17 (-0.045)	0.178 (0)	0.178 (0)	0.178 (0)	0.177 (-0.006)	0.175 (-0.017)	0.176 (-0.011)
W	NE Suisun	0.161	0.104 (-0.354)	0.16 (-0.006)	0.16 (-0.006)	0.16 (-0.006)	0.16 (-0.006)	0.133 (-0.174)	0.128 (-0.205)
W	NW Suisun	0.113	0.112 (-0.009)	0.112 (-0.009)	0.111 (-0.018)	0.112 (-0.009)	0.112 (-0.009)	0.109 (-0.035)	0.111 (-0.018)
W	SE Suisun	0.106	0.062 (-0.415)	0.106 (0)	0.106 (0)	0.106 (0)	0.106 (0)	0.094 (-0.113)	0.088 (-0.17)
W	SW Suisun	0.058	0.065 (0.121)	0.058 (0)	0.058 (0)	0.058 (0)	0.058 (0)	0.063 (0.086)	0.063 (0.086)
W	Sacramento River	0.332	0.319 (-0.039)	0.332 (0)	0.331 (-0.003)	0.332 (0)	0.332 (0)	0.315 (-0.051)	0.331 (-0.003)
W	South Delta	0.180	0.178 (-0.011)	0.181 (0.006)	0.181 (0.006)	0.181 (0.006)	0.181 (0.006)	0.176 (-0.022)	0.18 (0)
W	Suisun Marsh	0.216	0.155 (-0.282)	0.214 (-0.009)	0.212 (-0.019)	0.214 (-0.009)	0.214 (-0.009)	0.215 (-0.005)	0.214 (-0.009)
W	Yolo Bypass	0.229	0.225 (-0.017)	0.229 (0)	0.229 (0)	0.229 (0)	0.229 (0)	0.229 (0)	0.23 (0.004)
W	SummerFall	0.205	0.148 (-0.278)	0.204 (-0.005)	0.203 (-0.01)	0.204 (-0.005)	0.204 (-0.005)	0.199 (-0.029)	0.201 (-0.02)
W	Delta	0.193	0.163 (-0.155)	0.193 (0)	0.193 (0)	0.193 (0)	0.193 (0)	0.184 (-0.047)	0.188 (-0.026)

K.1.3.4 Delta

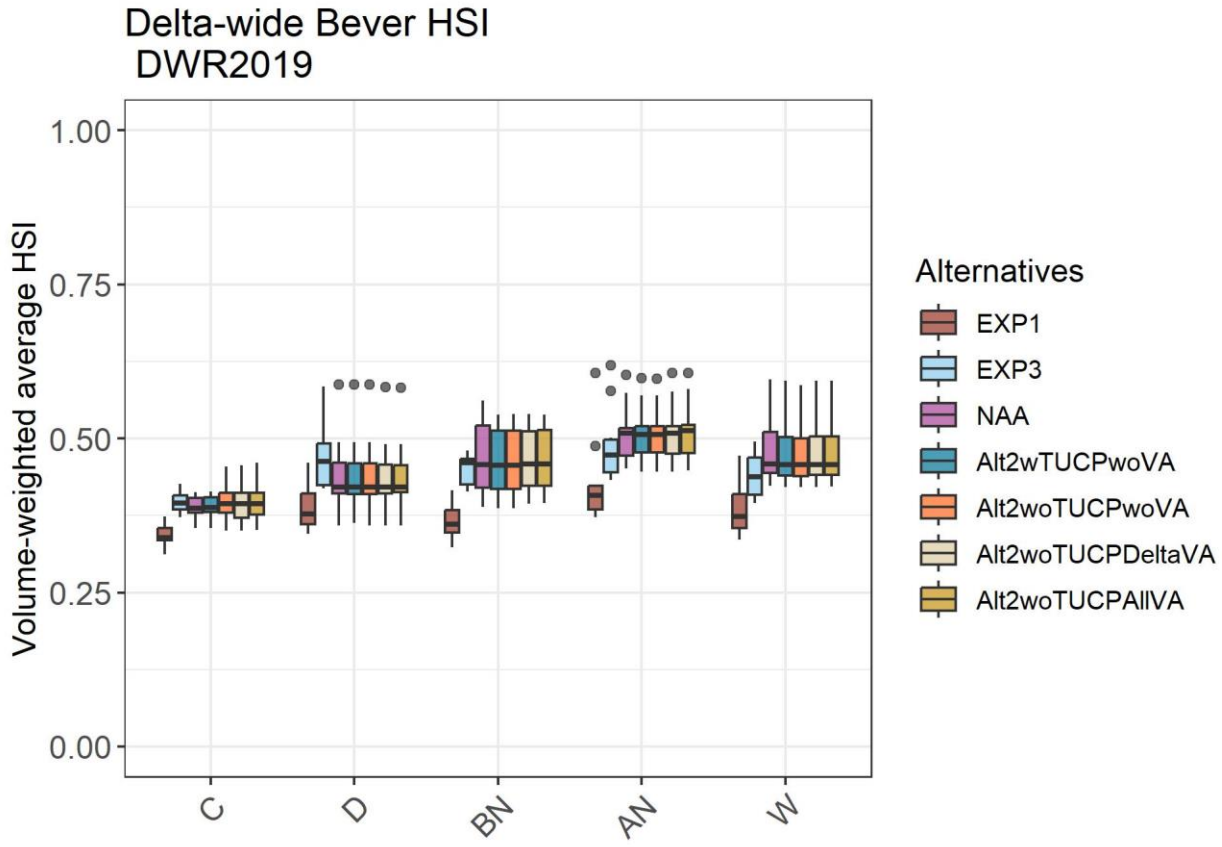

Figure K.1-53. Bever et al. (2016) Delta-wide habitat suitability indices for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA).

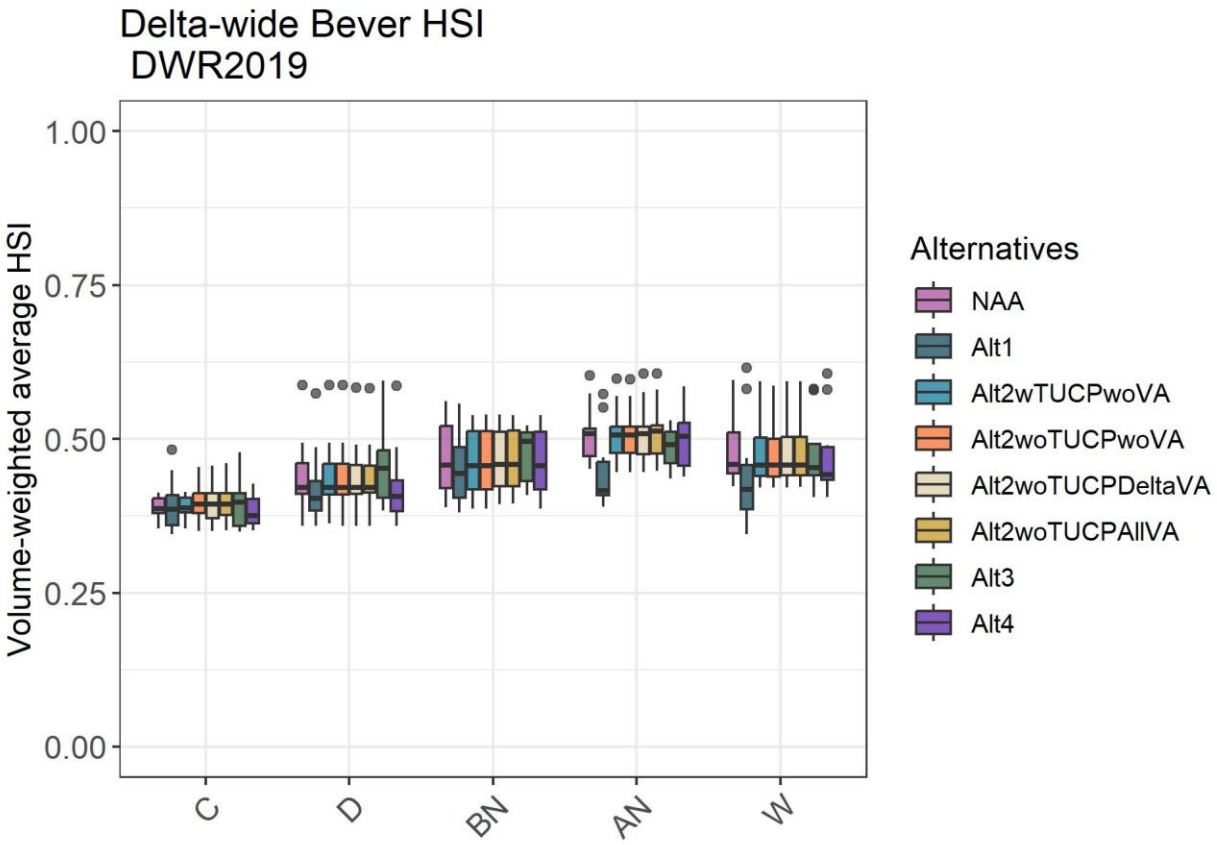

Figure K.1-54. Bever et al. (2016) Delta-wide habitat suitability indices for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt 4).

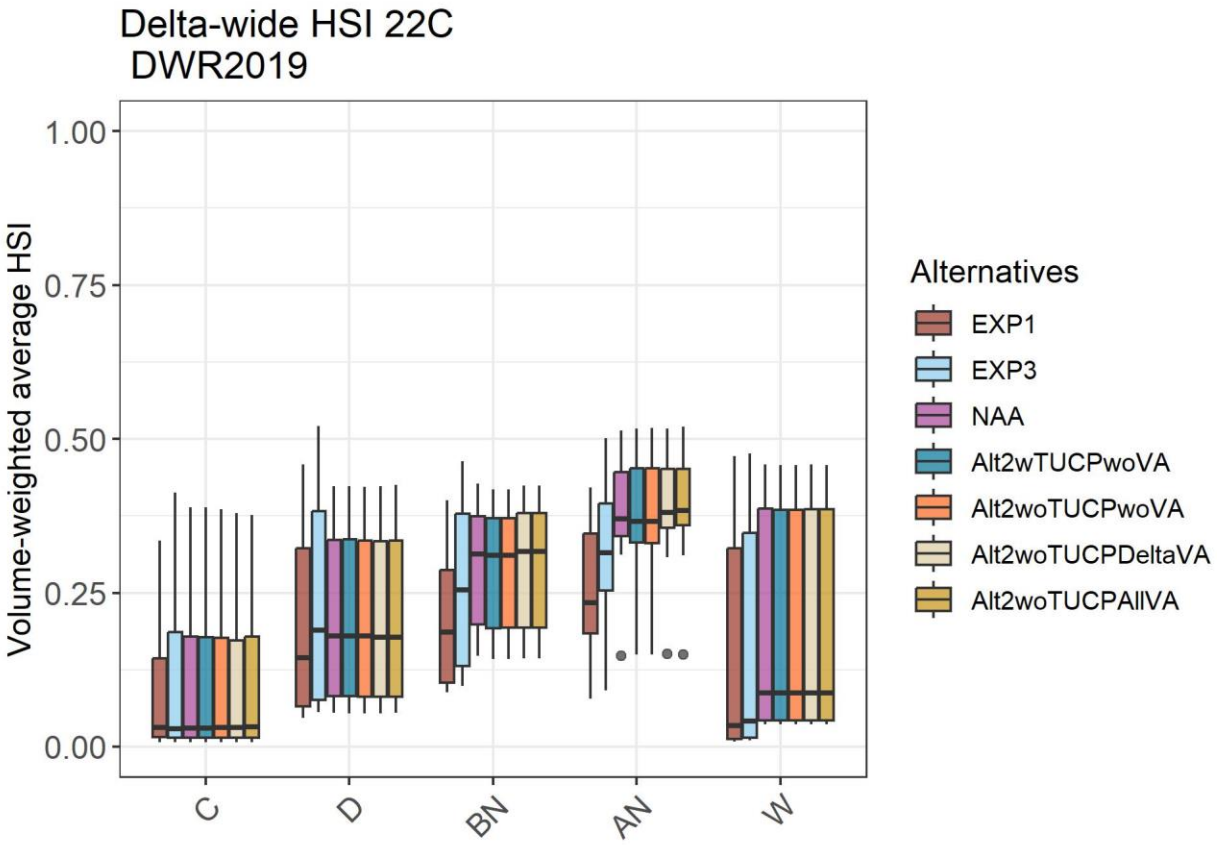

Figure K.1-55. Bever et al. (2016) Delta-wide habitat suitability indices modified by a 22-degree Celsius threshold for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA).

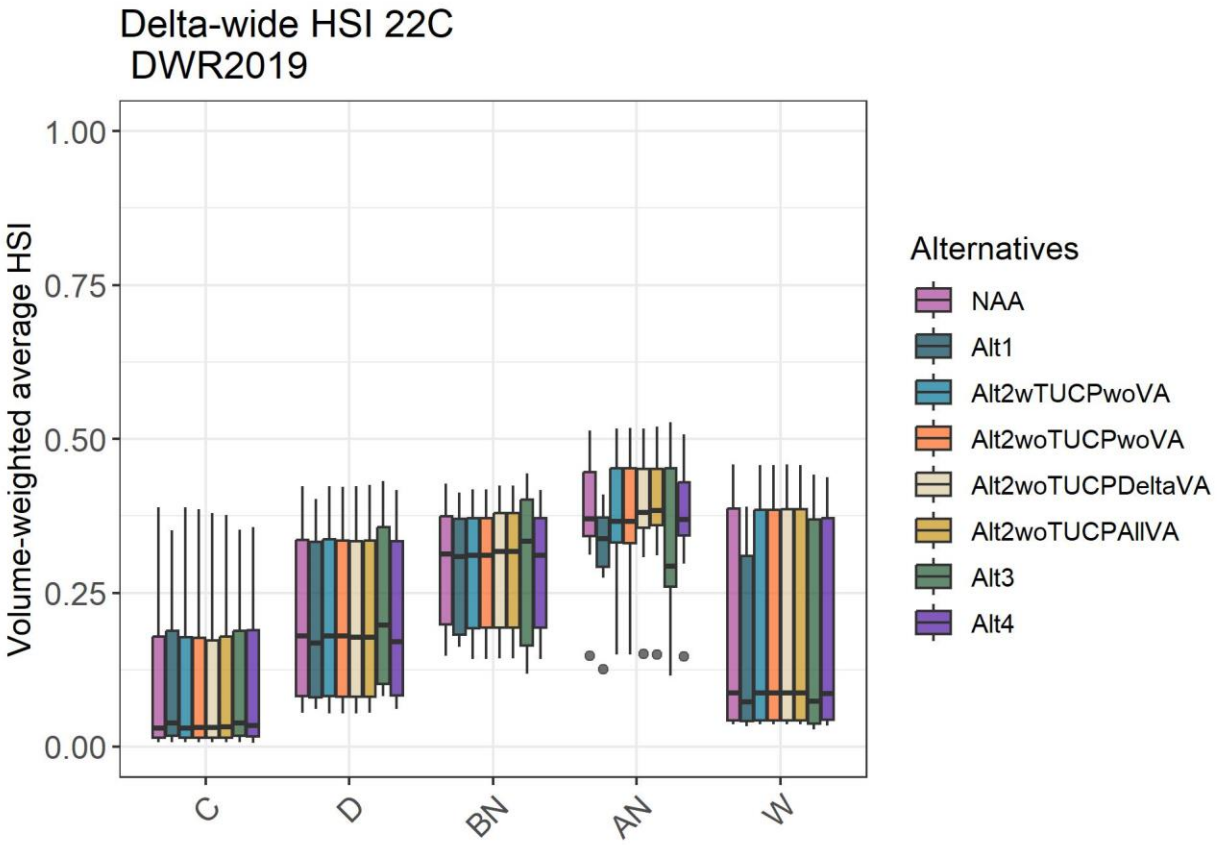

Figure K.1-56. Bever et al. (2016) Delta-wide habitat suitability indices modified by a 22-degree Celsius threshold for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4).

K.1.3.5 Summer-fall habitat arc

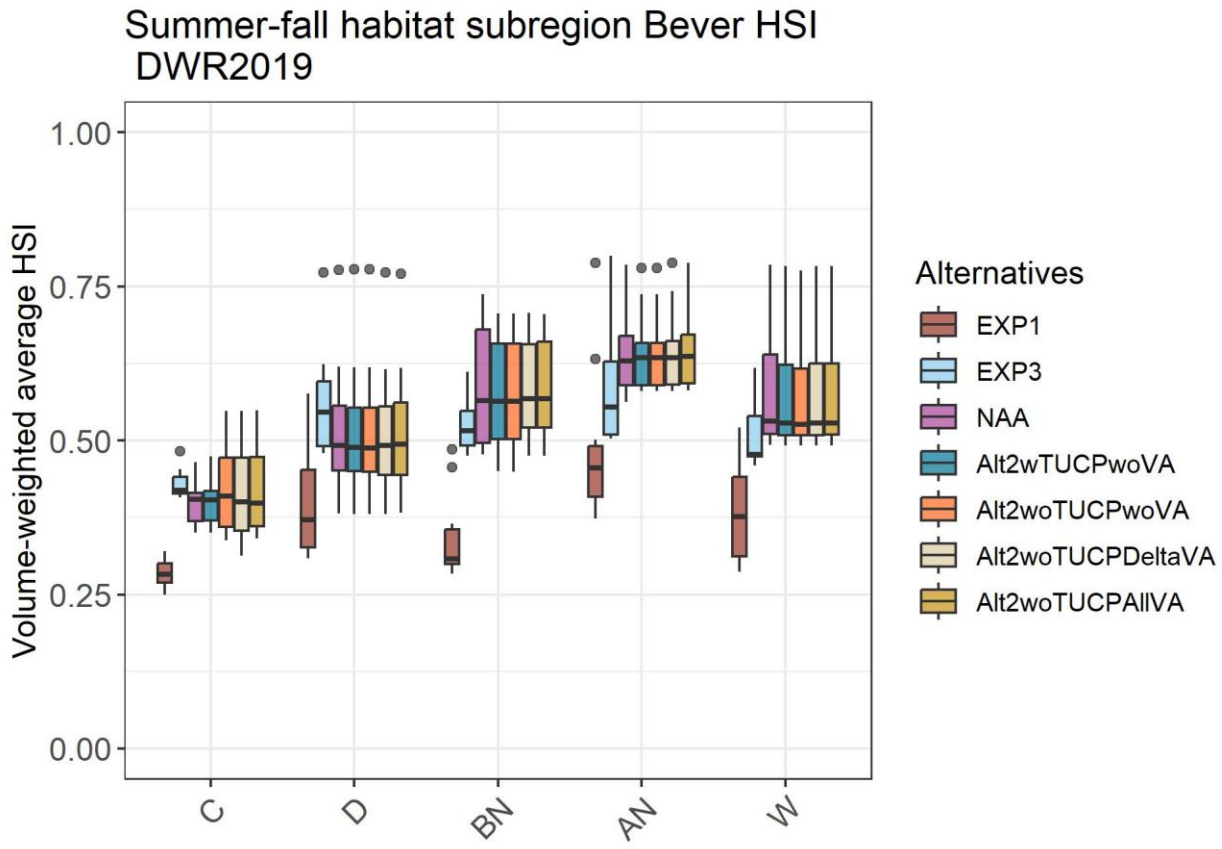

Figure K.1-57. Bever et al. (2016) habitat suitability indices in the summer and fall habitat arc for each alternative and water year type for July 1 – November 18. The arc includes subregions Confluence, Lower Sacramento River, northwest Suisun Bay, and Suisun Marsh. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA), alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA).

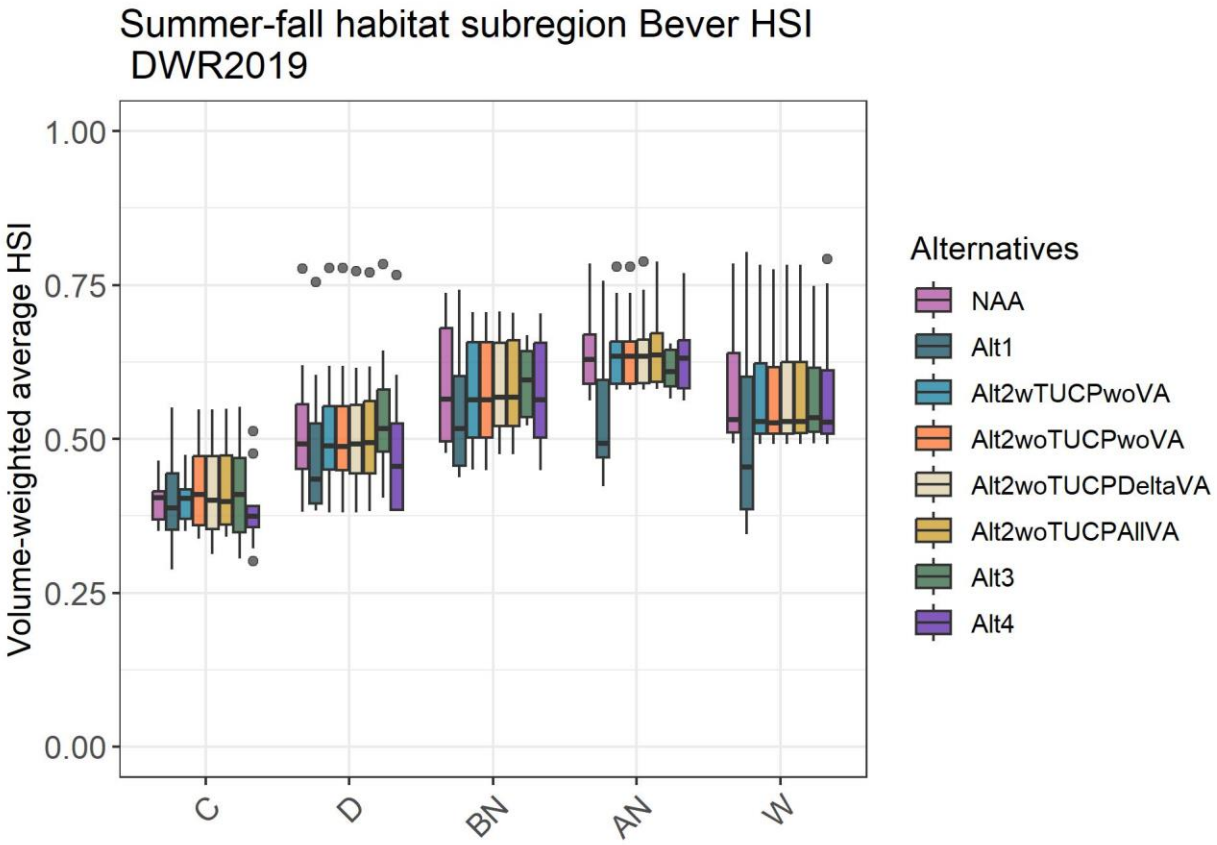

Figure K.1-58. Bever et al. (2016) habitat suitability indices in the summer and fall habitat arc for each alternative and water year type for July 1 – November 18. The arc includes subregions Confluence, Lower Sacramento River, northwest Suisun Bay, and Suisun Marsh. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4).

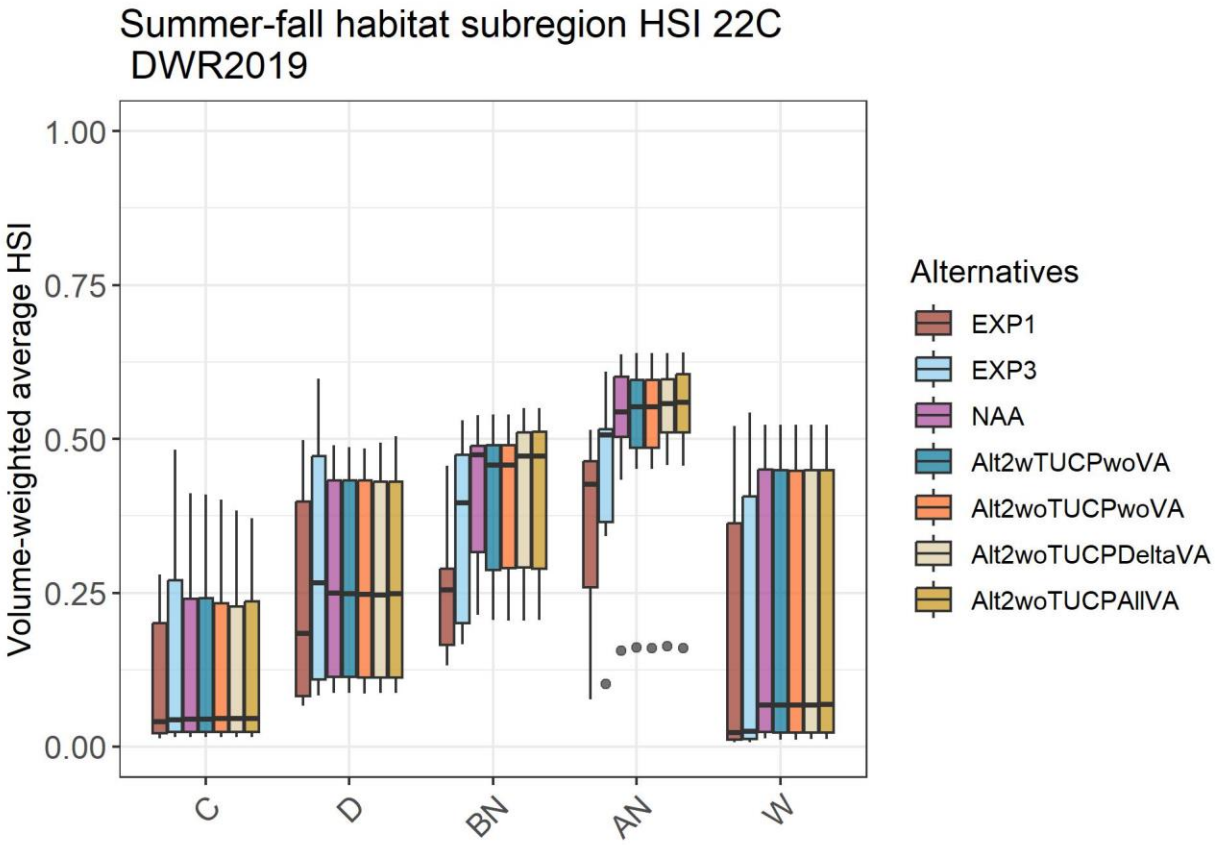

Figure K.1-59. Bever et al. (2016) habitat suitability indices modified by a 22-degree Celsius threshold in the summer and fall habitat arc for each alternative and water year type for July 1 – November 18. The arc includes subregions Confluence, Lower Sacramento River, northwest Suisun Bay, and Suisun Marsh. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA).

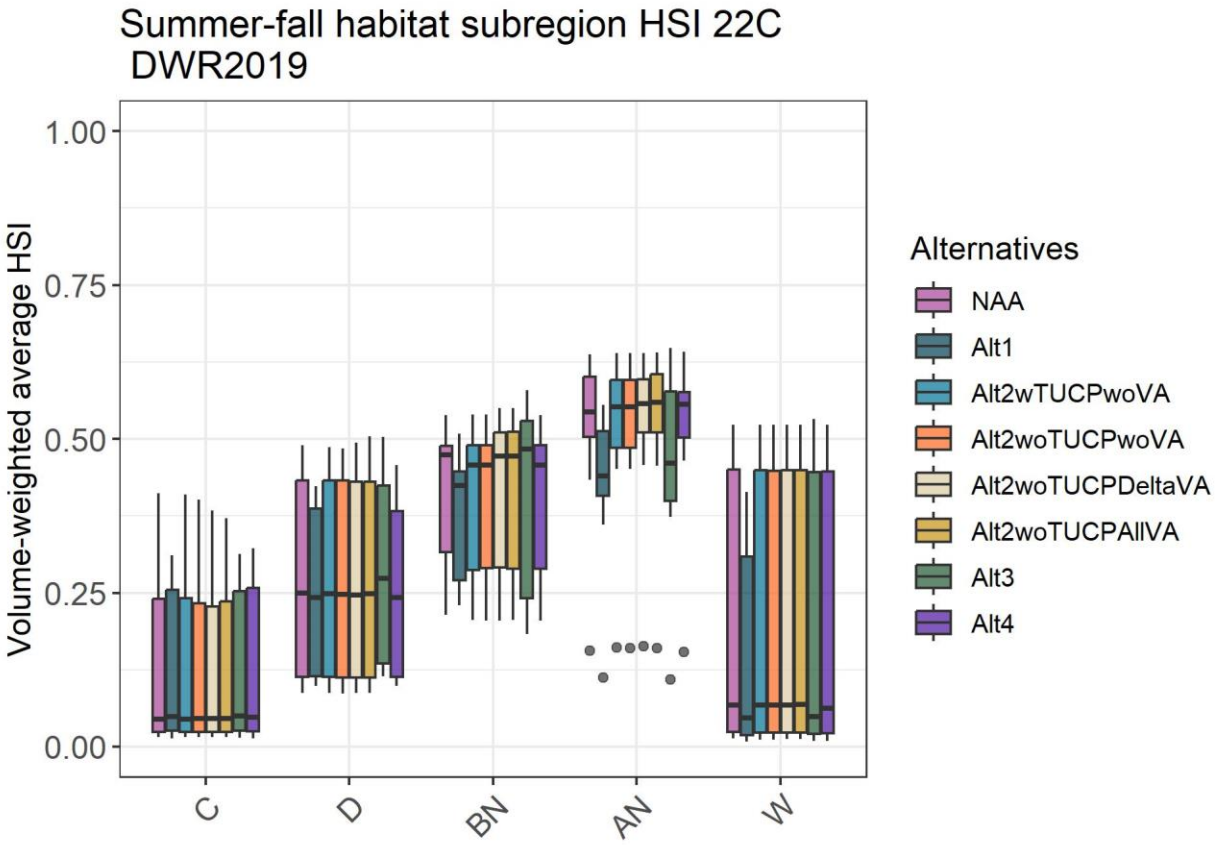

Figure K.1-60. Bever et al. (2016) habitat suitability indices modified by a 22-degree Celsius threshold in the summer and fall habitat arc for each alternative and water year type for July 1 – November 18. The arc includes subregions Confluence, Lower Sacramento River, northwest Suisun Bay, and Suisun Marsh. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. Water year types presented from left to right are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W). The alternatives, from left to right for each water year type are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4).

K.1.3.6 Subregions

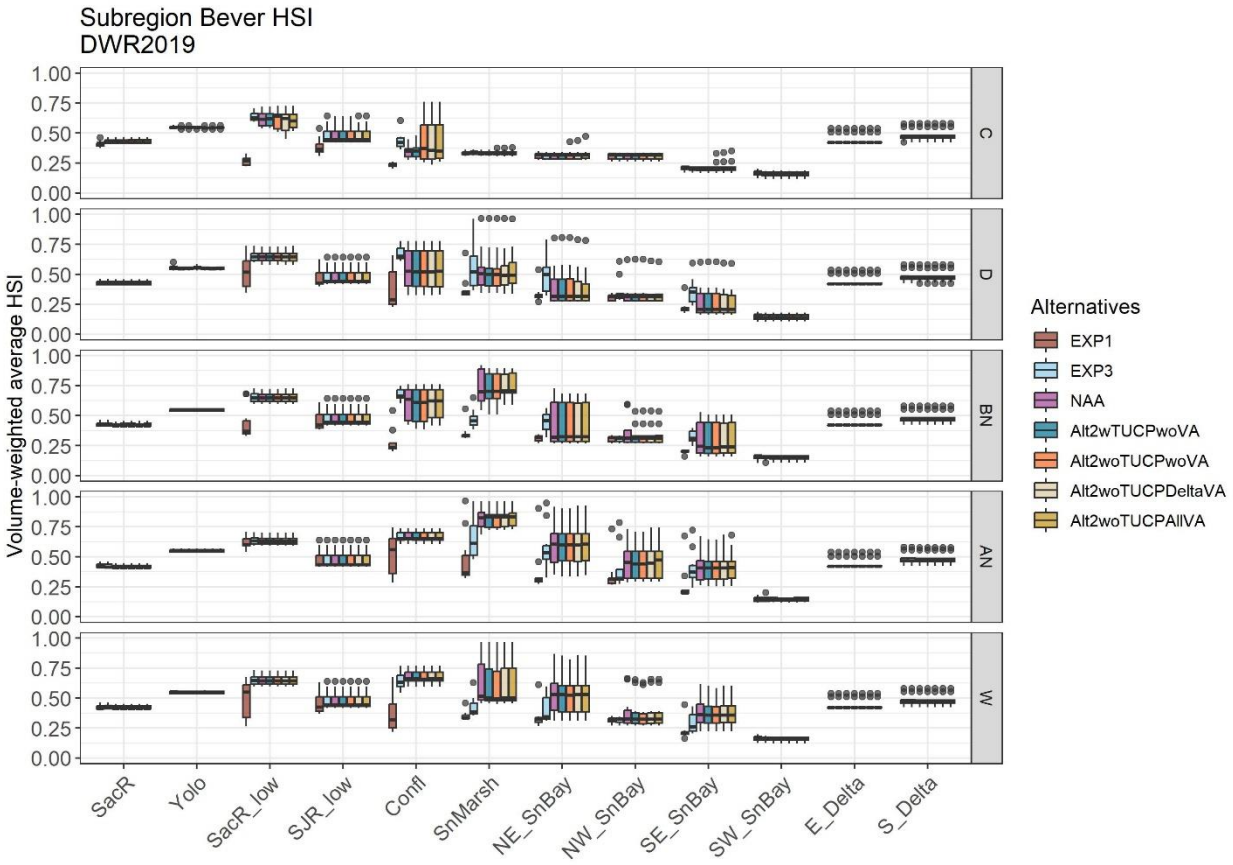

Figure K.1-61. Bever et al. (2016) habitat suitability indices for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

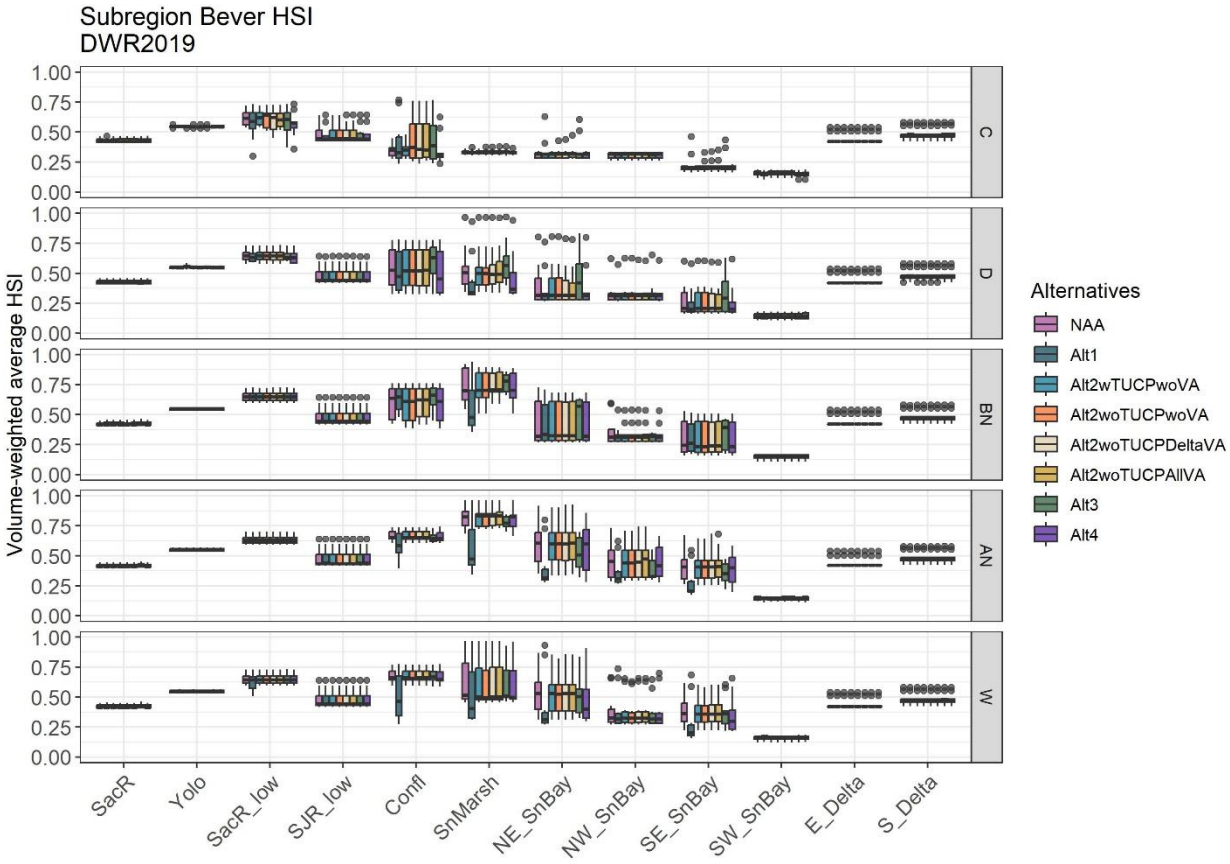

Figure K.1-62. Bever et al. (2016) habitat suitability indices for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

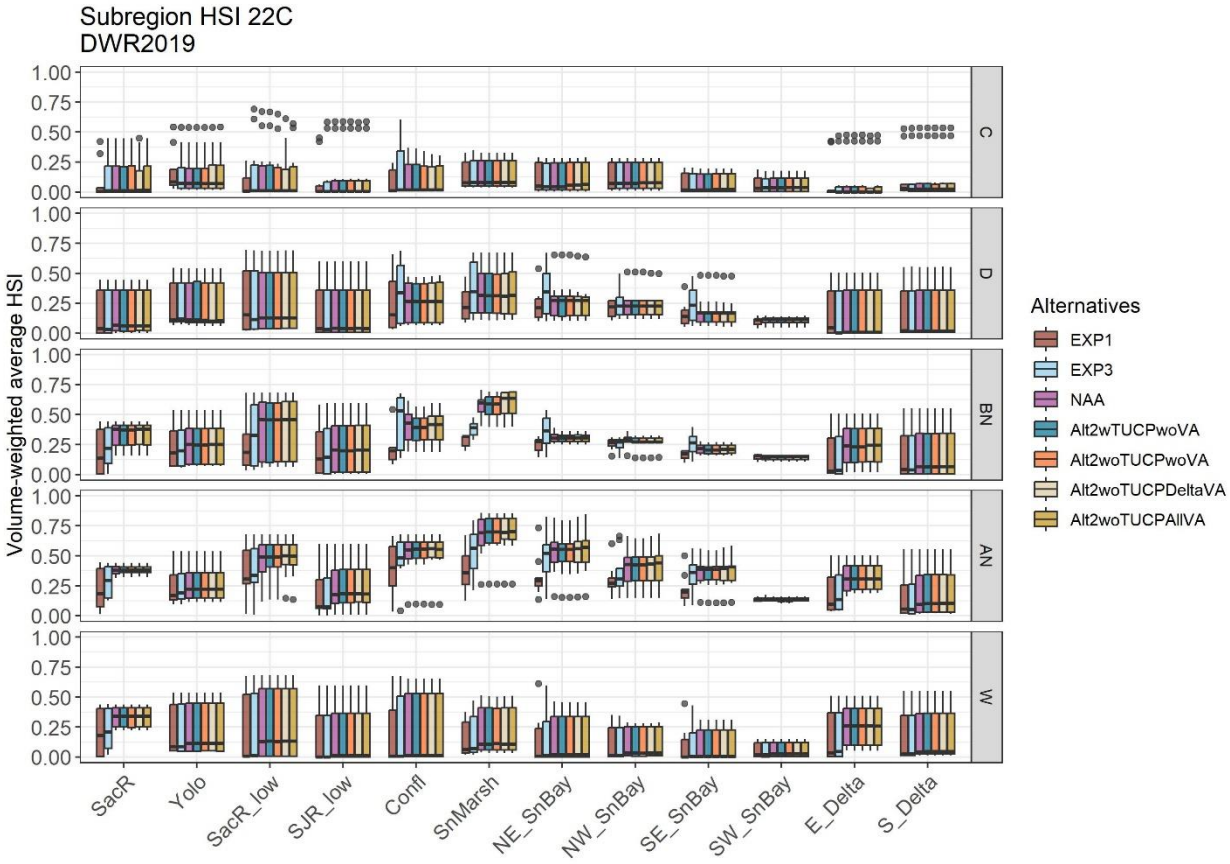

Figure K.1-63. Bever et al. (2016) habitat suitability indices modified by a 22-degree Celsius threshold for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: exploratory 1 (EXP1); exploratory 3 (EXP3); no action alternative (NAA); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

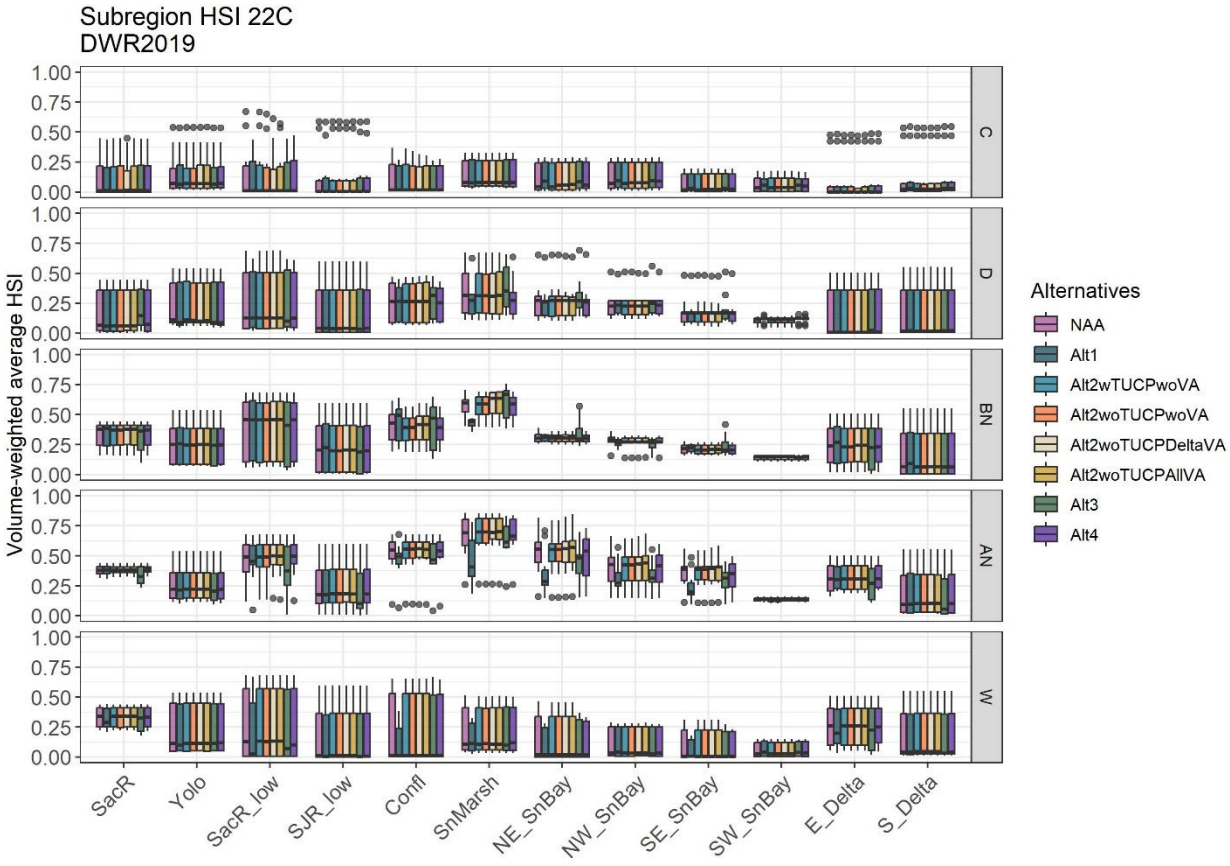

Figure K.1-64. Bever et al. (2016) habitat suitability indices modified by a 22-degree Celsius threshold for each alternative and water year type for July 1 – November 18. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The alternatives, from left to right are: no action alternative (NAA); alternative 1 (Alt1); alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2wTUCPwoVA); alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2woTUCPwoVA); alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2woTUCPDeltaVA); alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2woTUCPAllVA); alternative 3 (Alt3); alternative 4 (Alt4). Water year types presented from top to bottom panels are: critical (C); dry (D); below normal (BN); above normal (AN); wet (W).

K.1.3.7 Abiotic conditions and HSI estimates for each alternative and water year type

K.1.3.7.1 1997 Wet Water Year

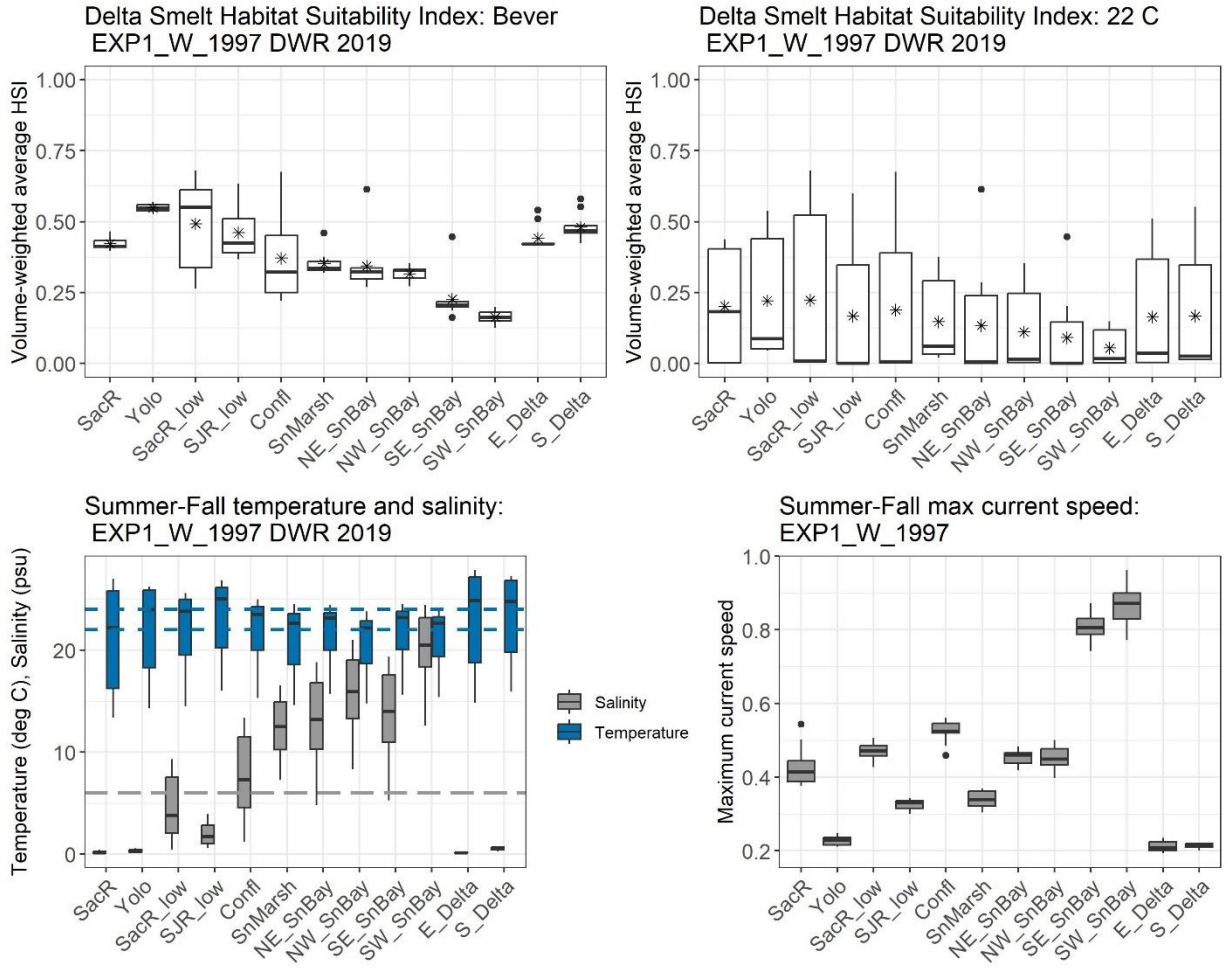

Figure K.1-65. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for the exploratory 1 (EXP1) alternative, using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

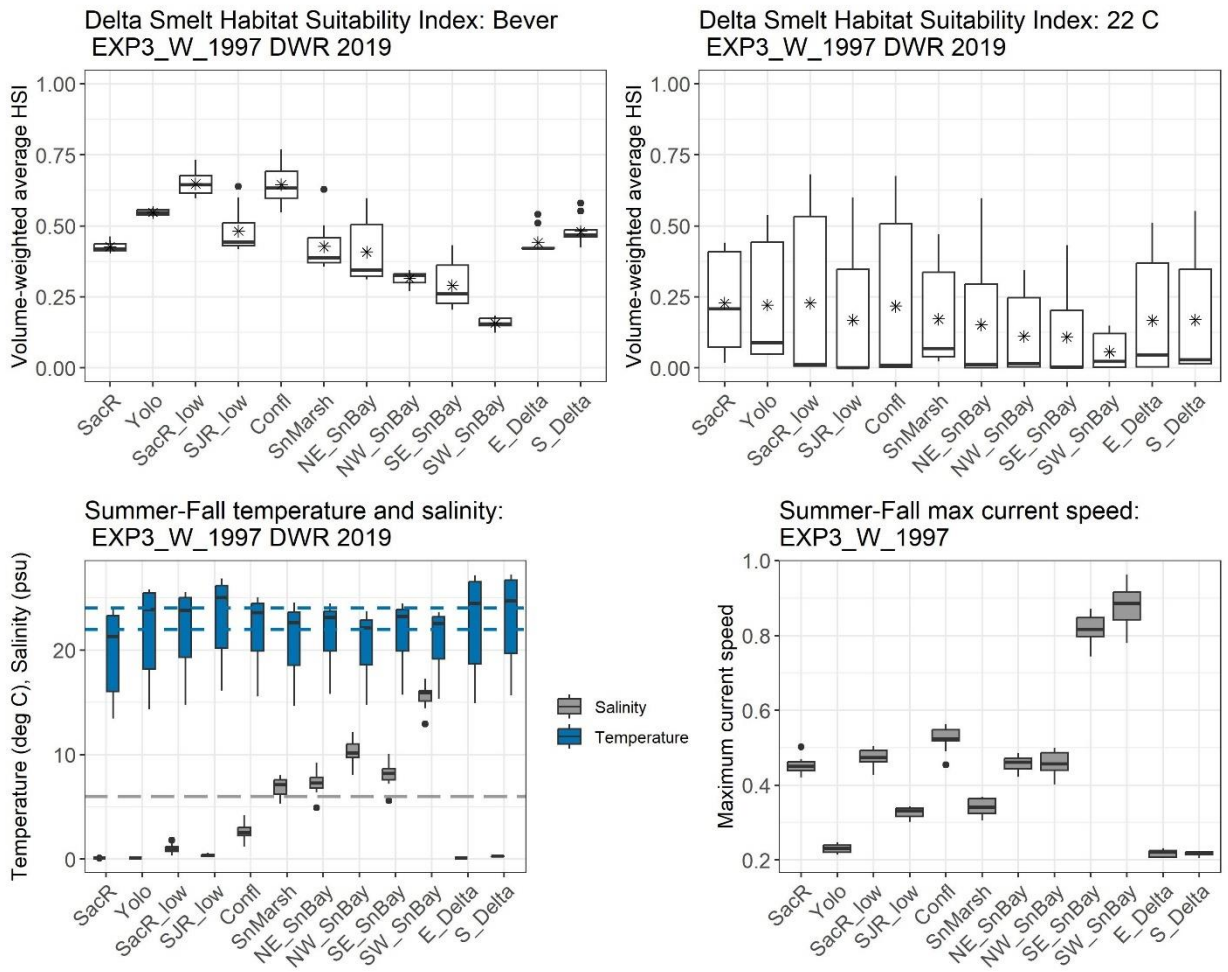

Figure K.1-66. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for the exploratory 3 (EXP3) alternative, using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

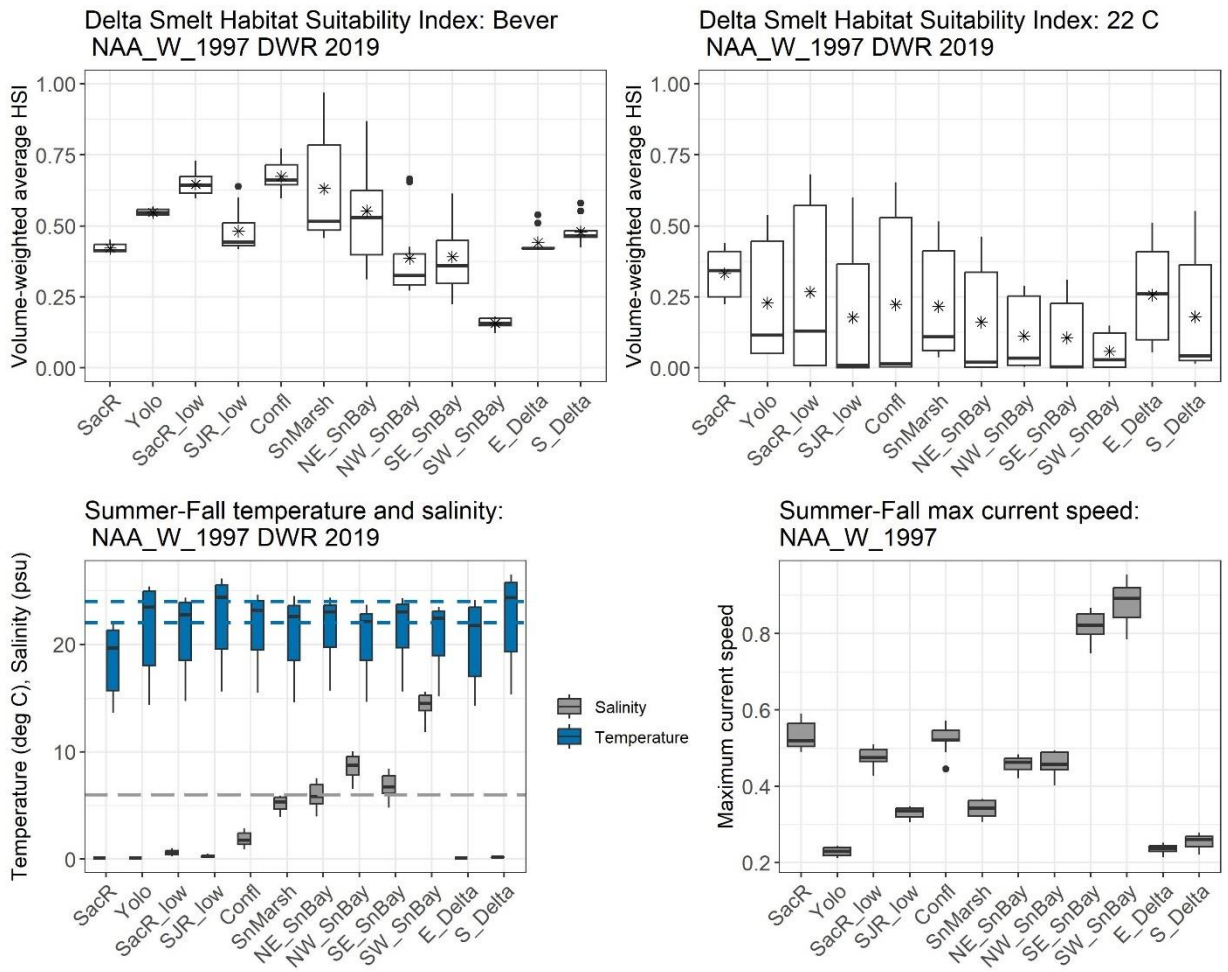

Figure K.1-67. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for the no action alternative (NAA), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

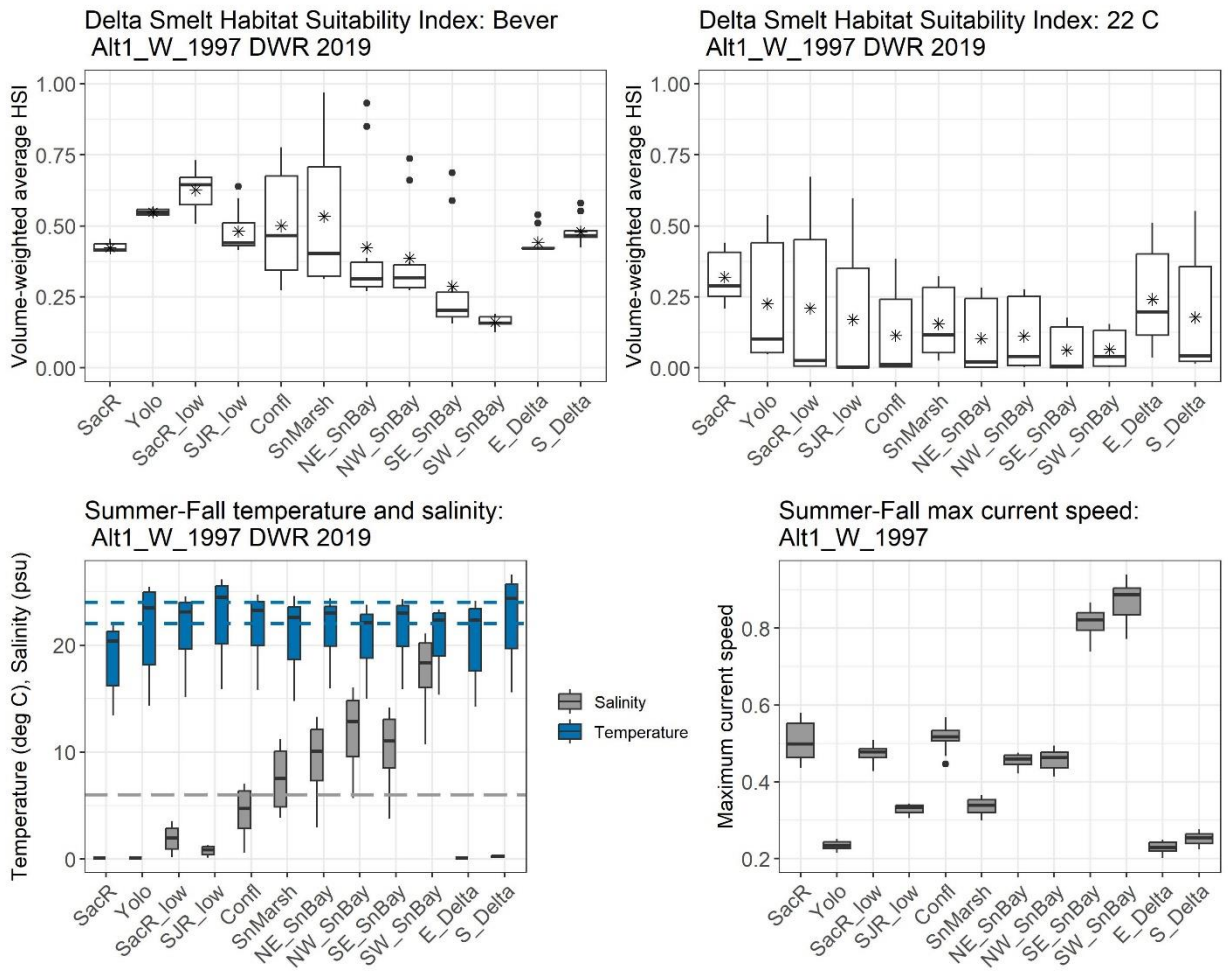

Figure K.1-68. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 1 (Alt1), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

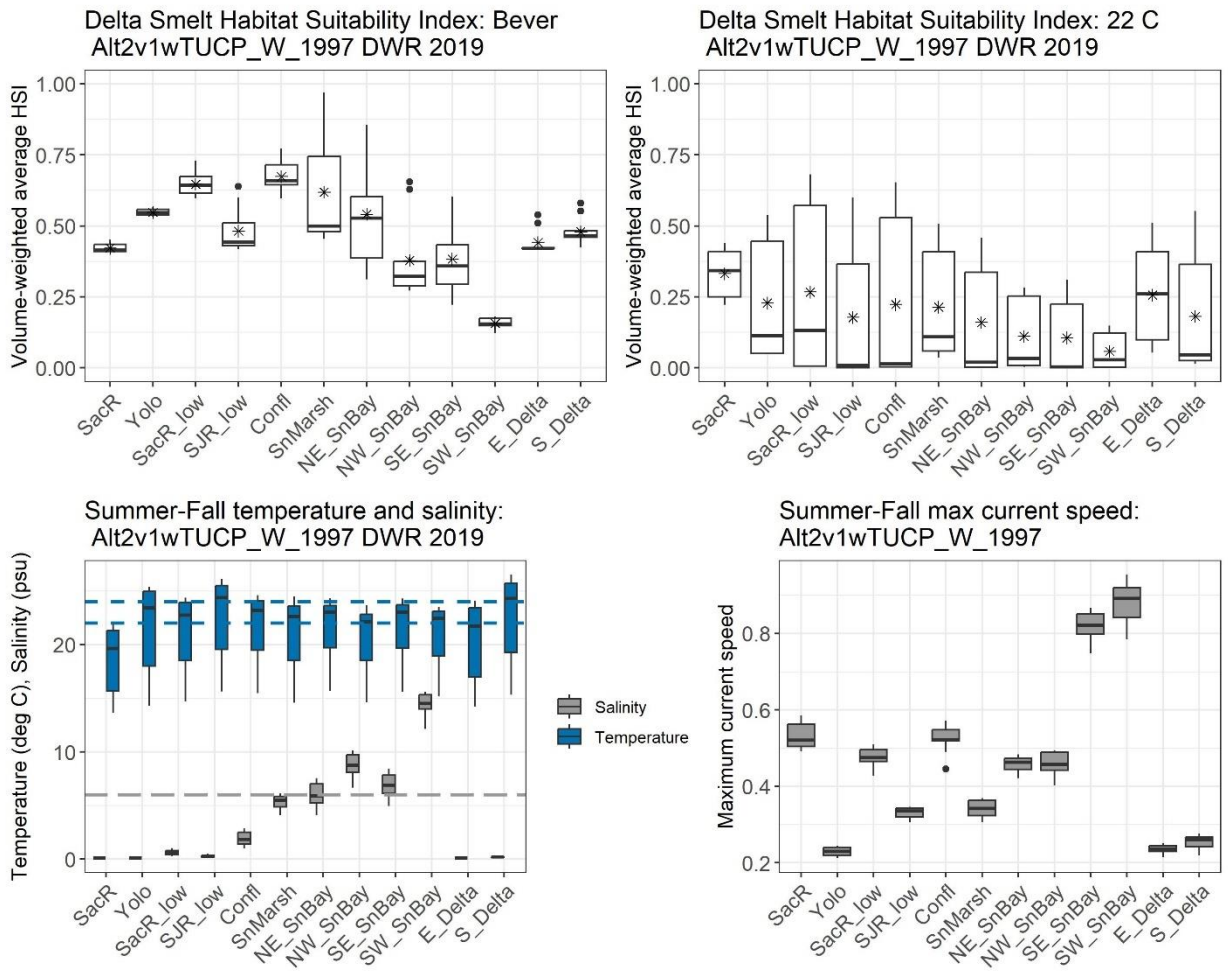

Figure K.1-69. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2v1wTUCP), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

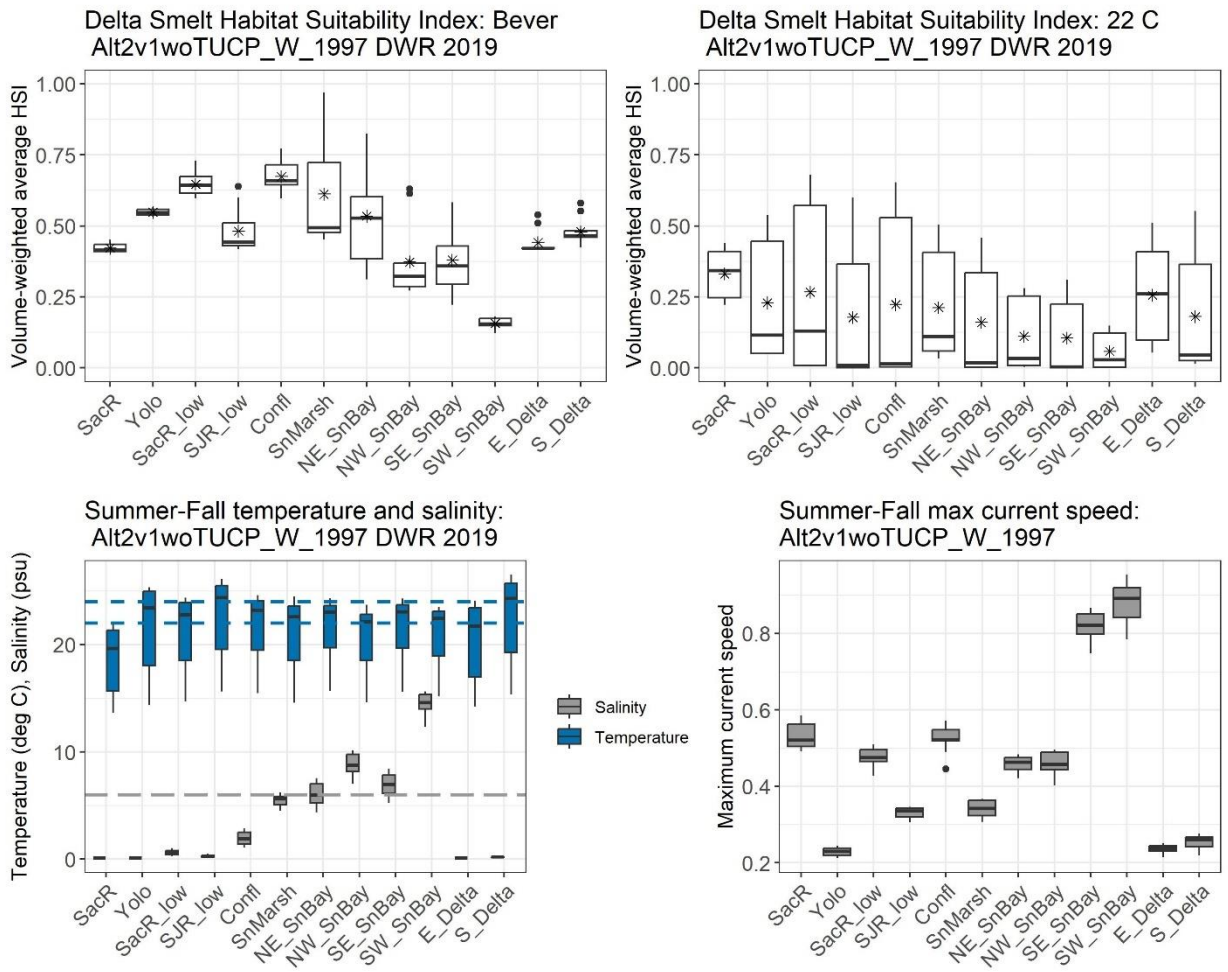

Figure K.1-70. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2v1woTUCP), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

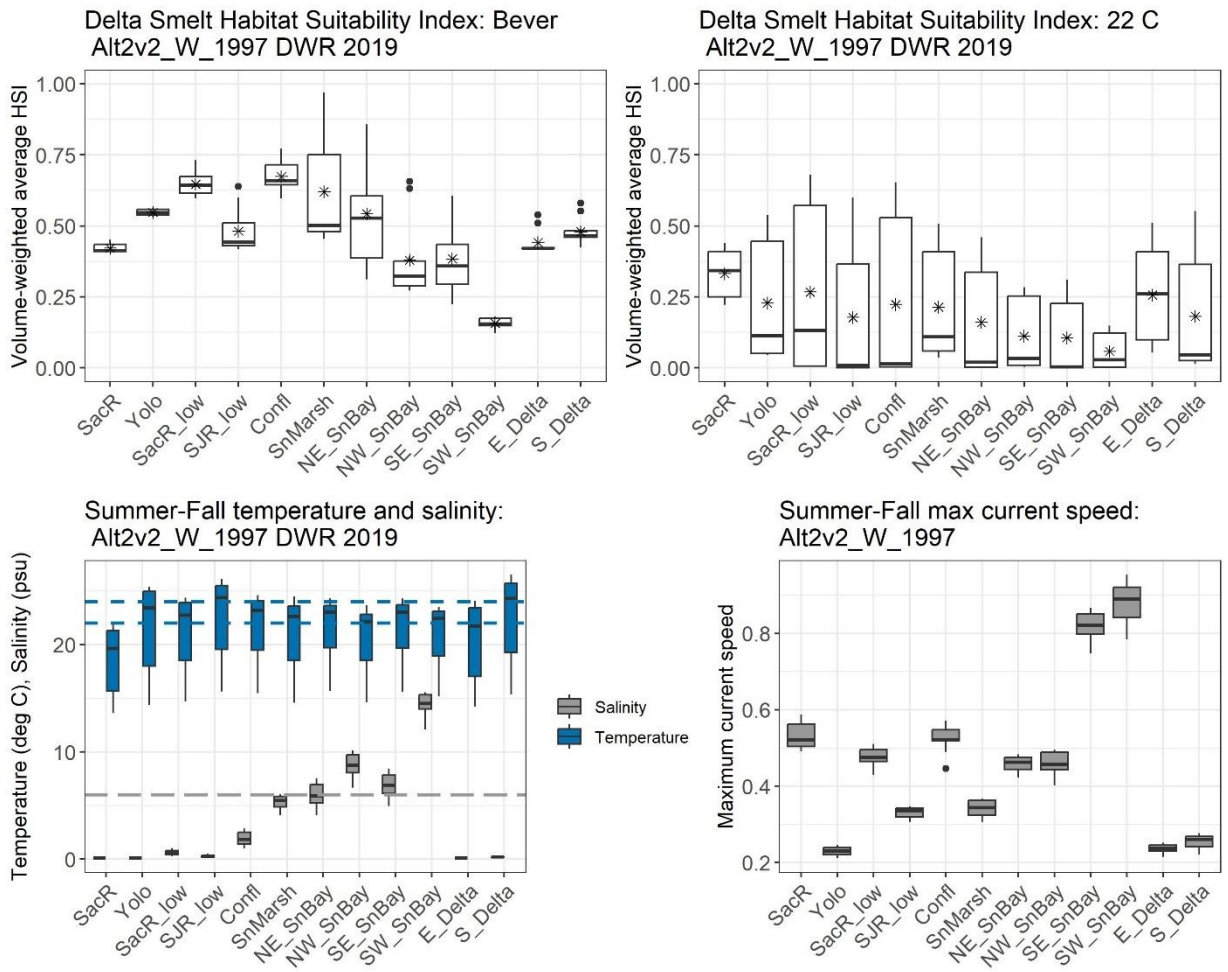

Figure K.1-71. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2v2), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

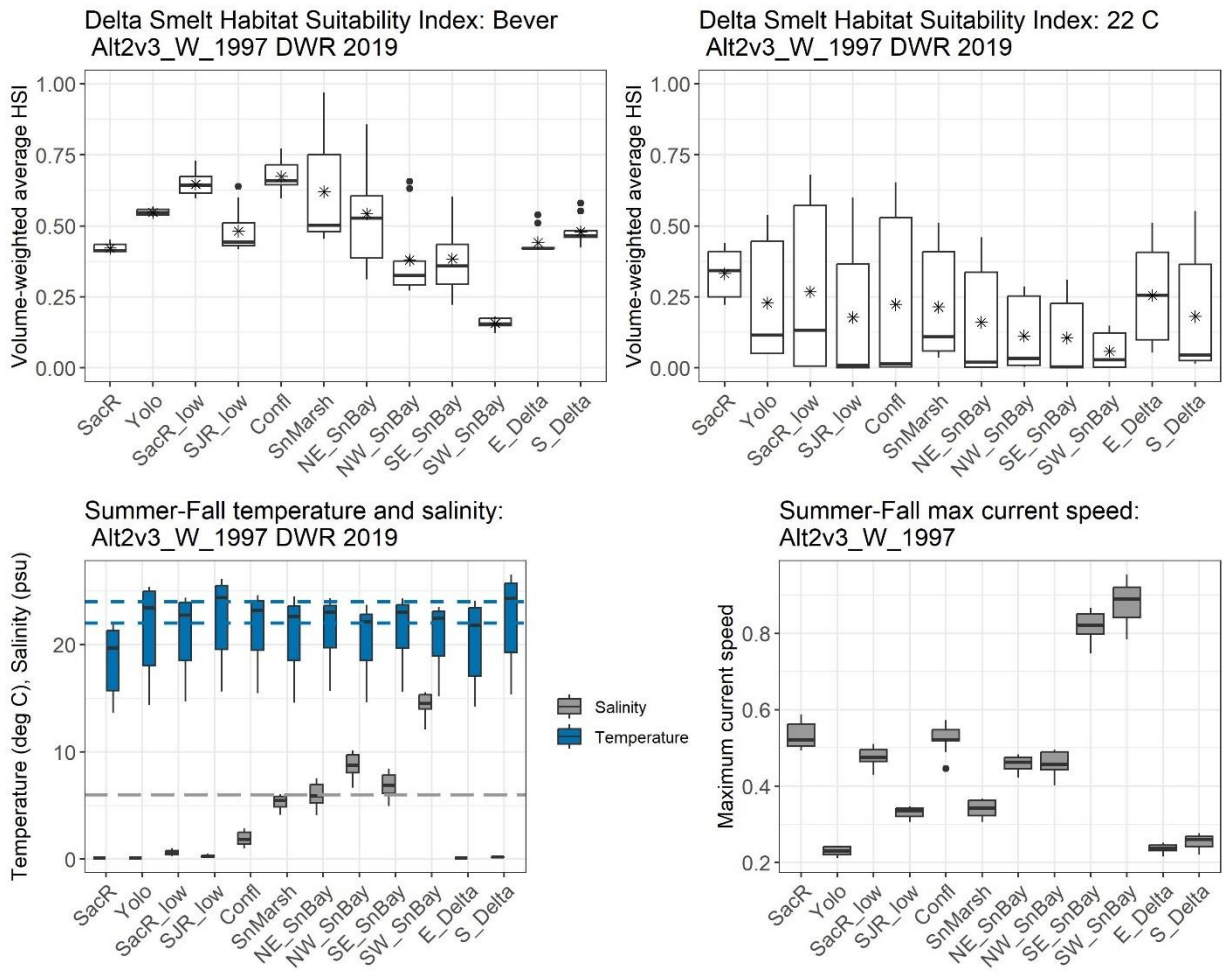

Figure K.1-72. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2v3), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

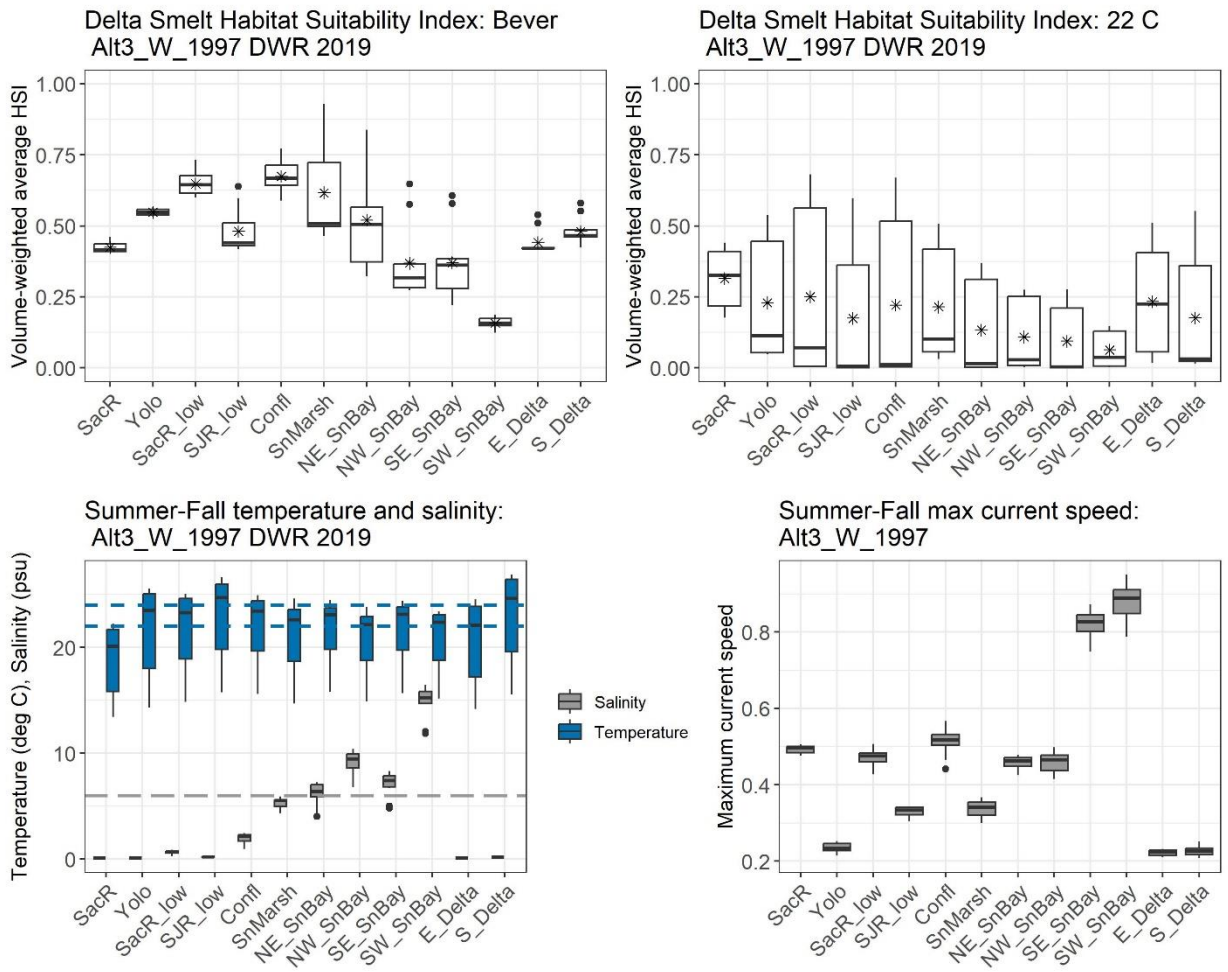

Figure K.1-73. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 3 (Alt3), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

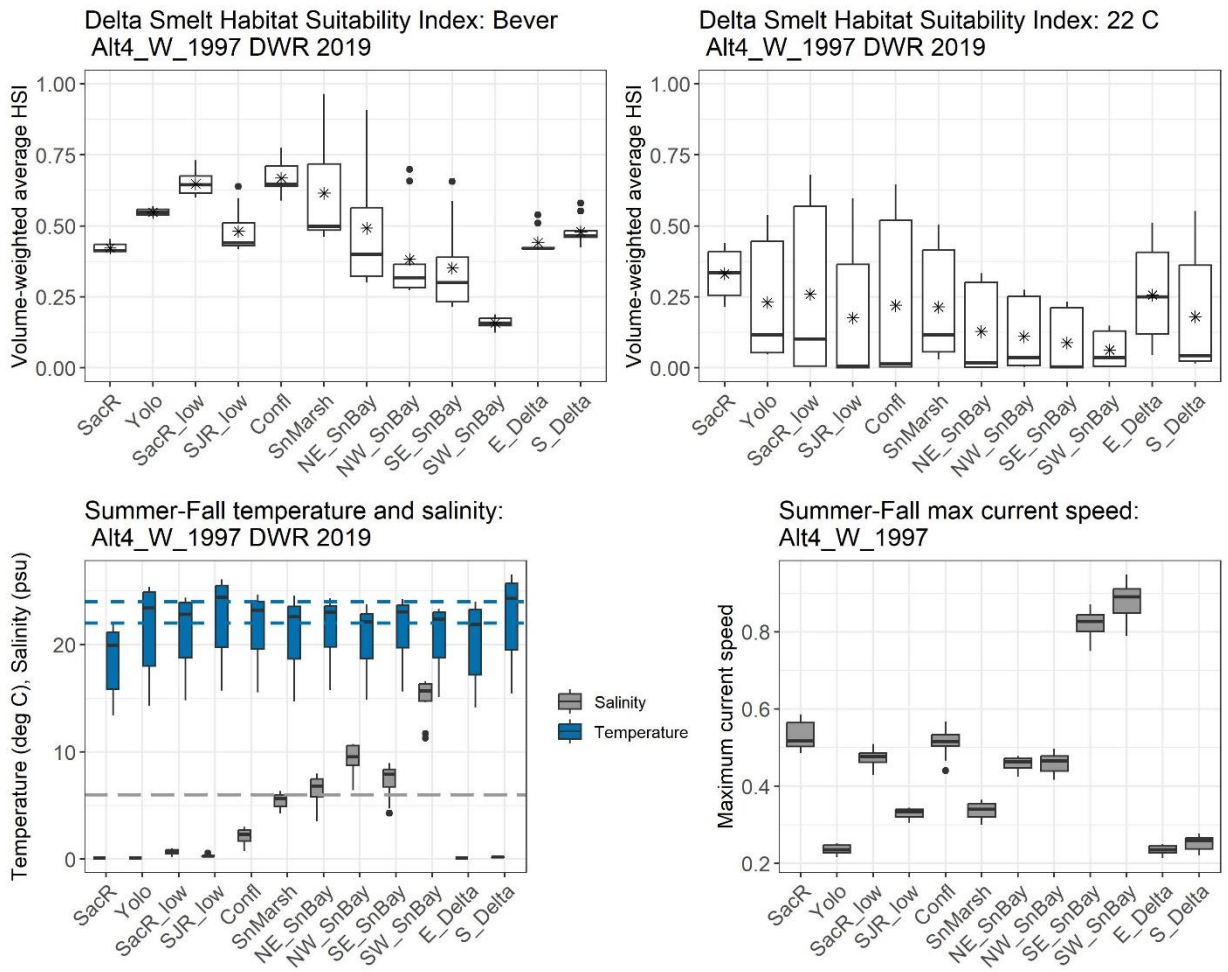

Figure K.1-74. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the wet water year (1997) are shown for alternative 4 (Alt4), using DWR 2019 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.3.7.2 1993 Above Normal Water Year

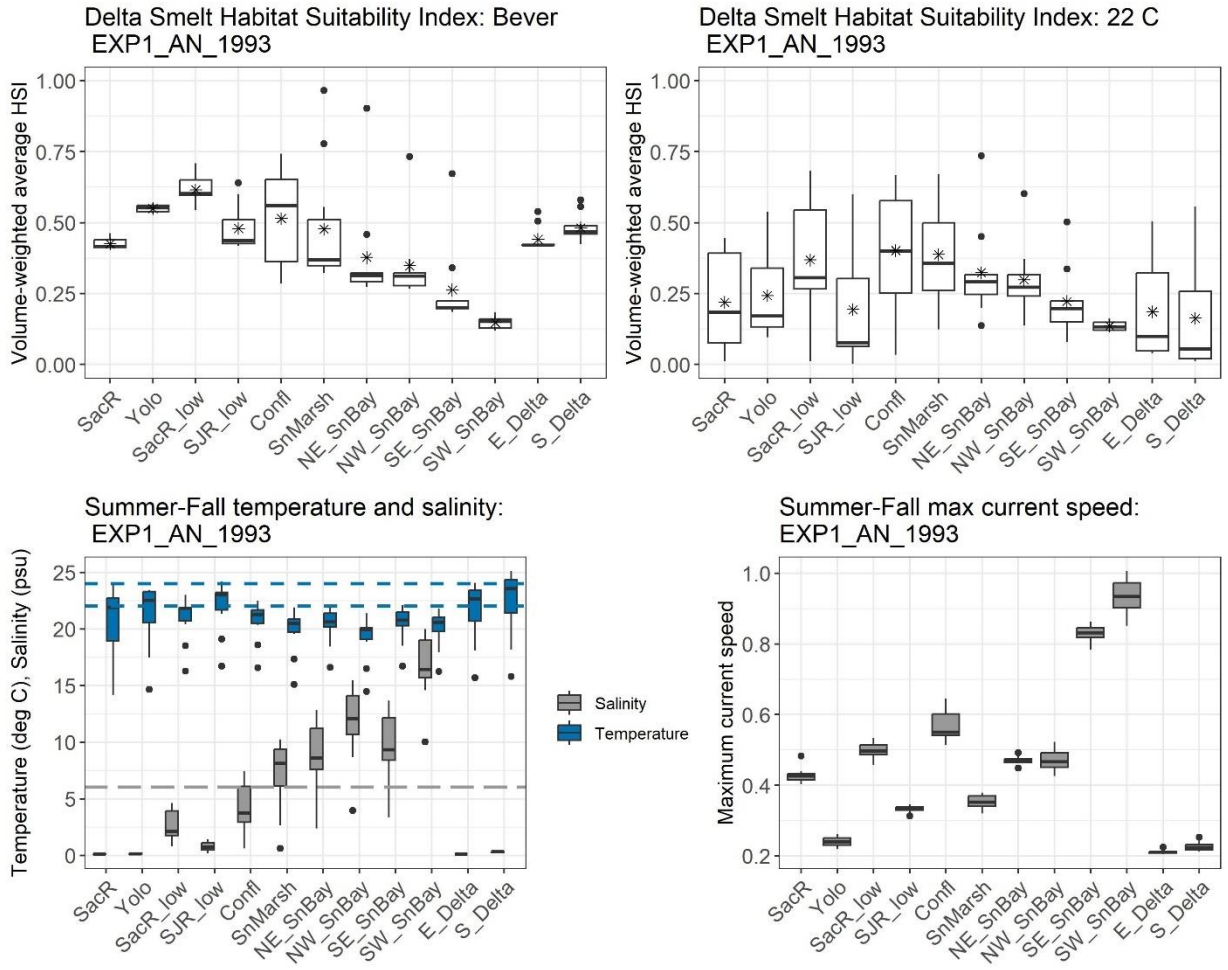

Figure K.1-75. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for exploratory 1 (EXP1), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

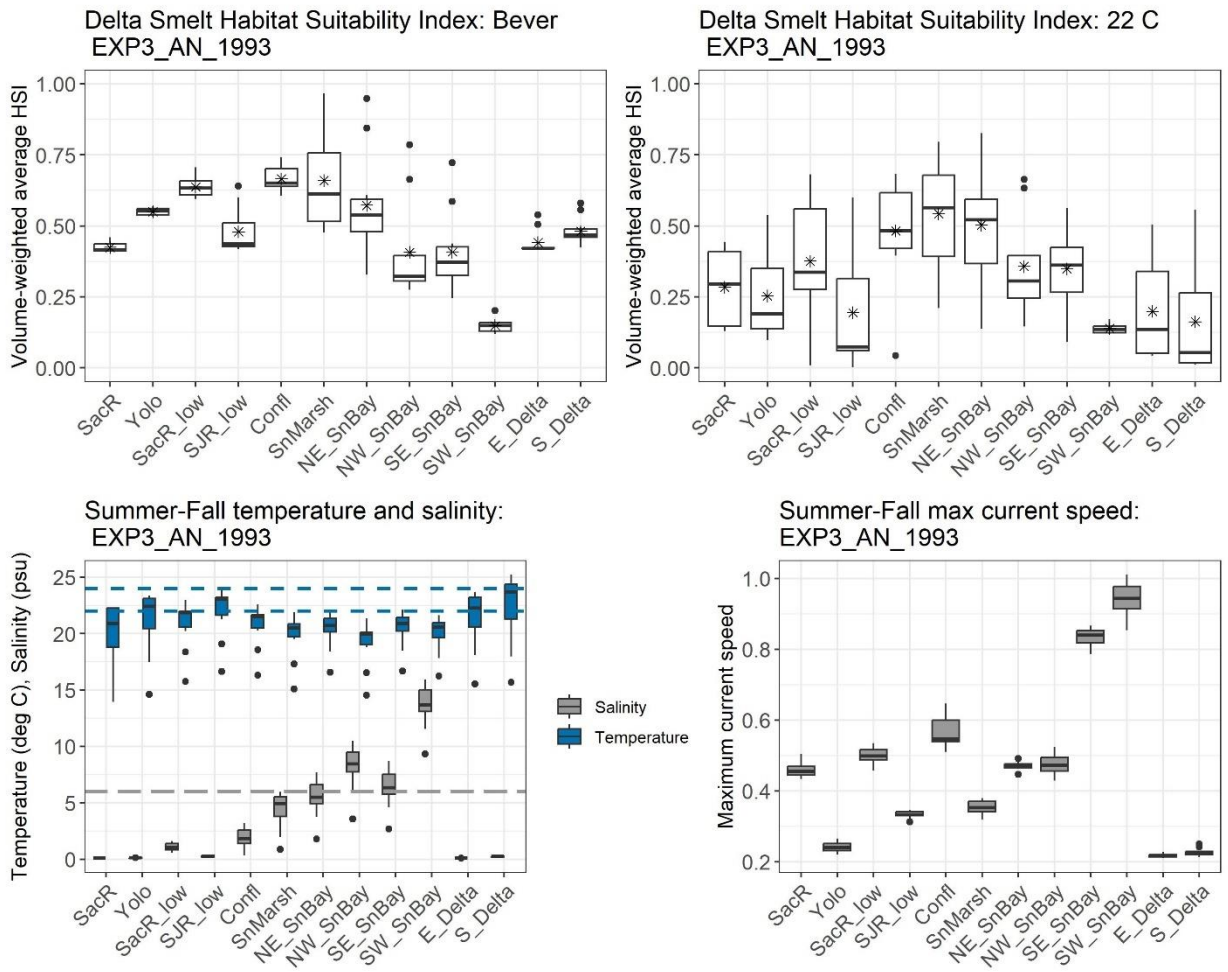

Figure K.1-76. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for exploratory 3 (EXP3), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HIS graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

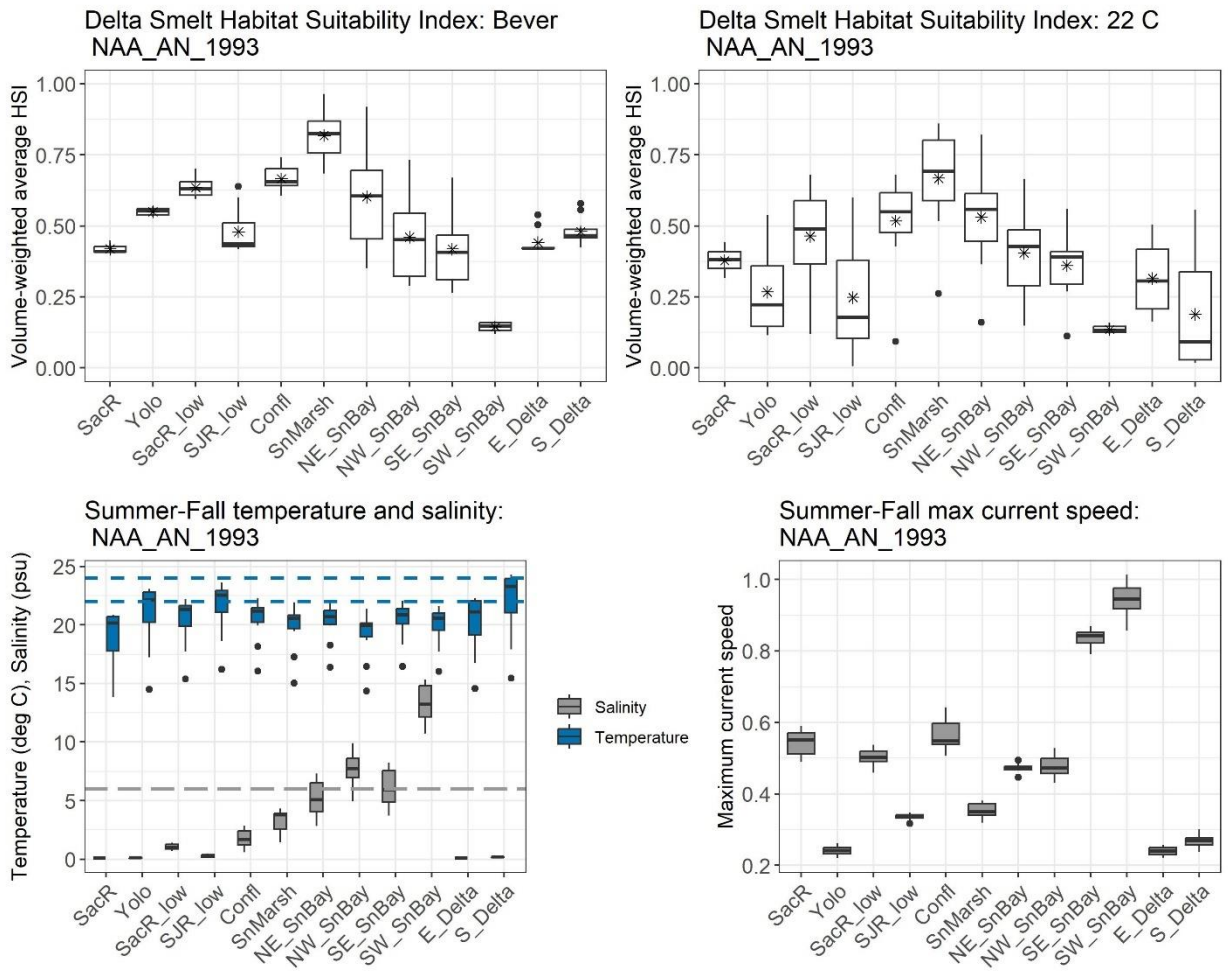

Figure K.1-77. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for the no action alternative, using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

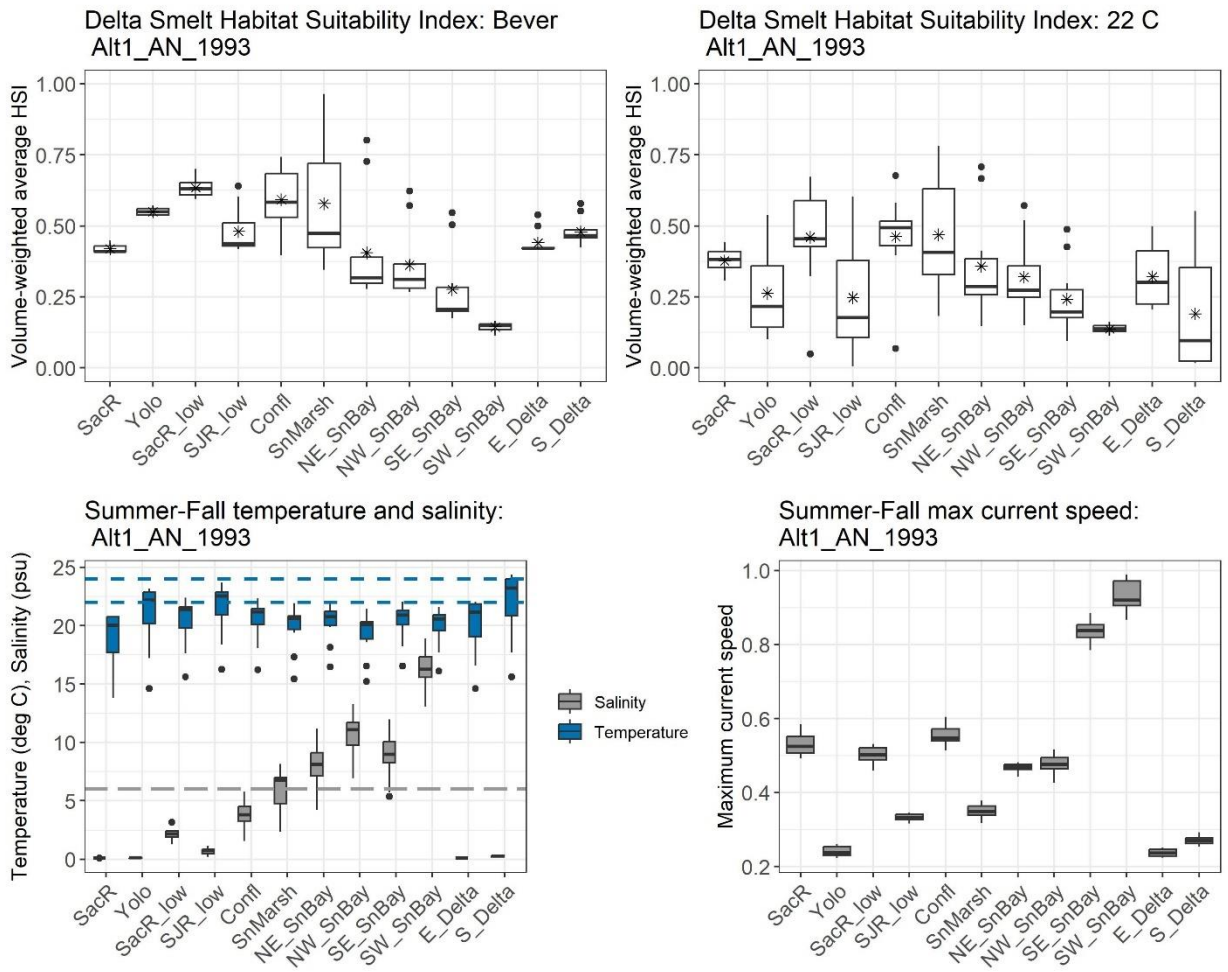

Figure K.1-78. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for Alternative 1 (Alt1), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

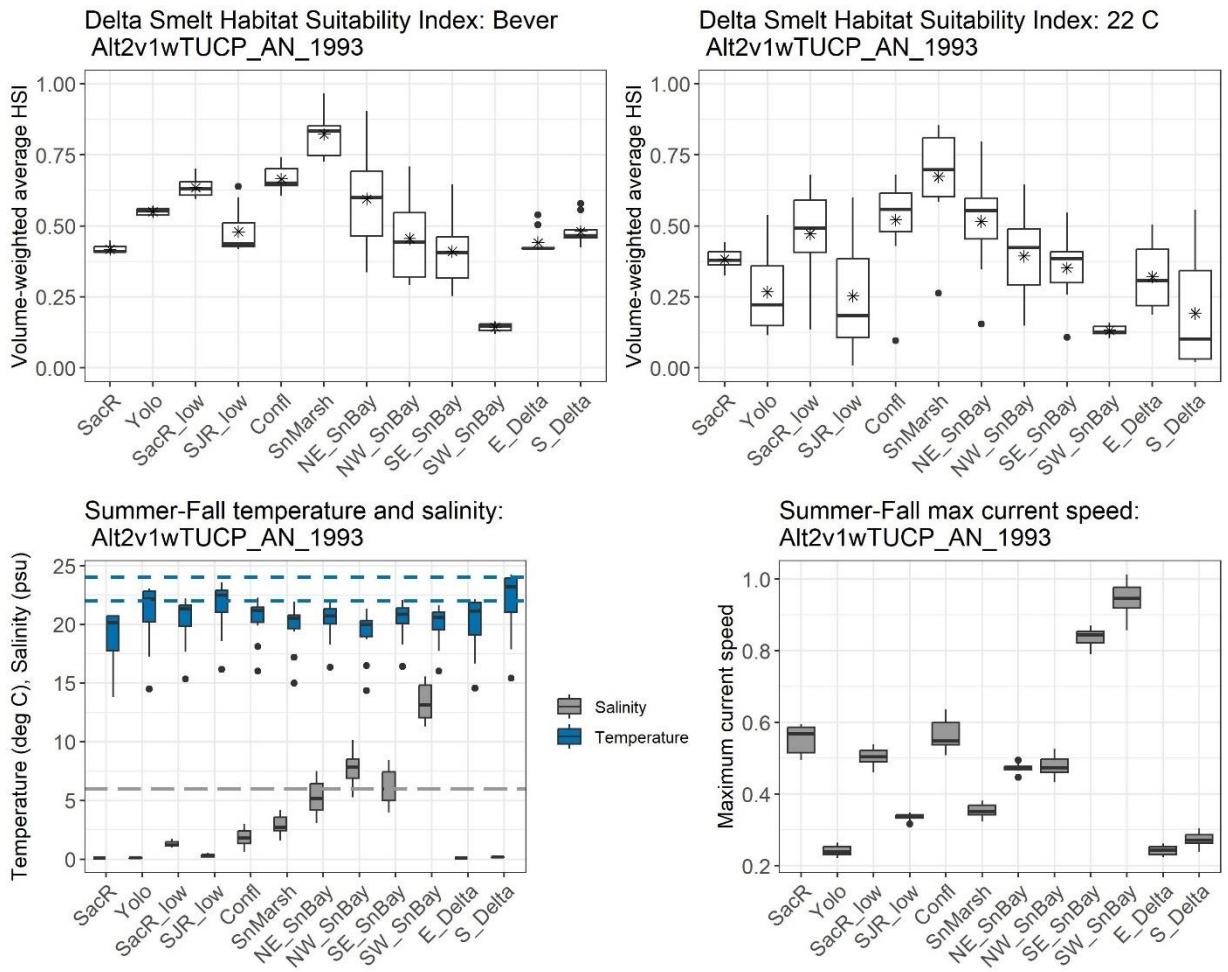

Figure K.1-79. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2v1wTUCP), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

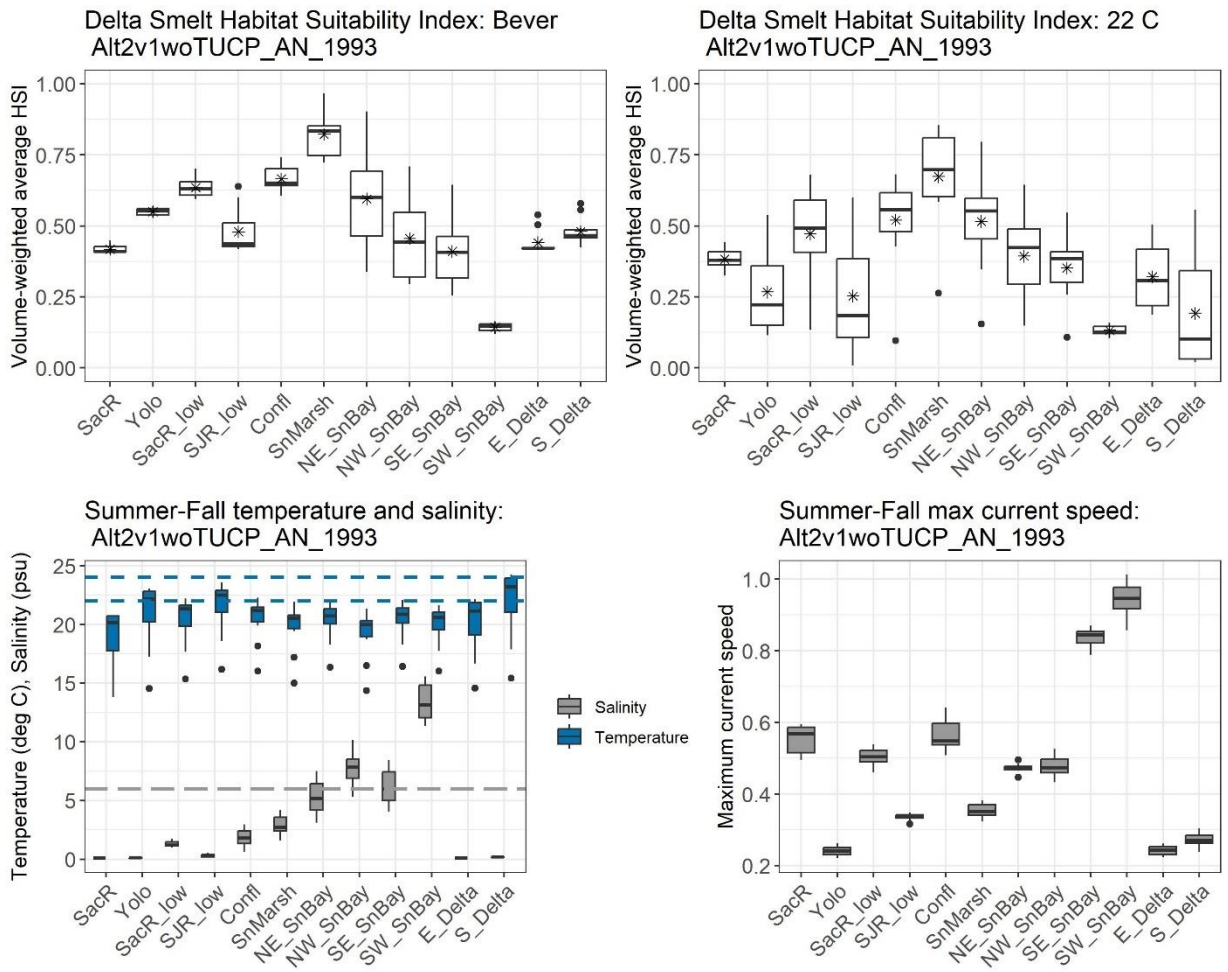

Figure K.1-80. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2v1woTUCP), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

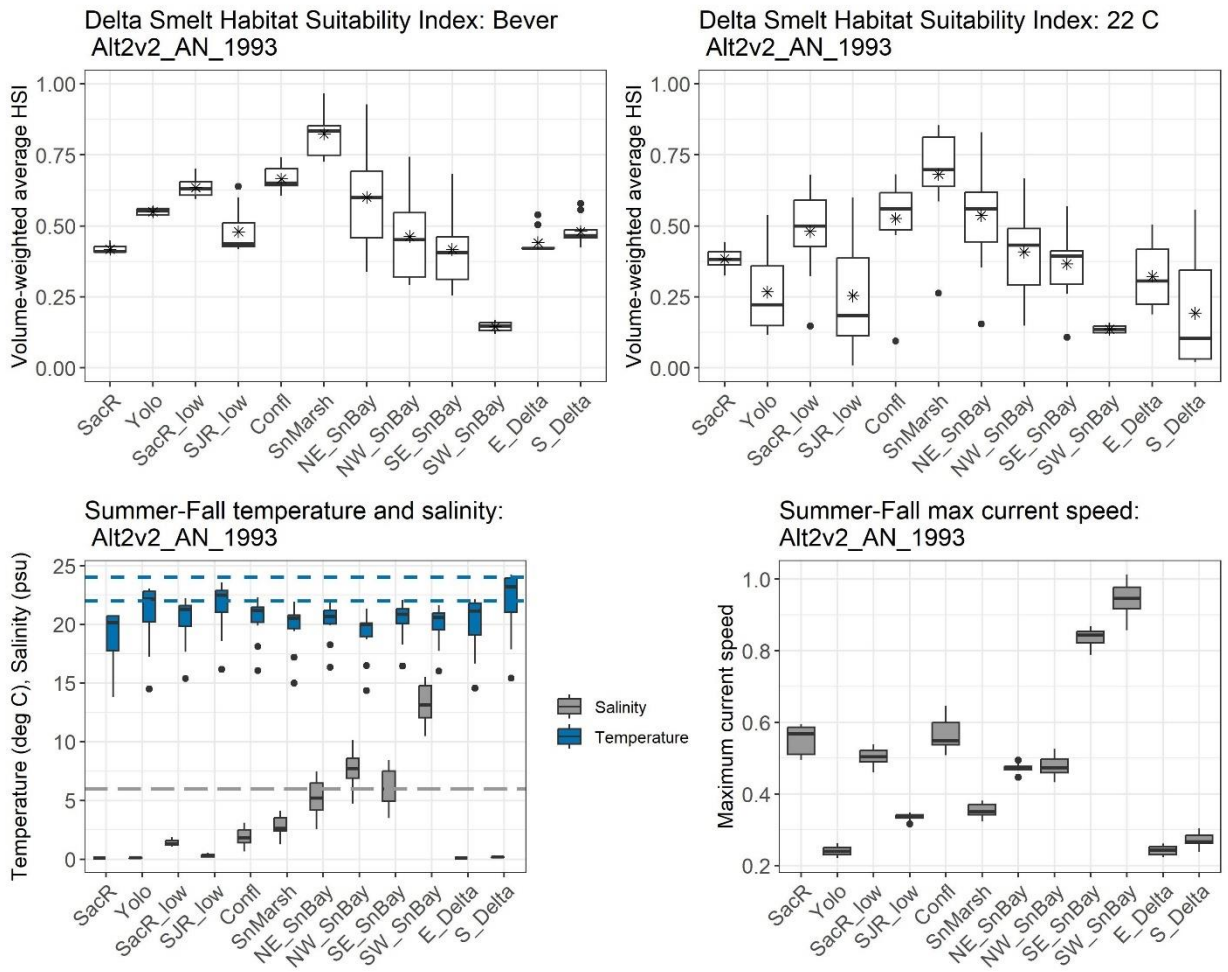

Figure K.1-81. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2v2), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

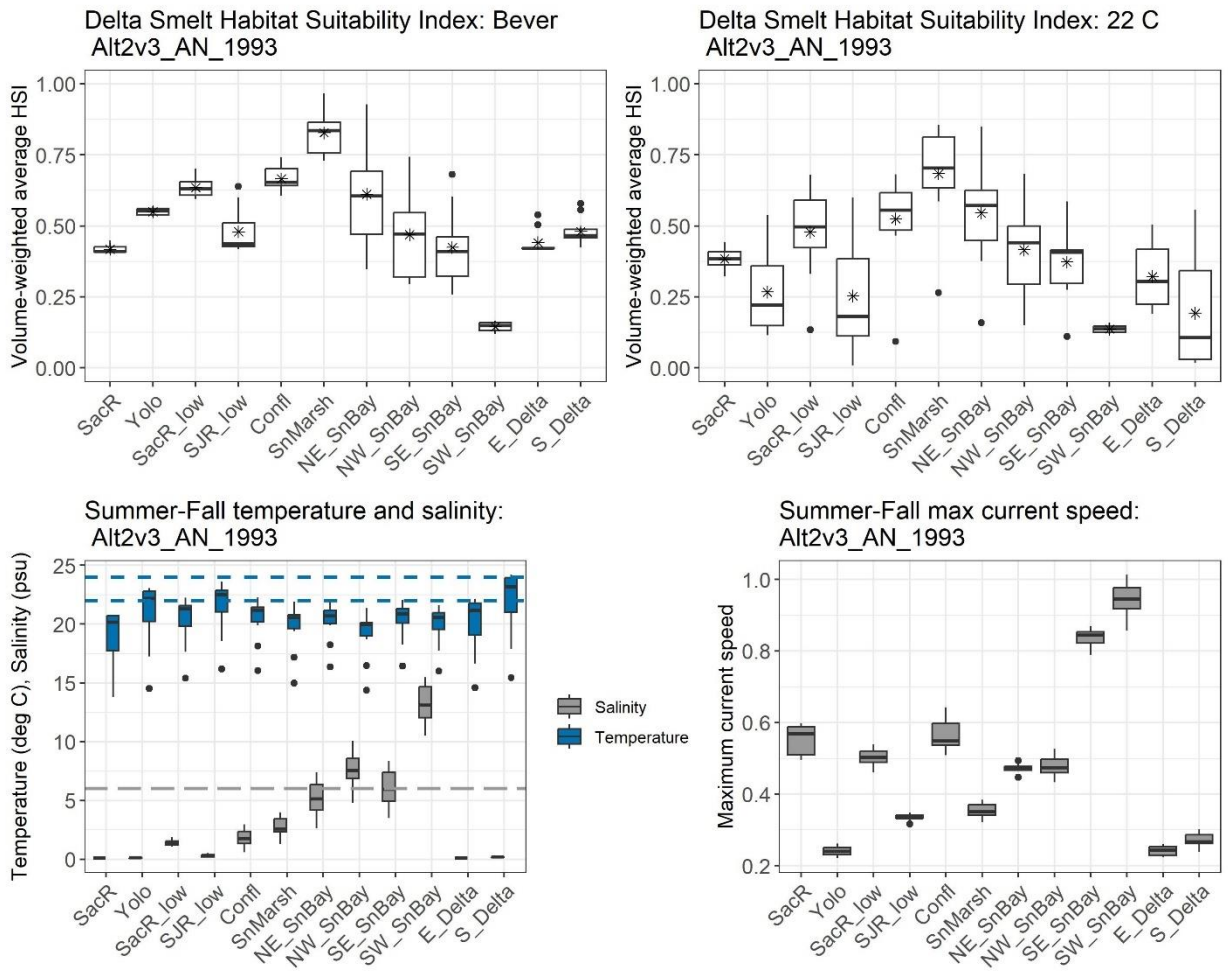

Figure K.1-82. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2v3), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

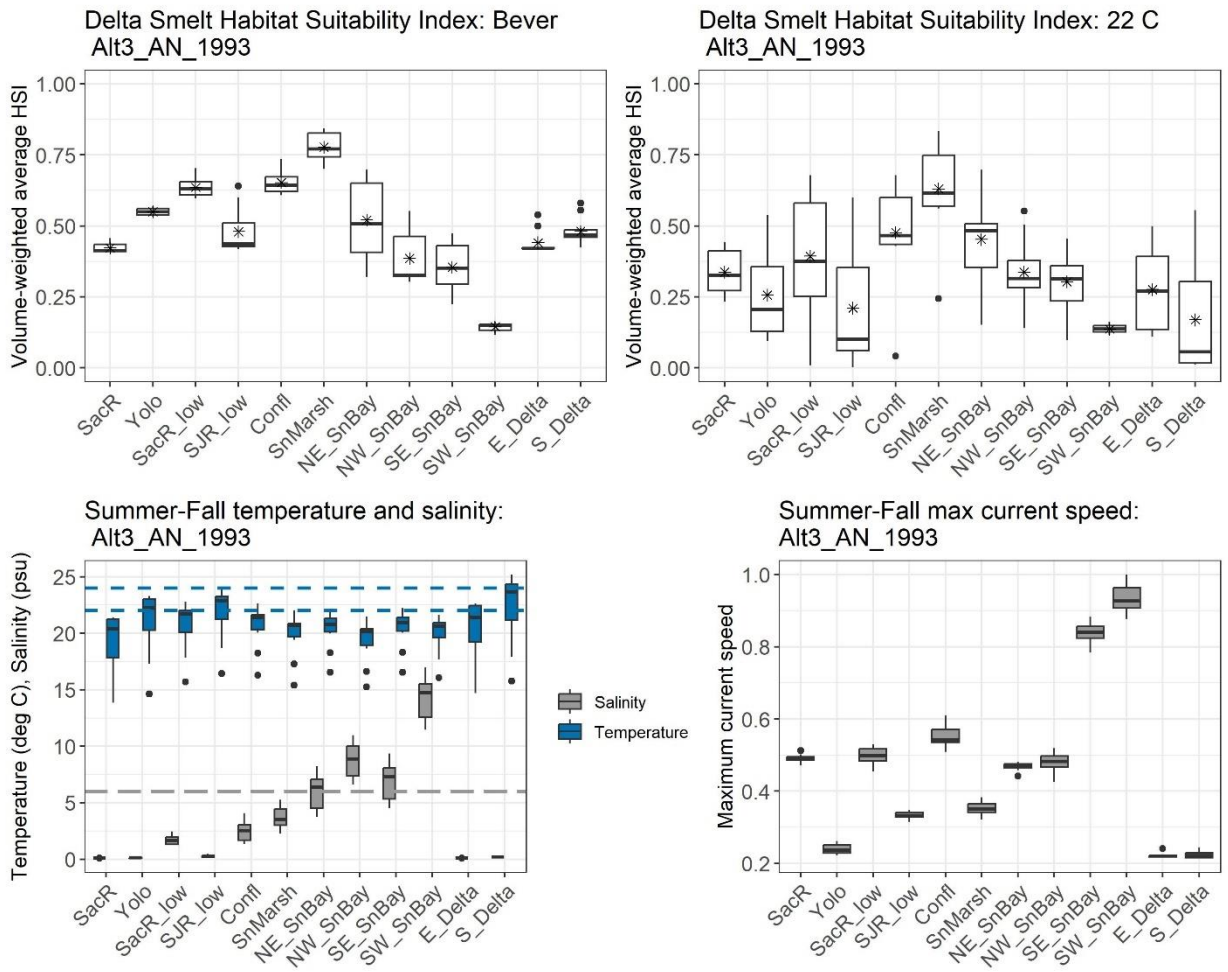

Figure K.1-83. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 3 (Alt3), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

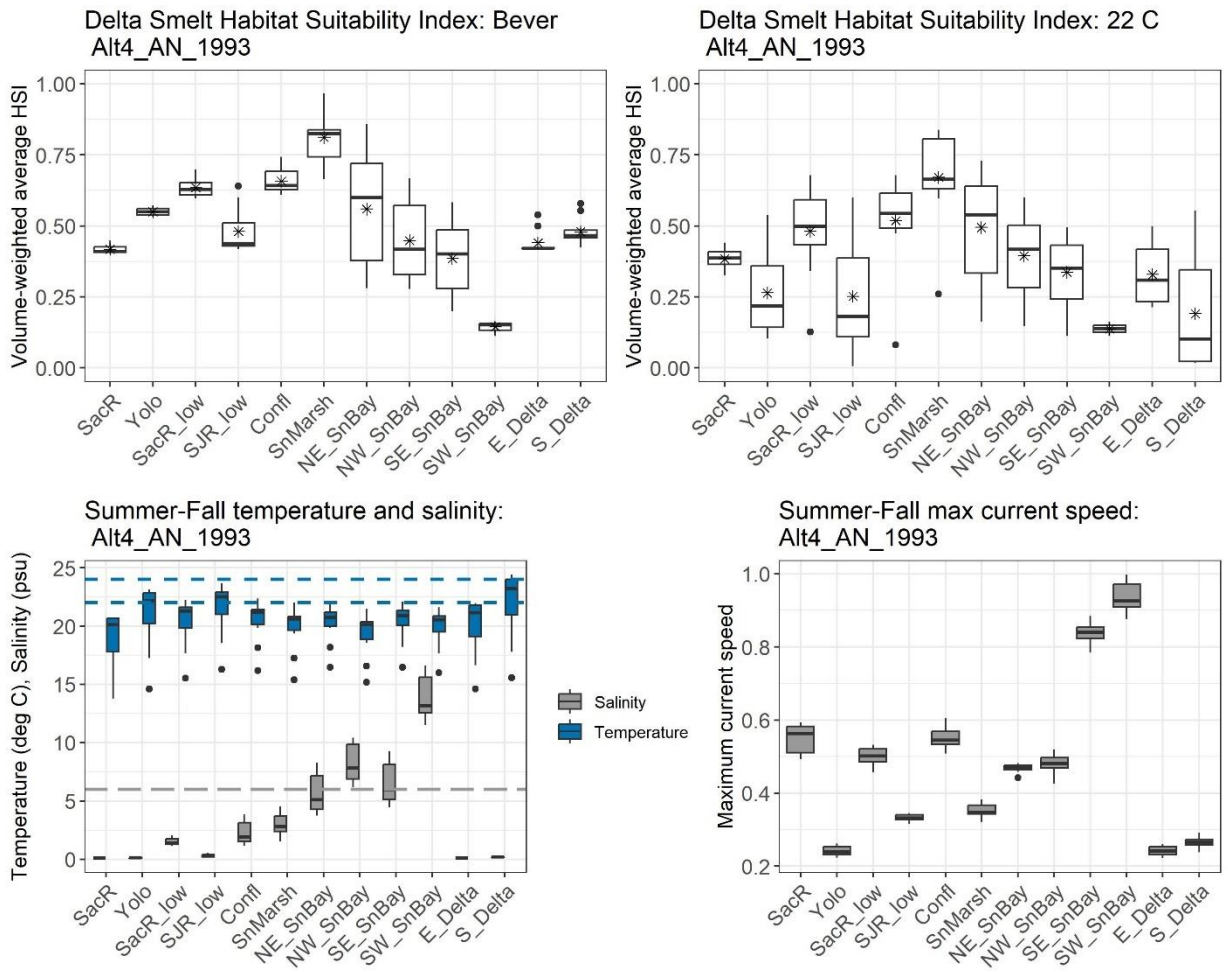

Figure K.1-84. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the above normal water year (1993) are shown for alternative 4 (Alt4), using DWR 2010 air inputs. The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.3.7.3 2012 Below Normal Water Year

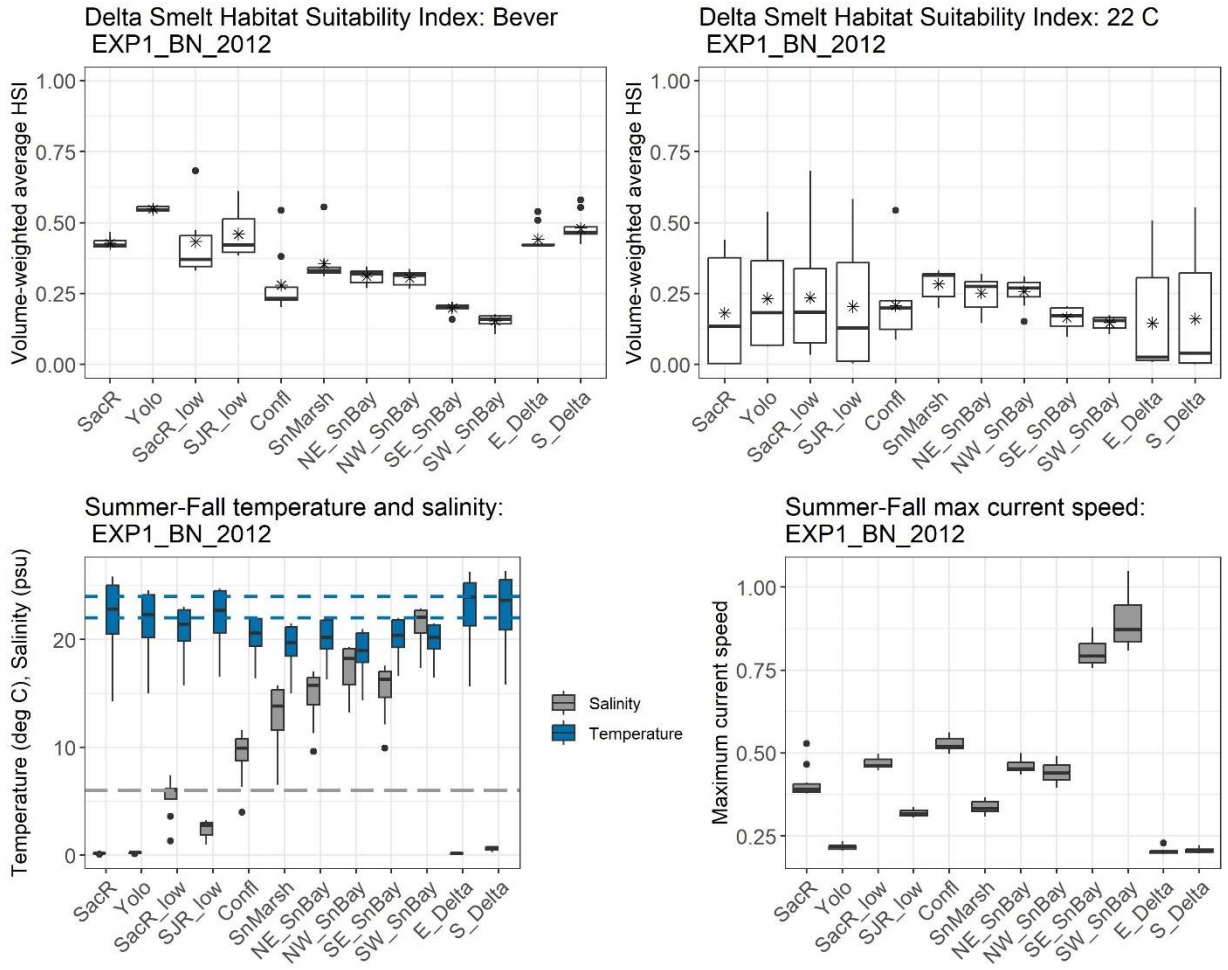

Figure K.1-85. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for exploratory 1 (EXP1). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

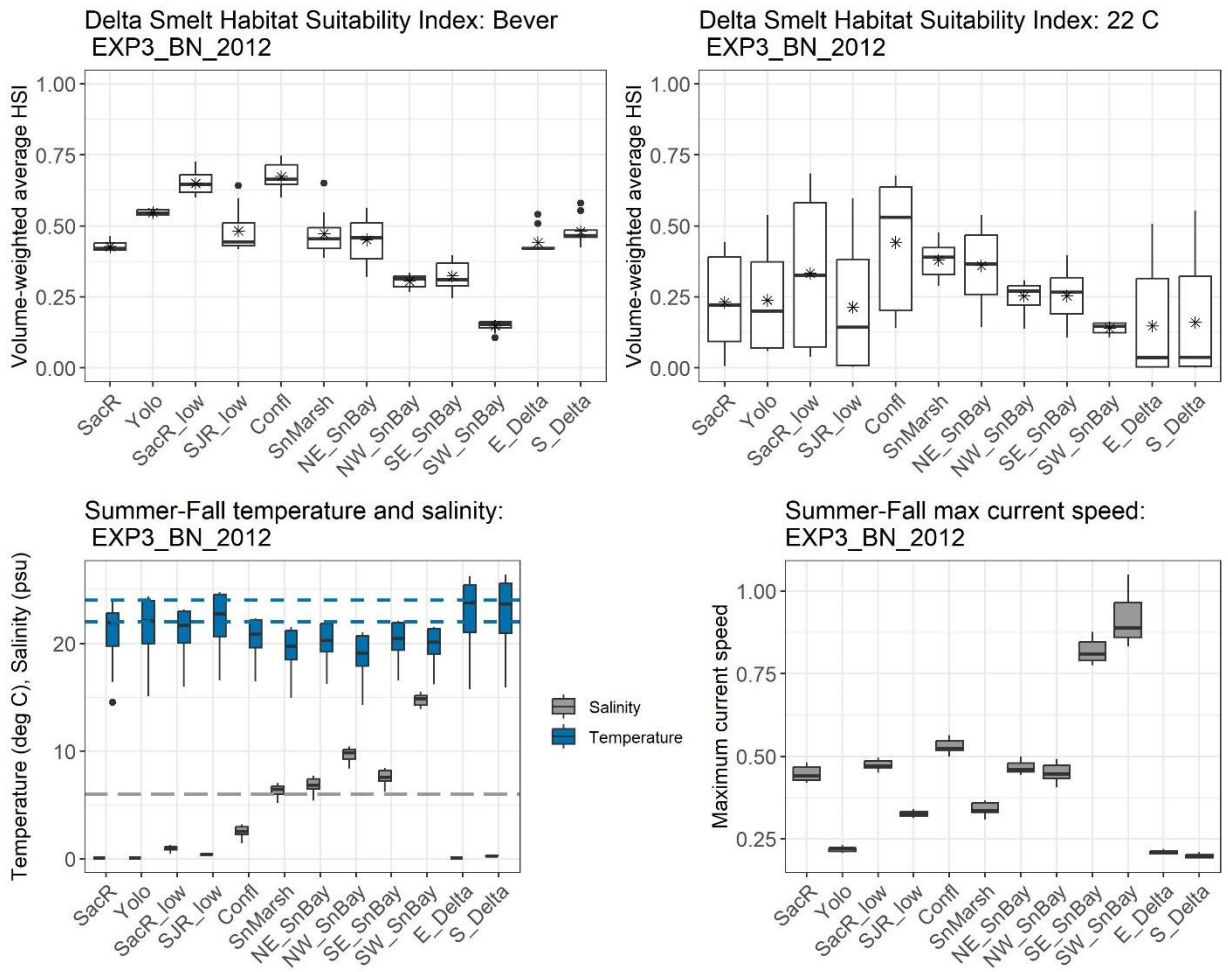

Figure K.1-86. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for exploratory 3 (EXP3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

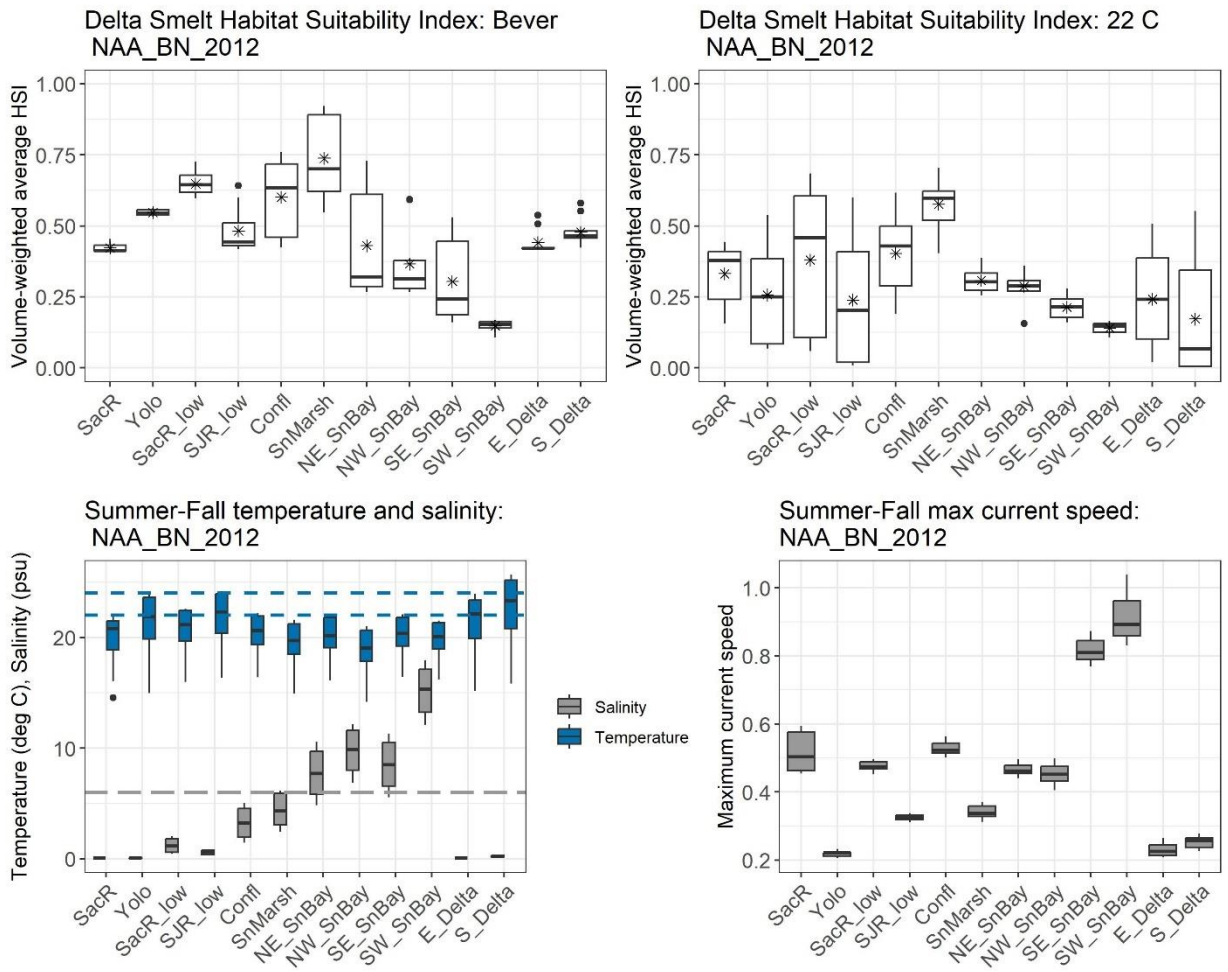

Figure K.1-87. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for the no action alternative (NAA). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

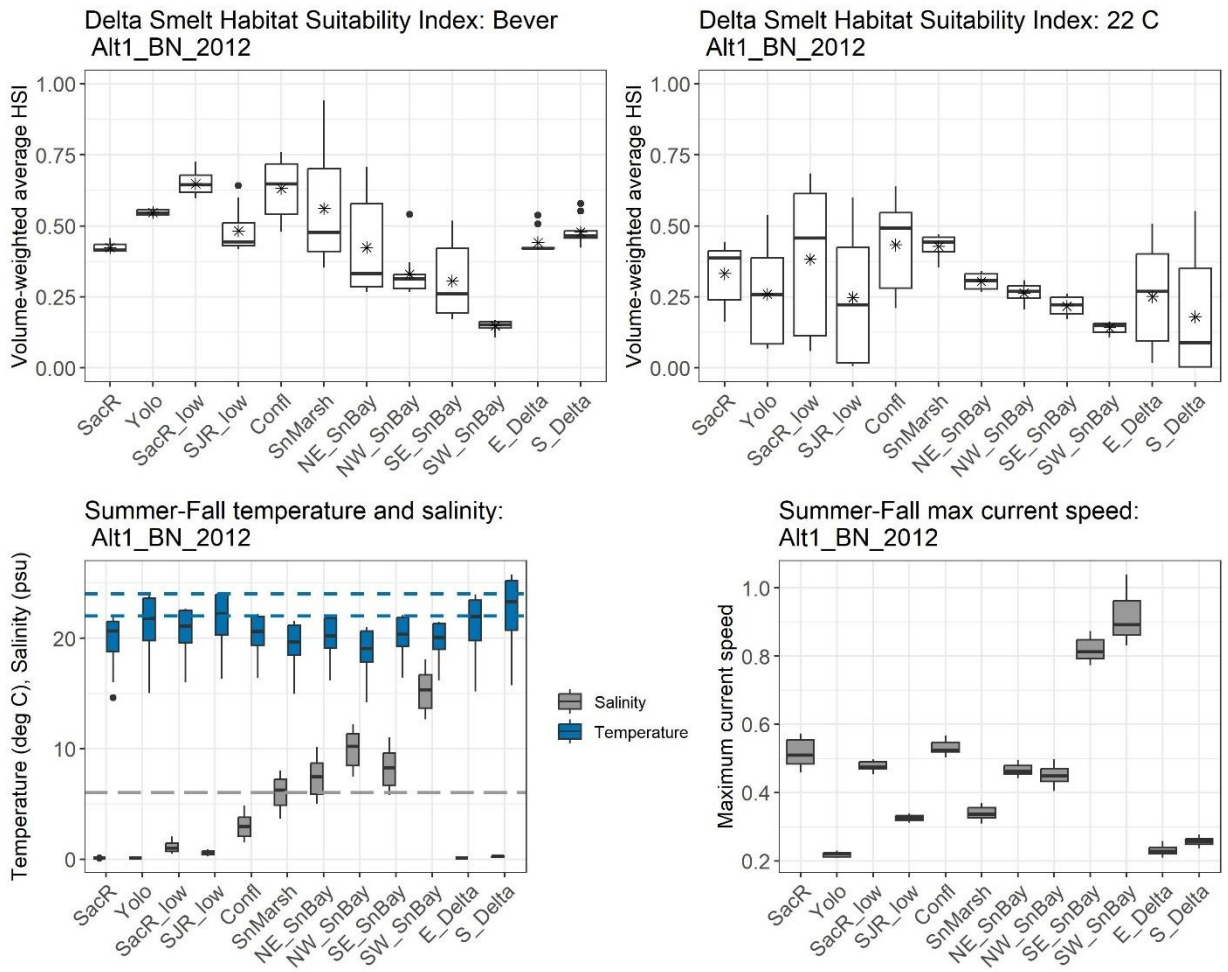

Figure K.1-88. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 1 (Alt1). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

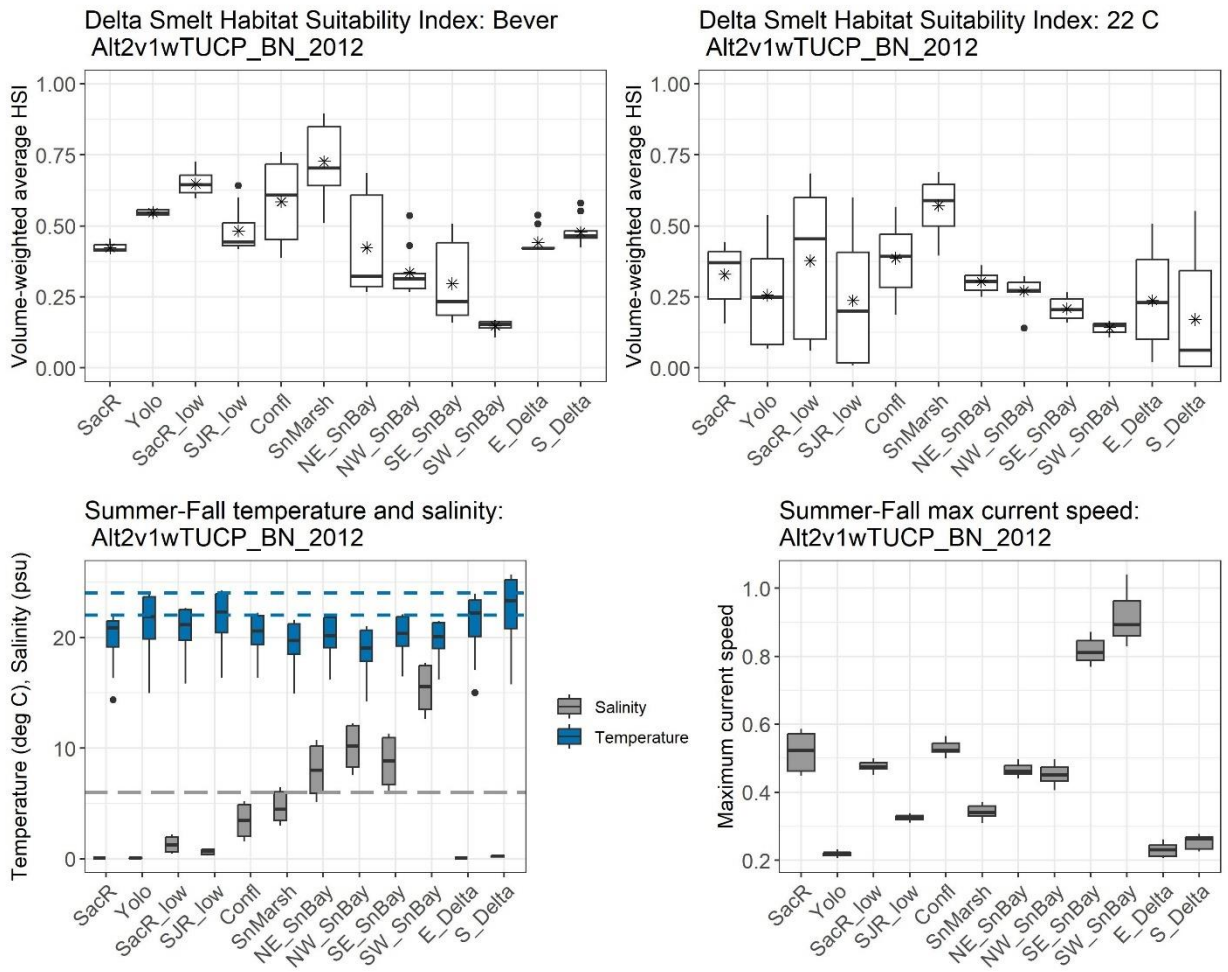

Figure K.1-89. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2v1wTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

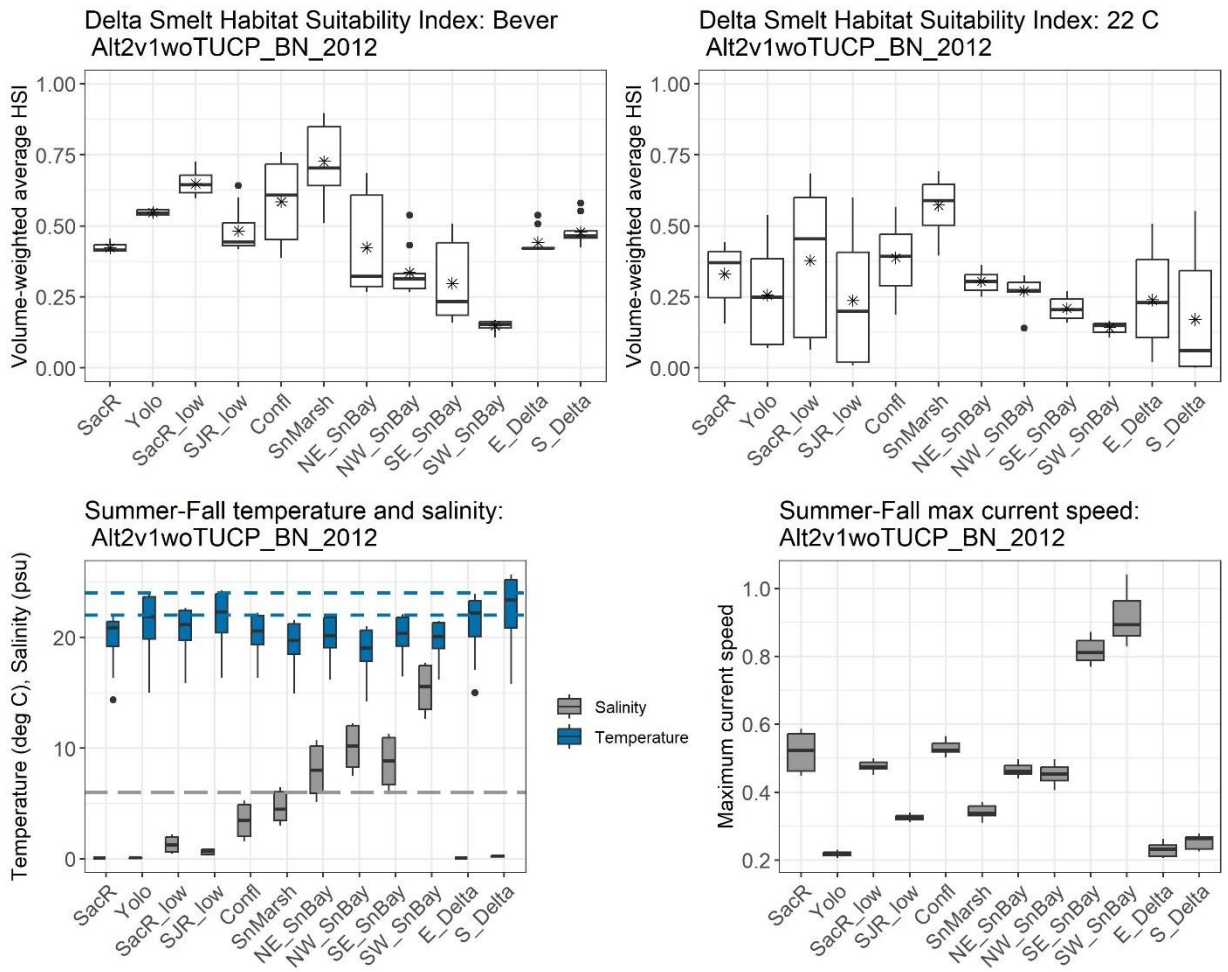

Figure K.1-90. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2v1woTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

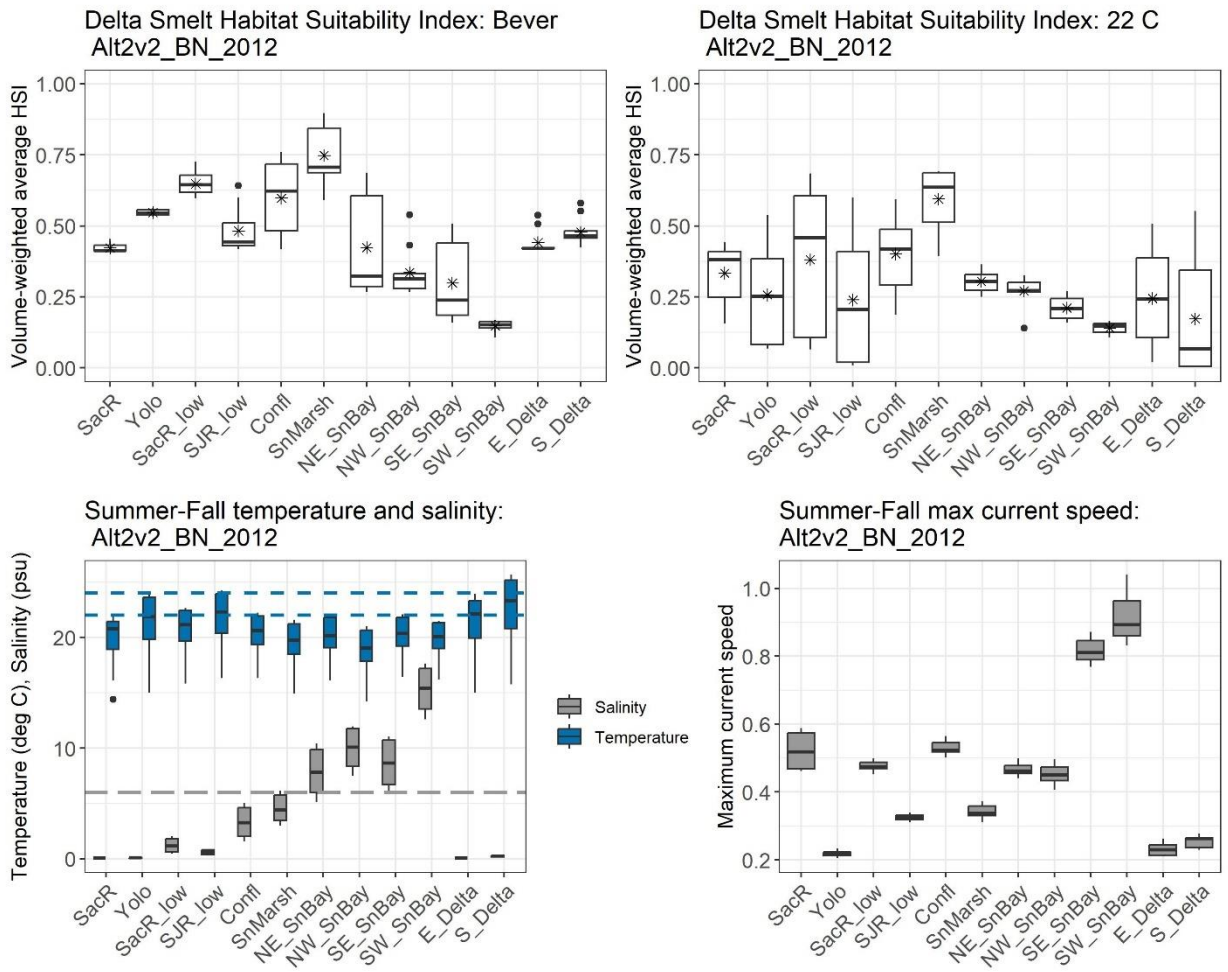

Figure K.1-91. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2v2). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

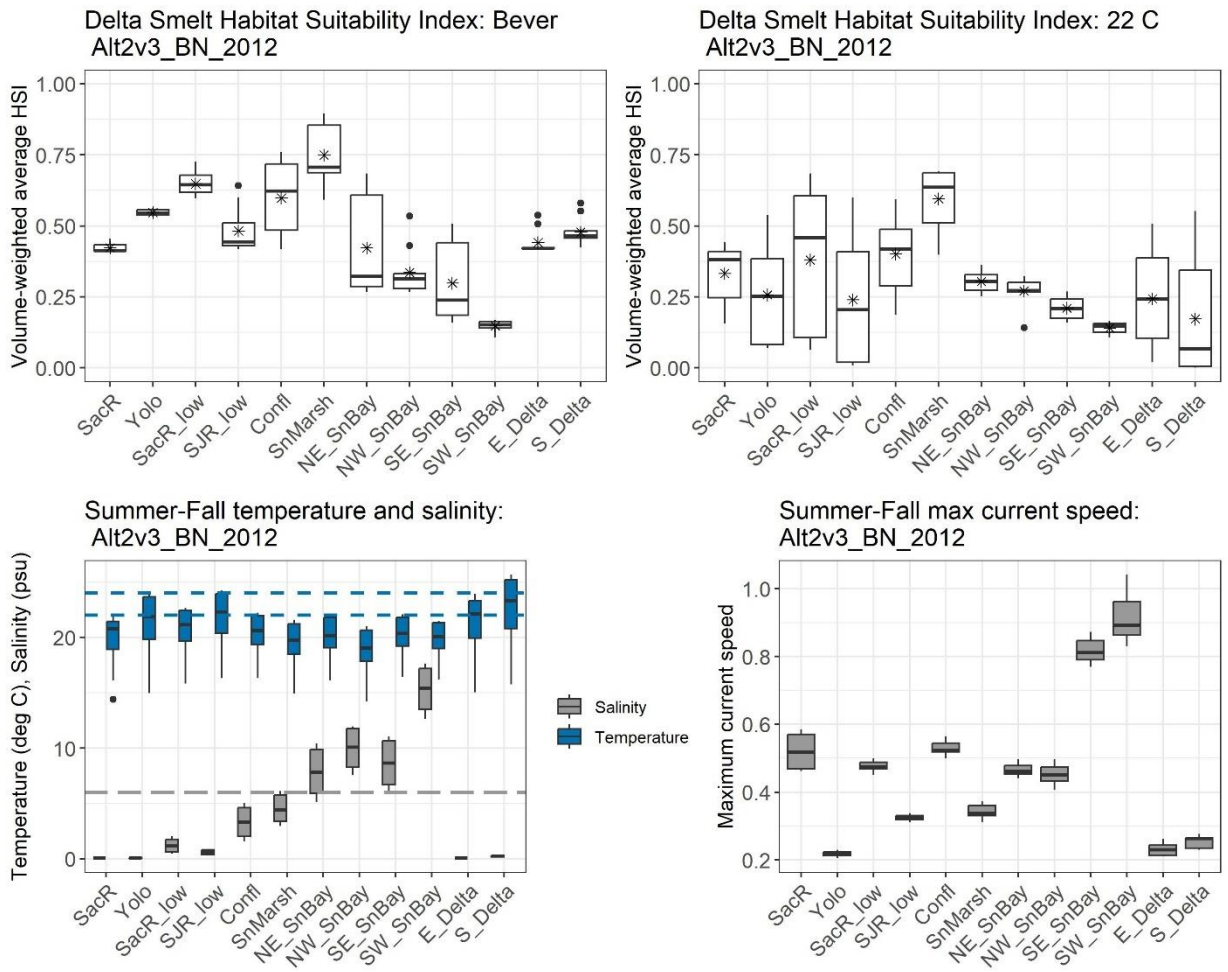

Figure K.1-92. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2v3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

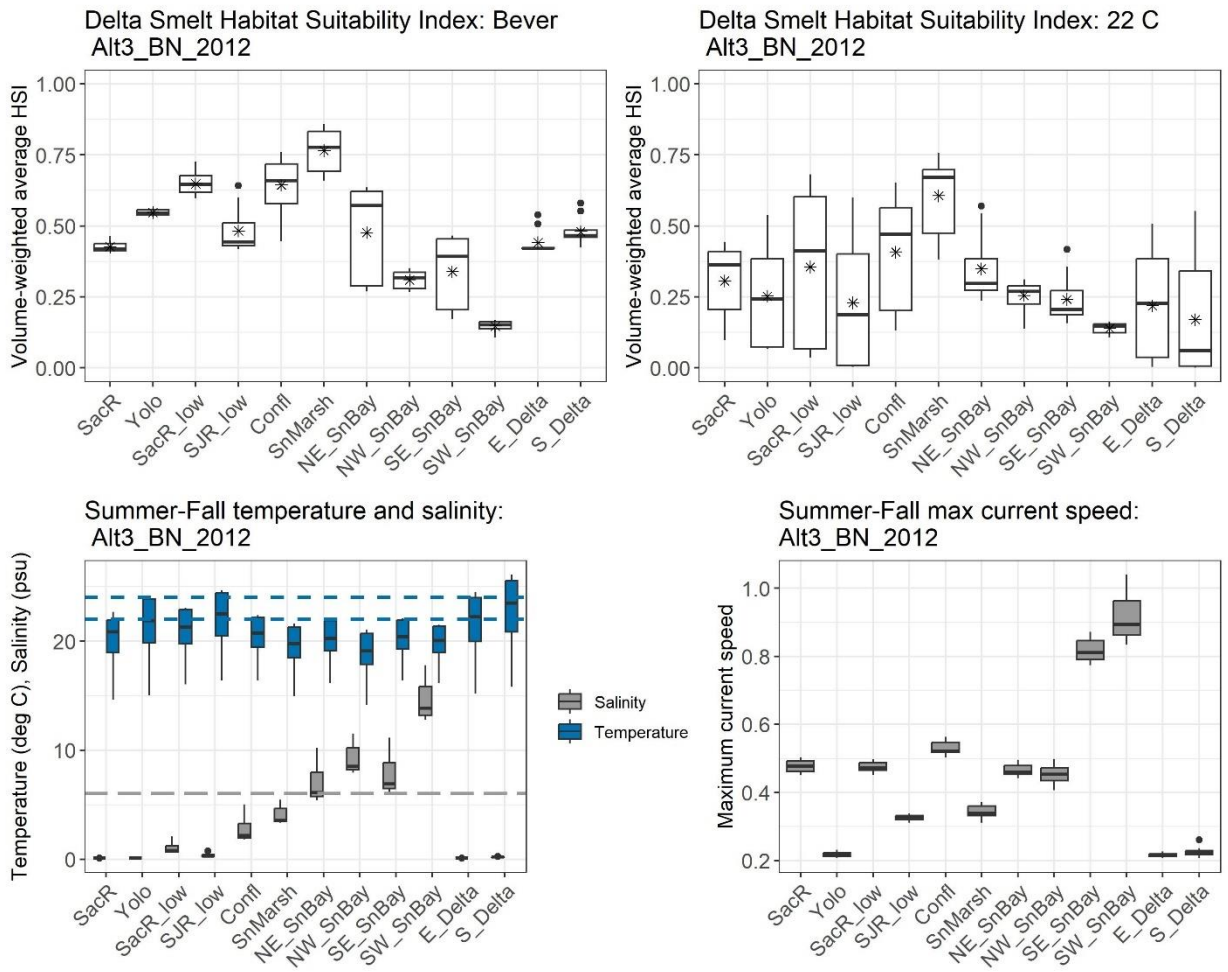

Figure K.1-93. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 3 (Alt3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

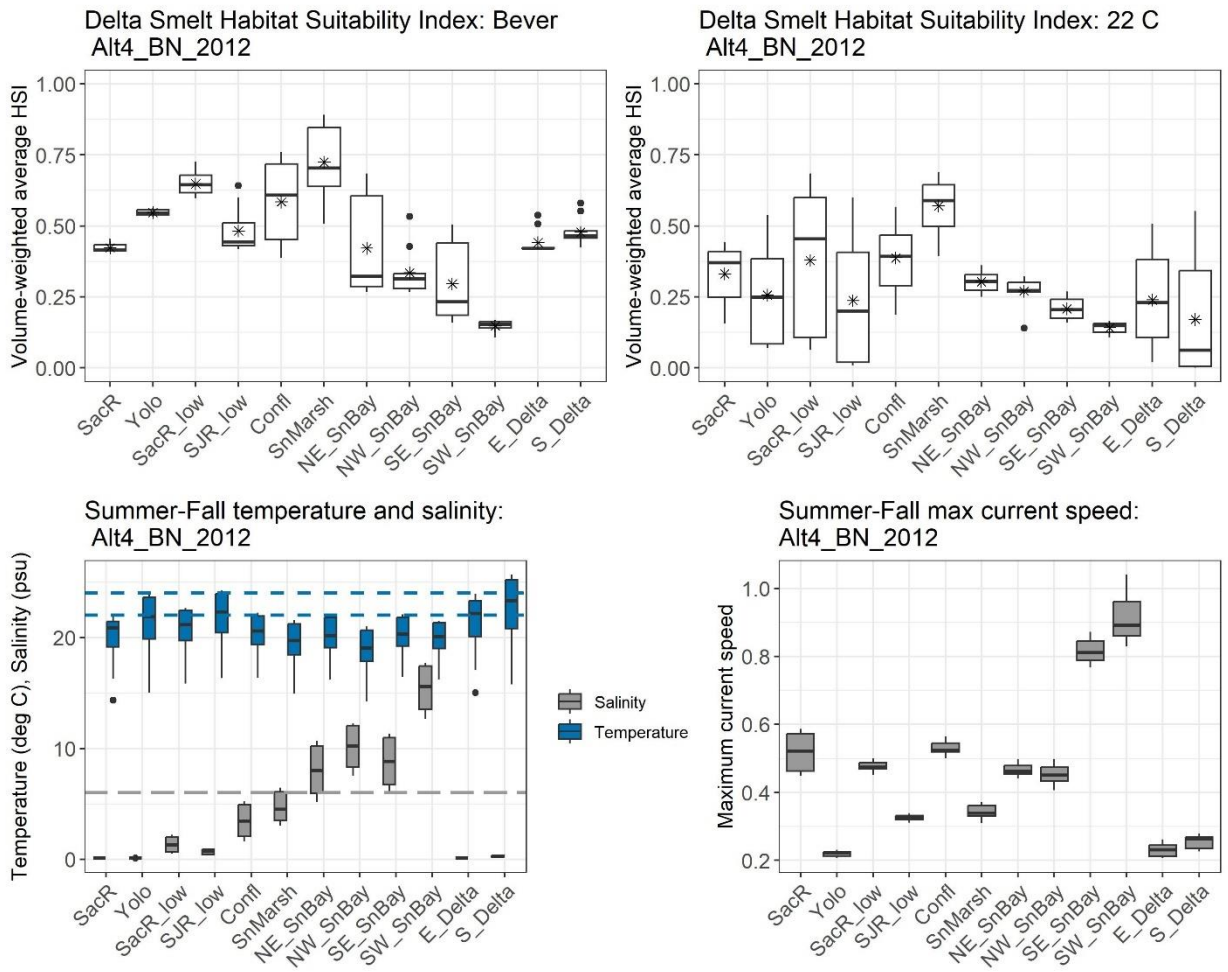

Figure K.1-94. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the below normal water year (2012) are shown for alternative 4 (Alt4). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.3.7.4 2009 Dry Water Year

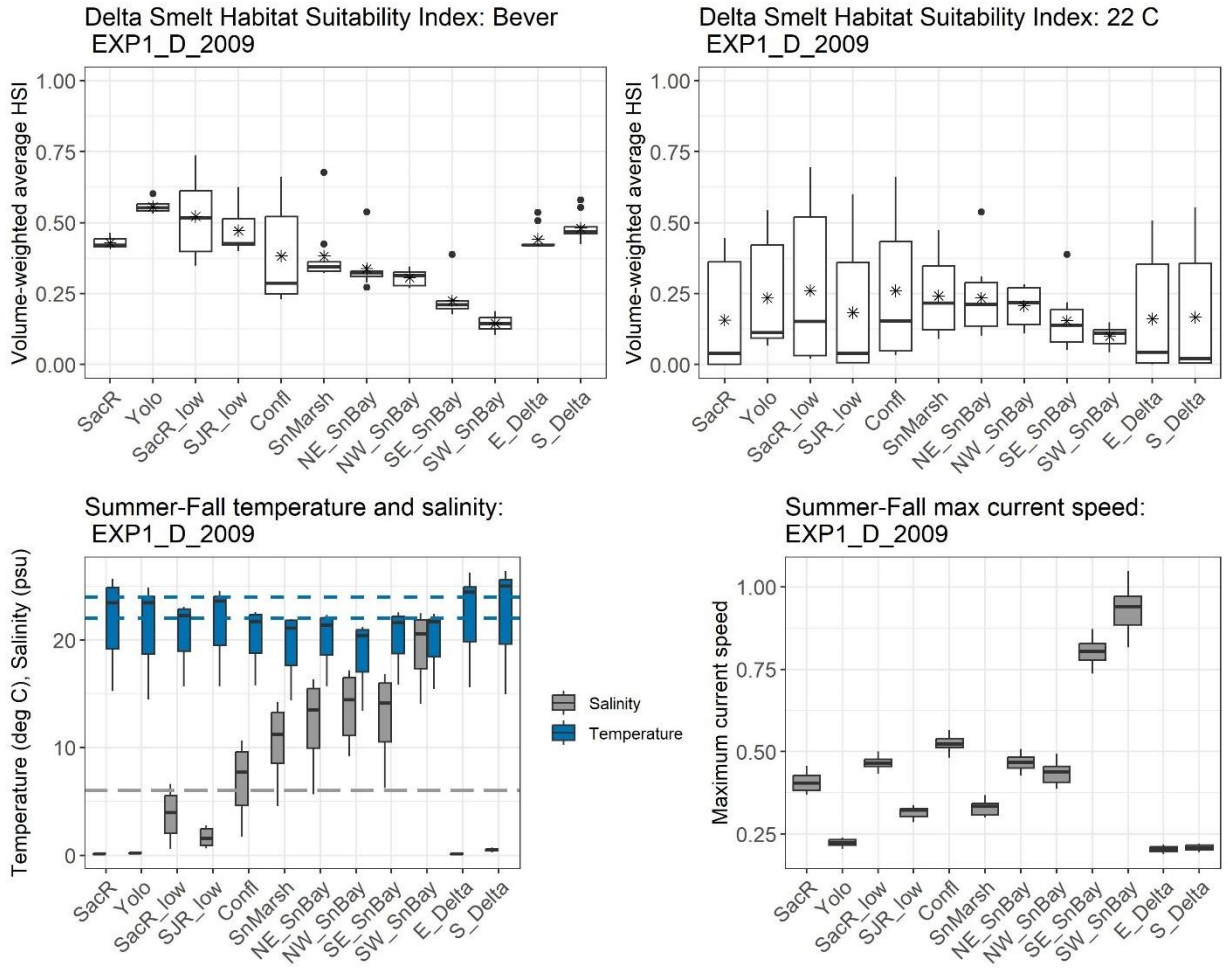

Figure K.1-95. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for exploratory 1 (EXP1). The median is shown as the horizontal line, the mean is shown with an asterisk (HIS graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

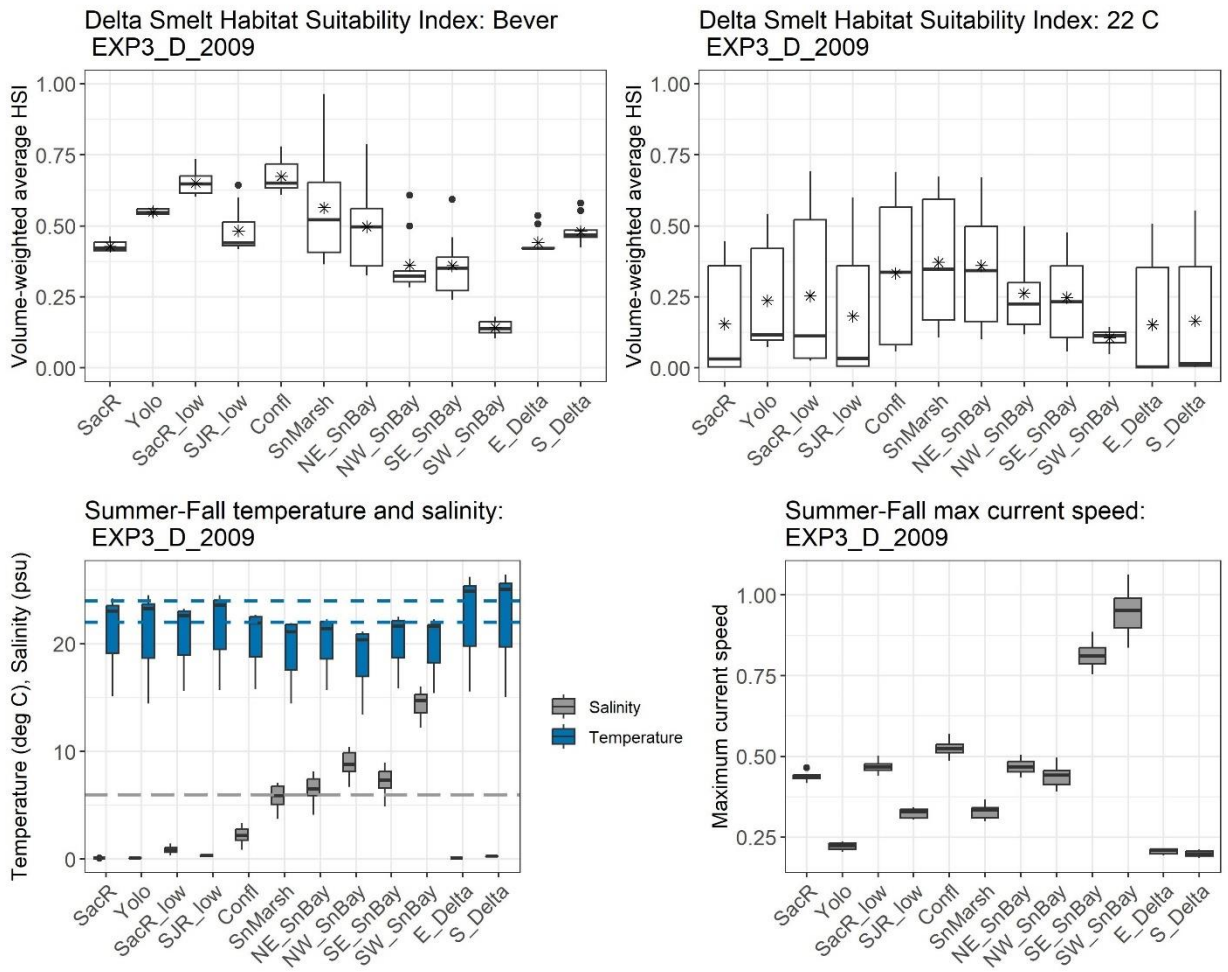

Figure K.1-96. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for exploratory 3 (EXP3). The median is shown as the horizontal line, the mean is shown with an asterisk (HIS graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

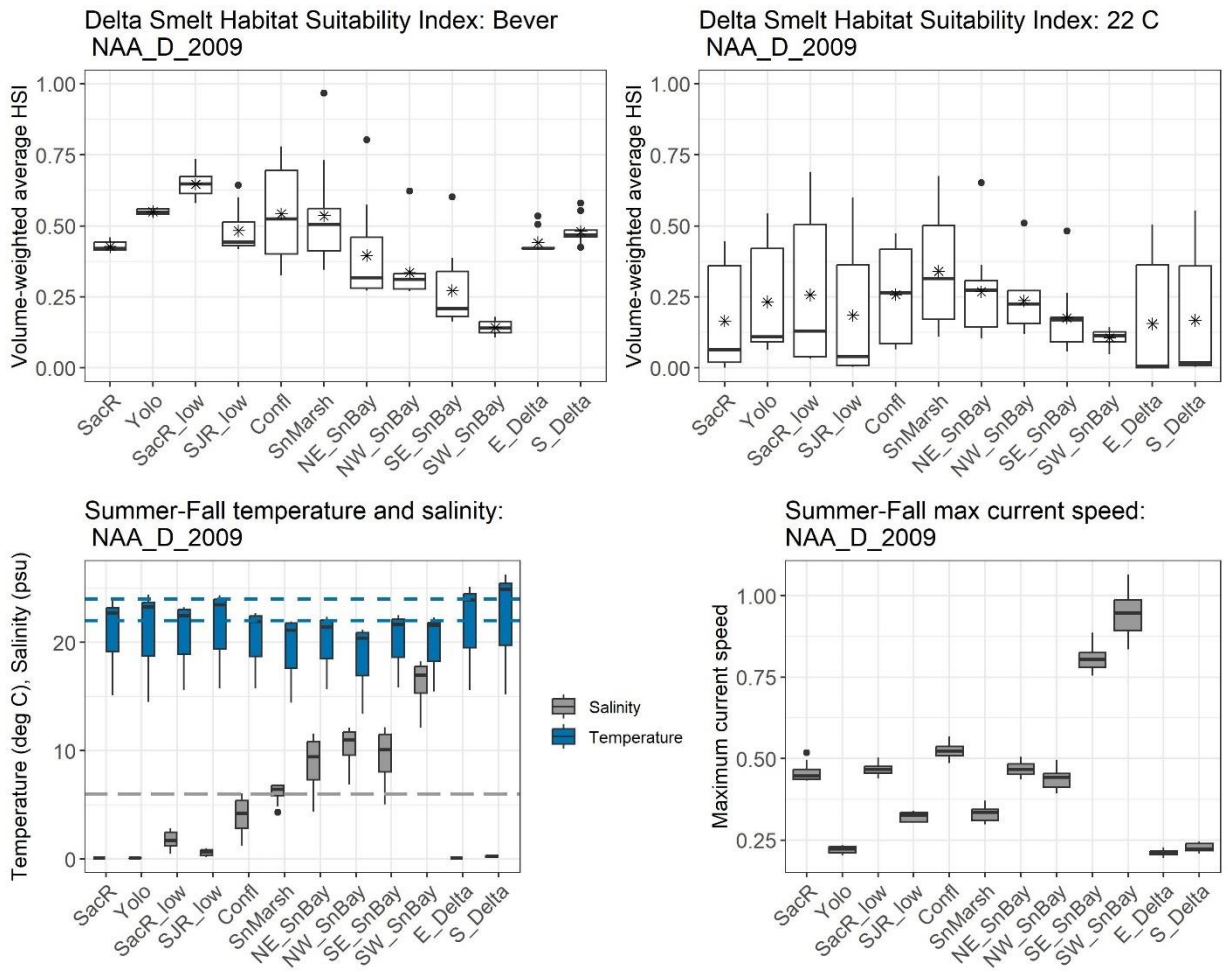

Figure K.1-97. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for the no action alternative (NAA). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

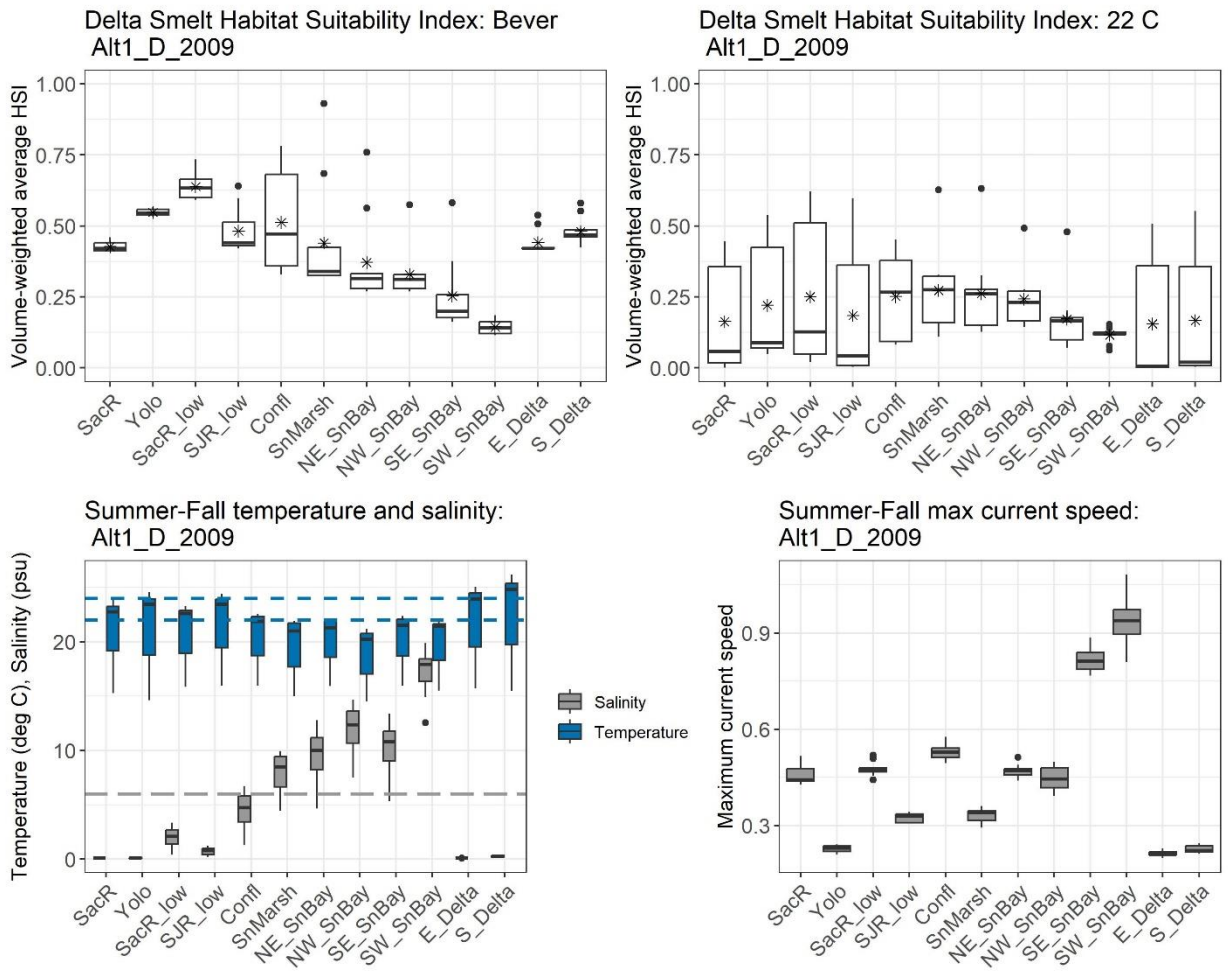

Figure K.1-98. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 1 (Alt1). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

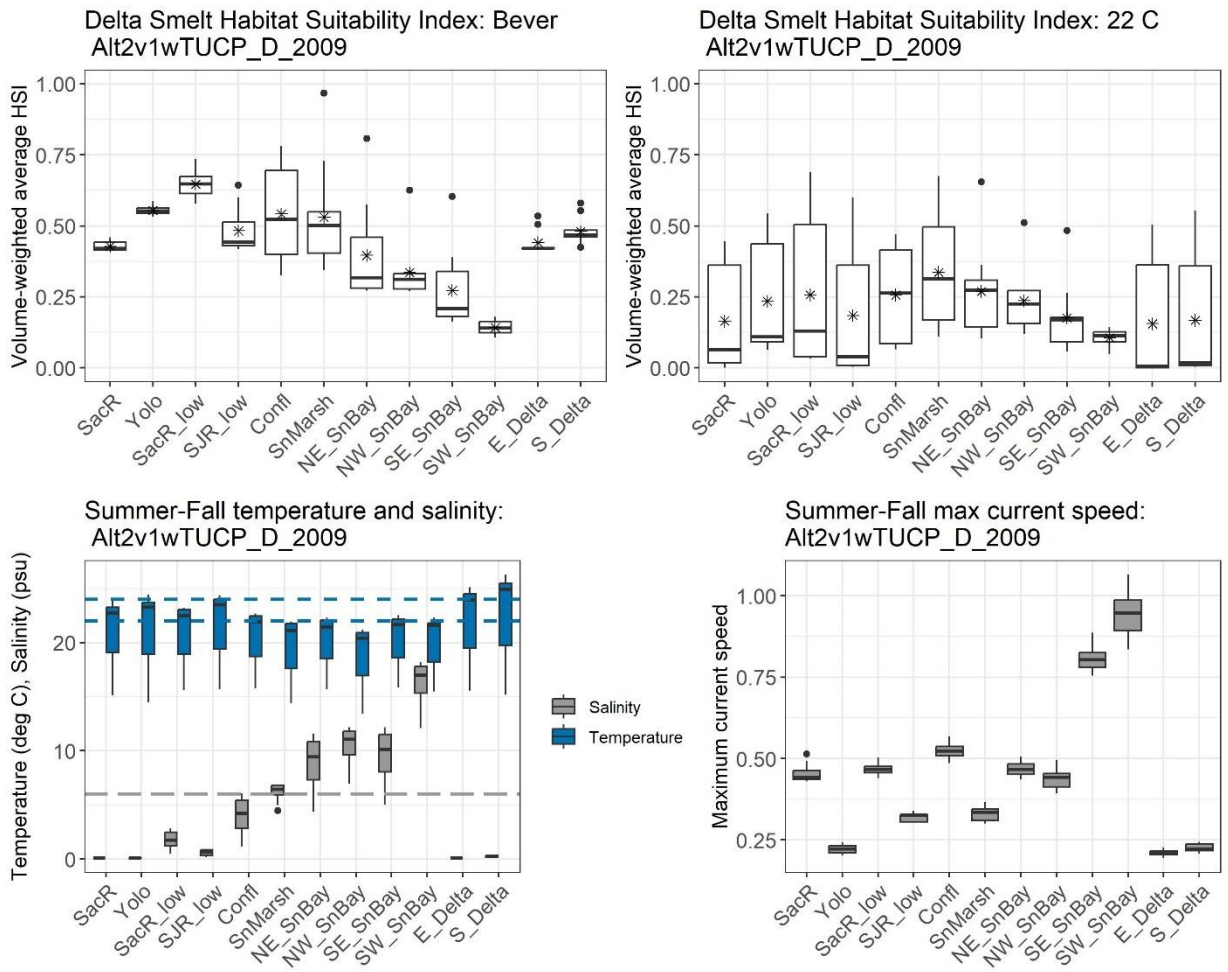

Figure K.1-99. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2v1wTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

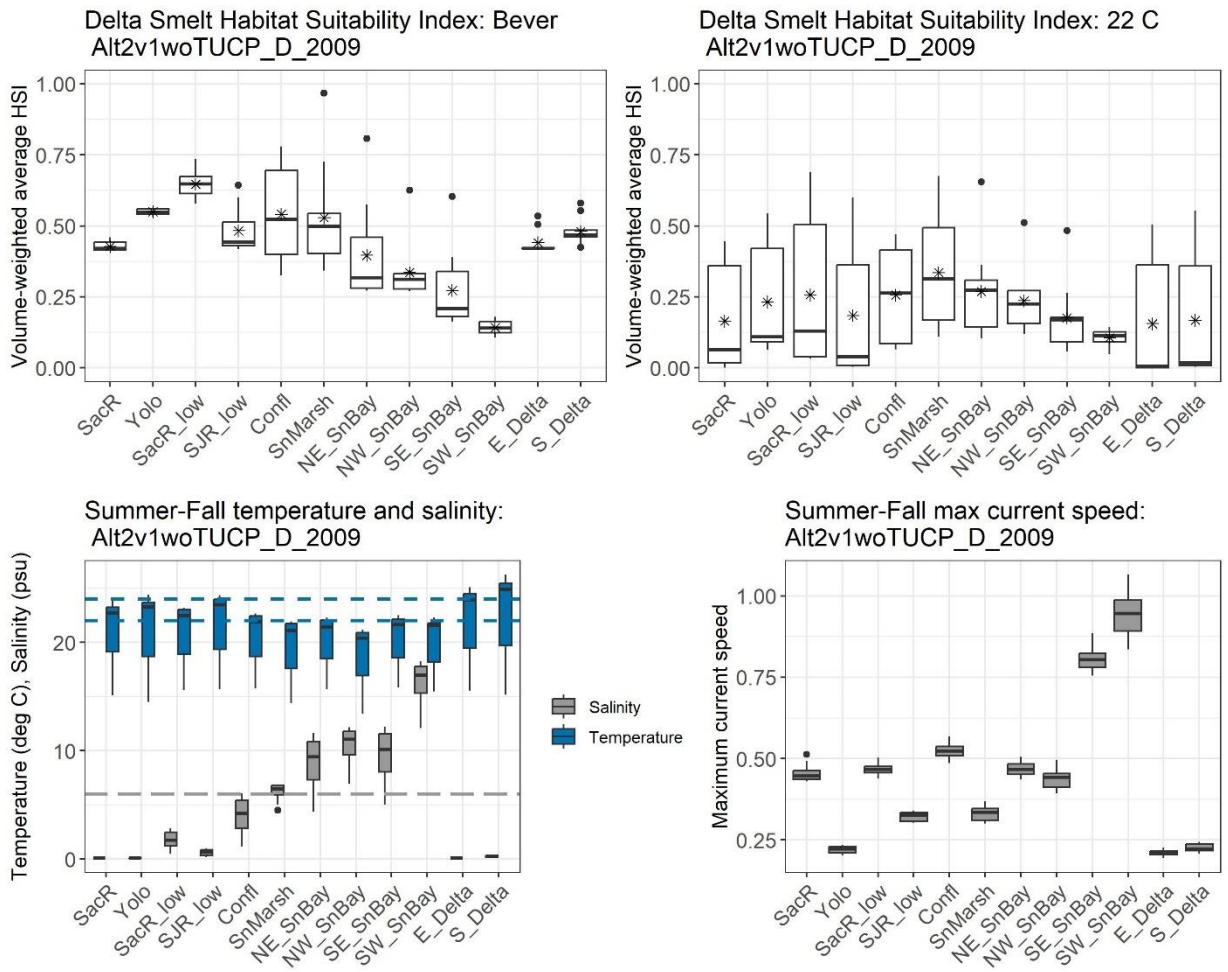

Figure K.1-100. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2v1woTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

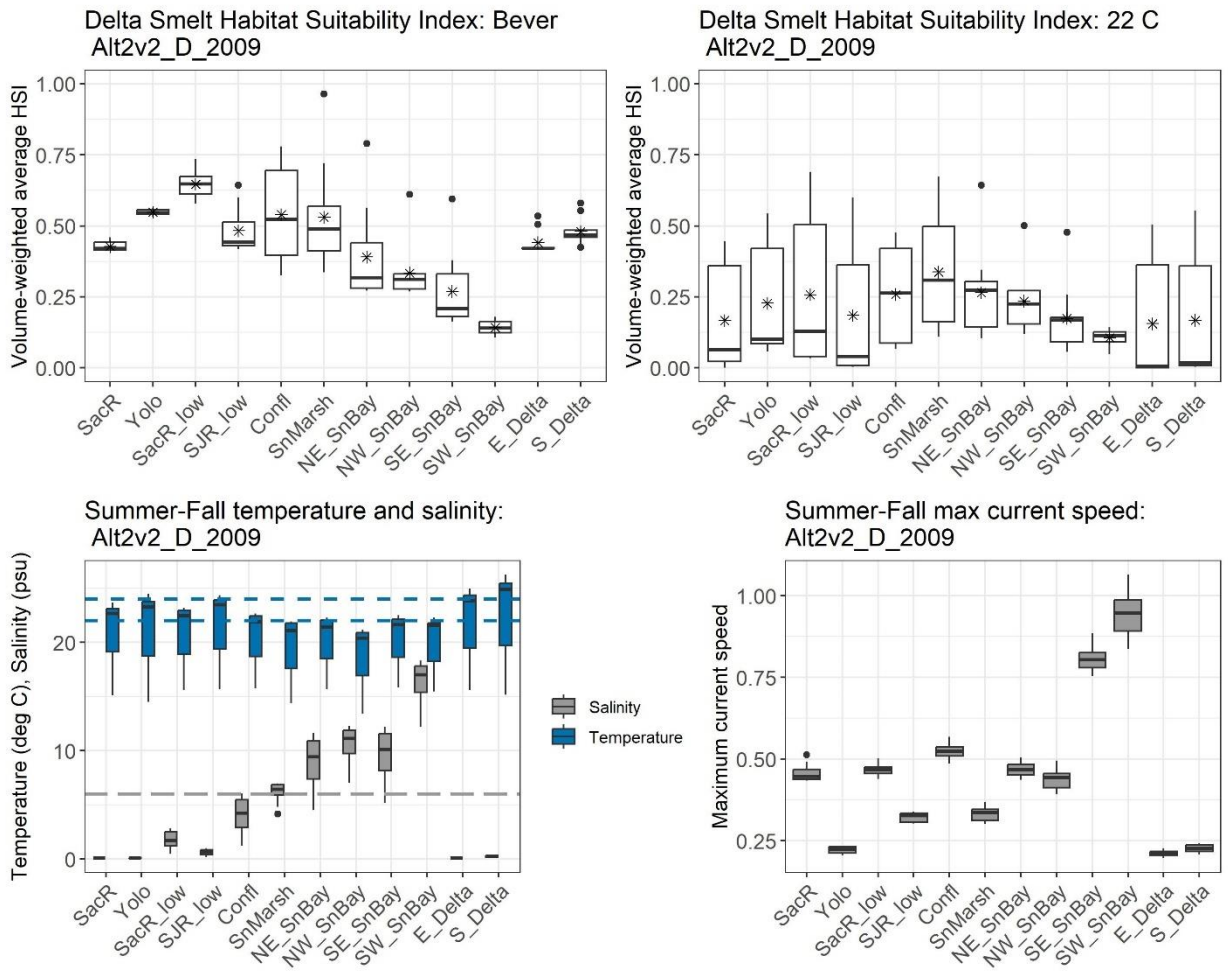

Figure K.1-101. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2v2). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

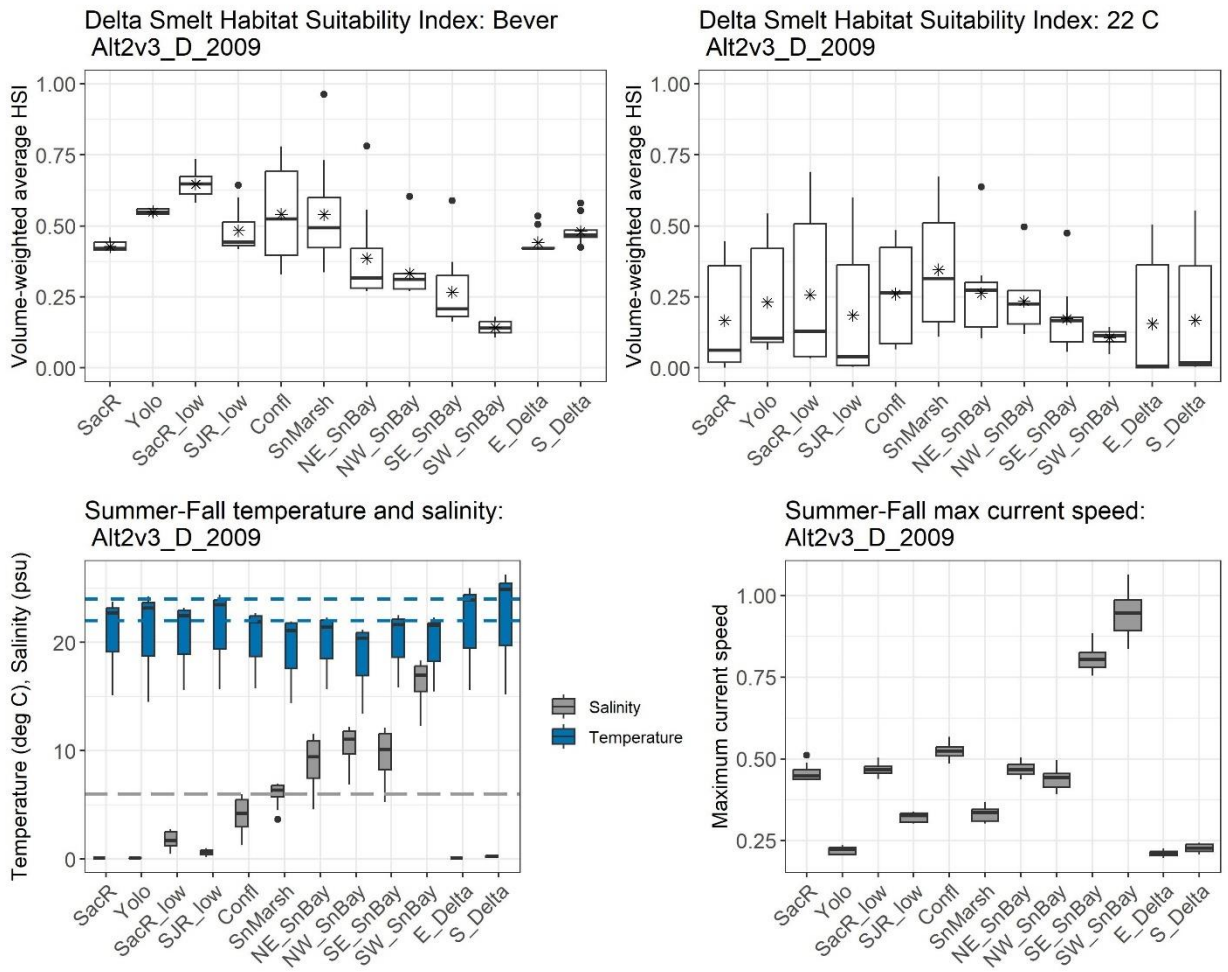

Figure K.1-102. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2v3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

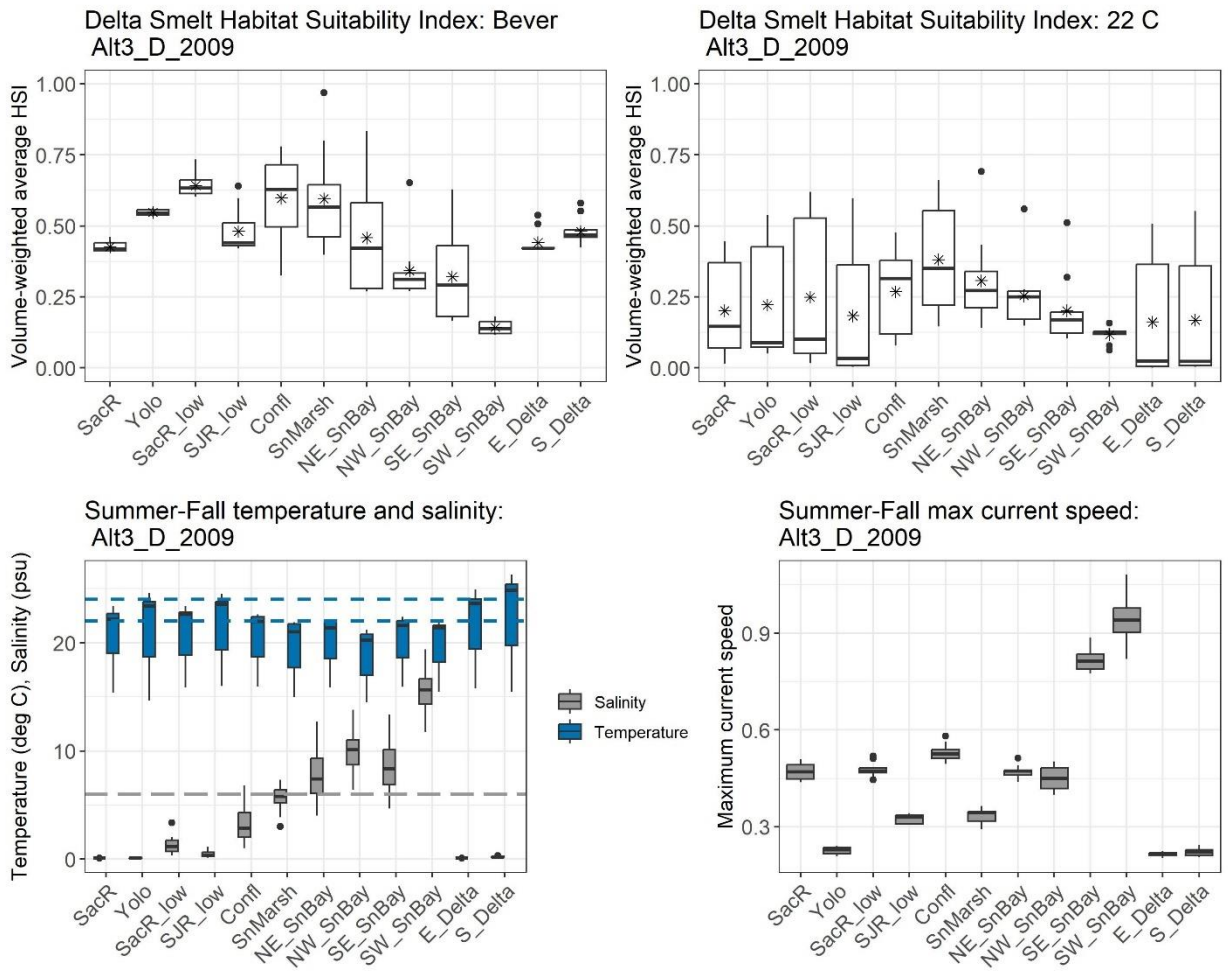

Figure K.1-103. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 3 (Alt3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

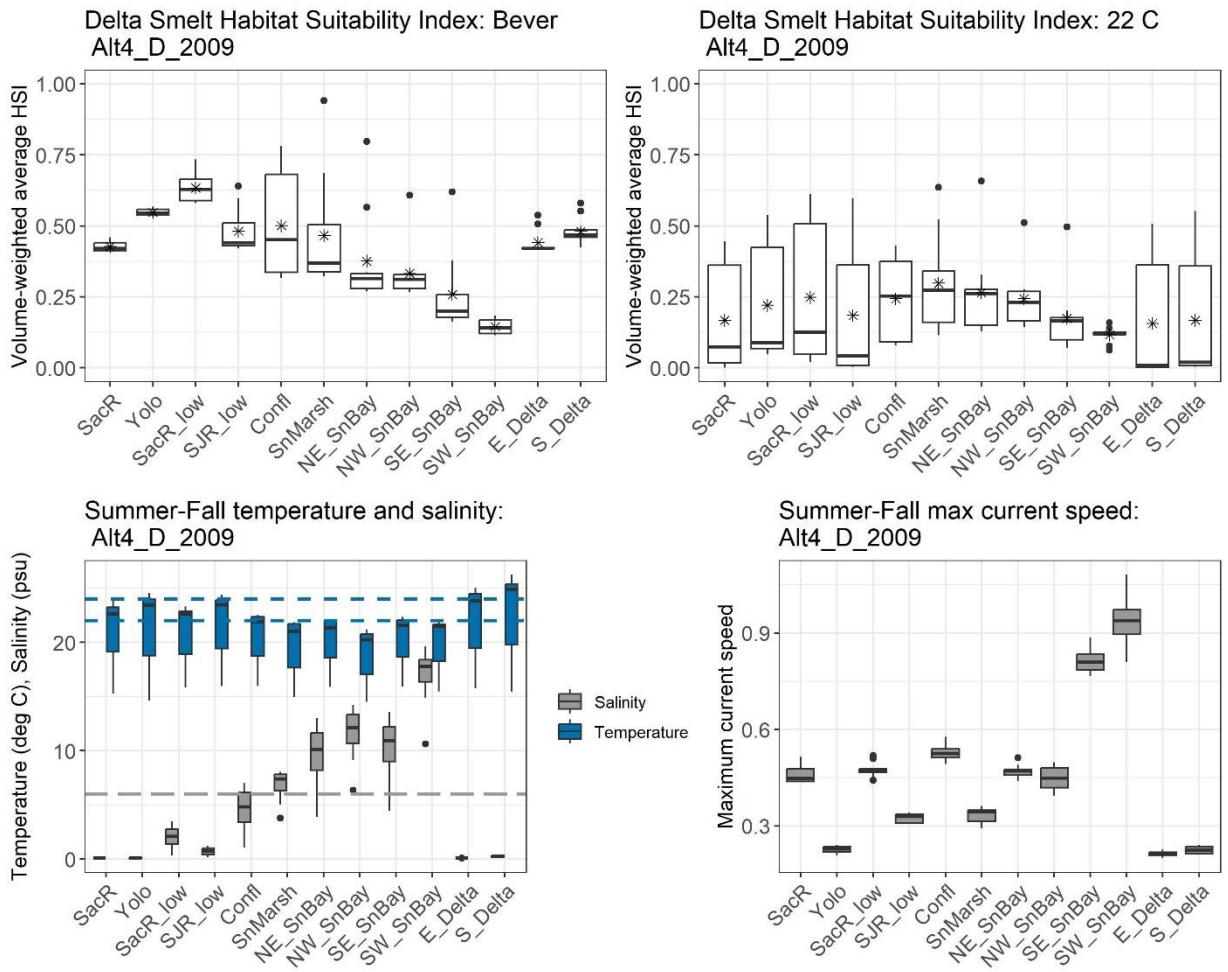

Figure K.1-104. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the dry water year (2009) are shown for alternative 4 (Alt4). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.3.7.5 2015 Critically Dry Water Year

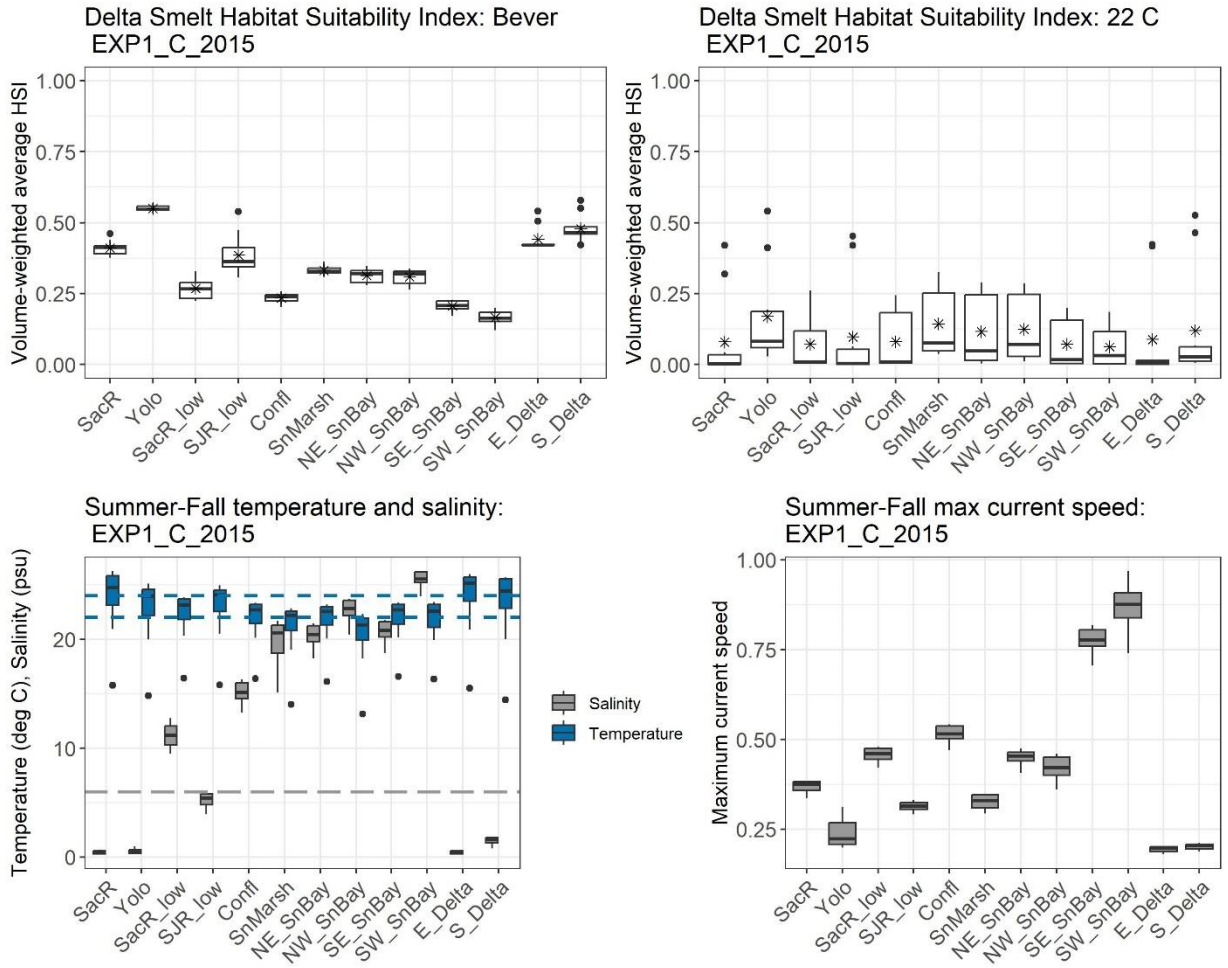

Figure K.1-105. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for exploratory 1 (EXP1). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

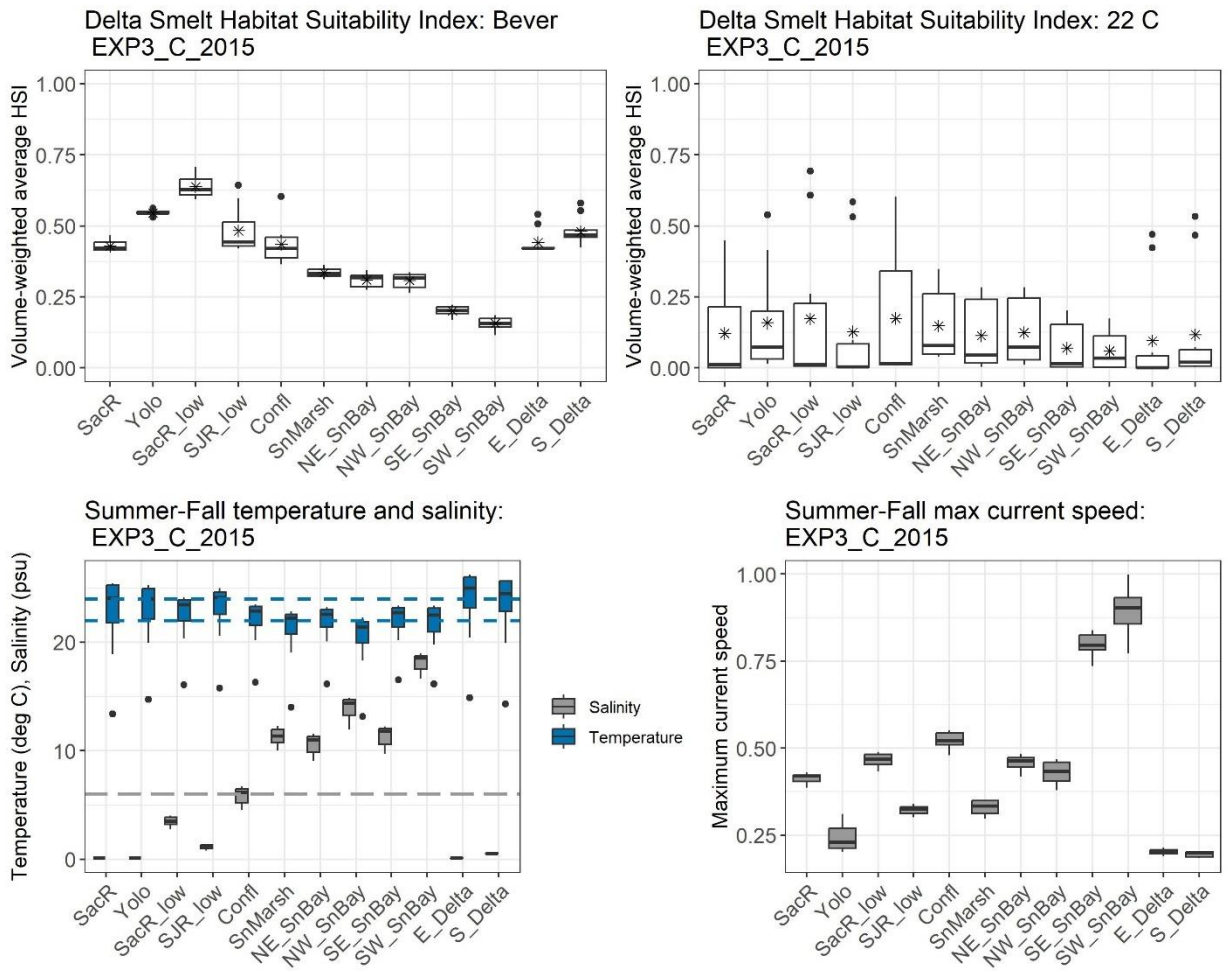

Figure K.1-106. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for exploratory 3 (EXP3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

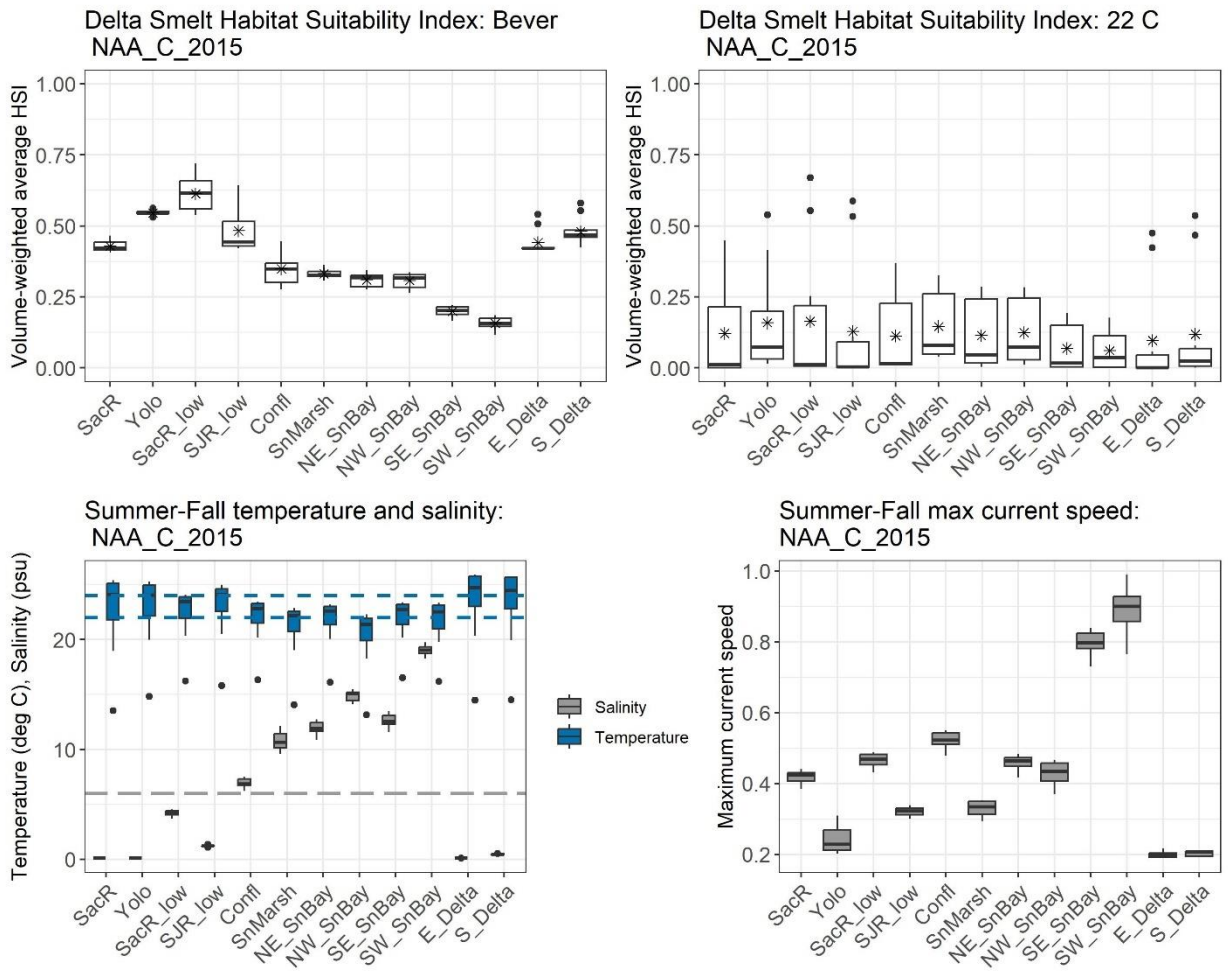

Figure K.1-107. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for the no action alternative (NAA). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

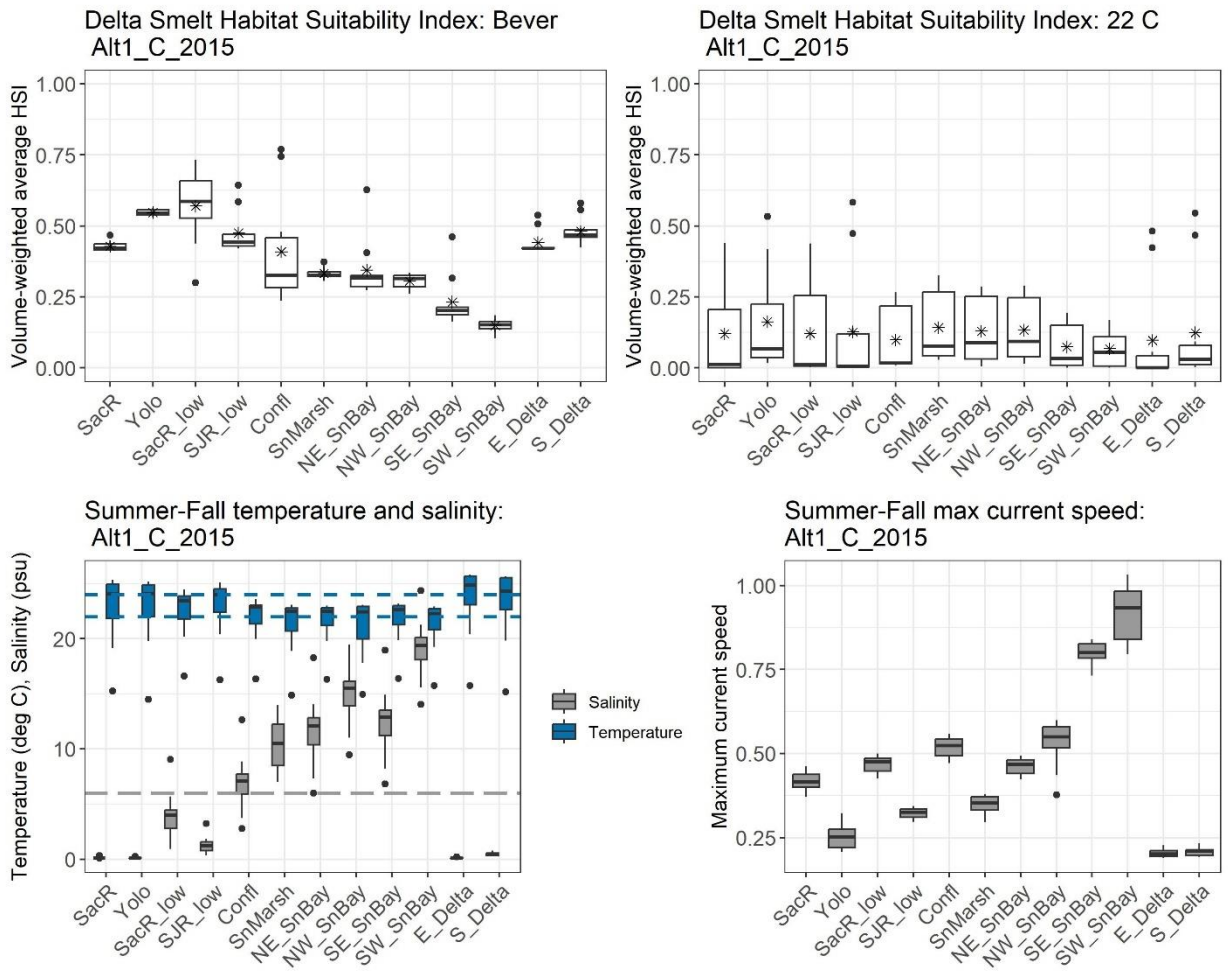

Figure K.1-108. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 1 (Alt1). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

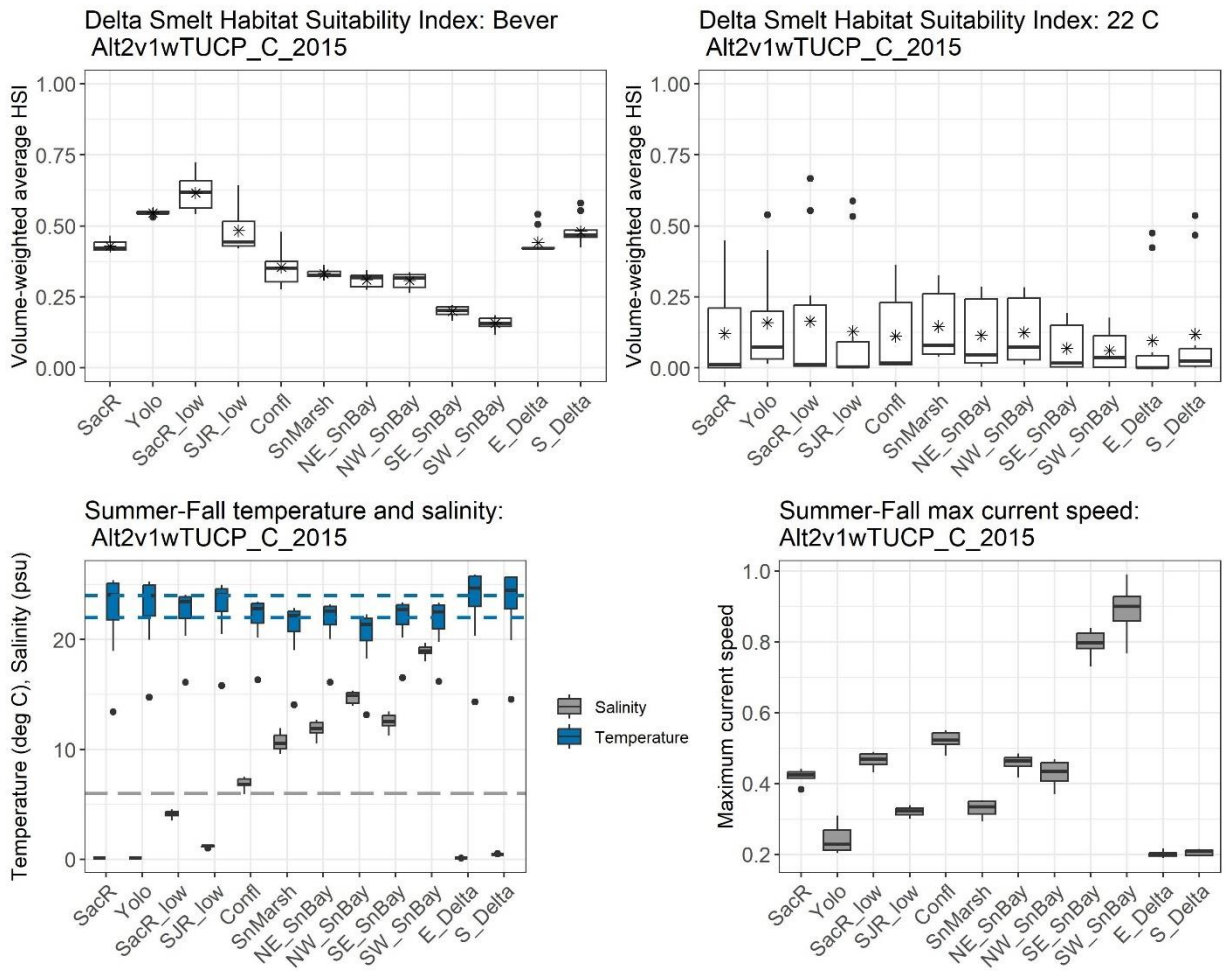

Figure K.1-109. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 2 with temporary urgency change, without Voluntary Agreements (Alt2v1wTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

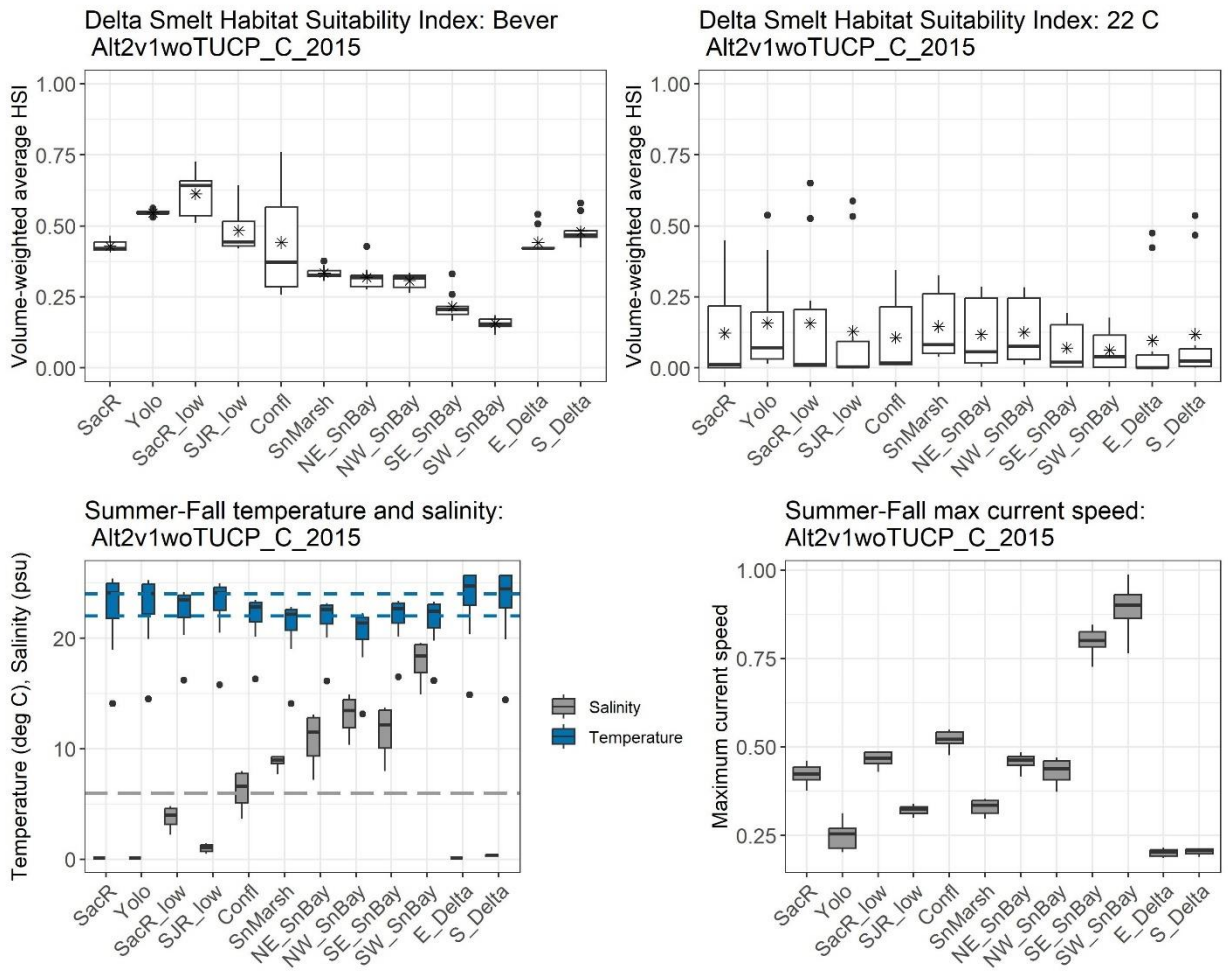

Figure K.1-110. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 2 without temporary urgency change, without Voluntary Agreements (Alt2v1woTUCP). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

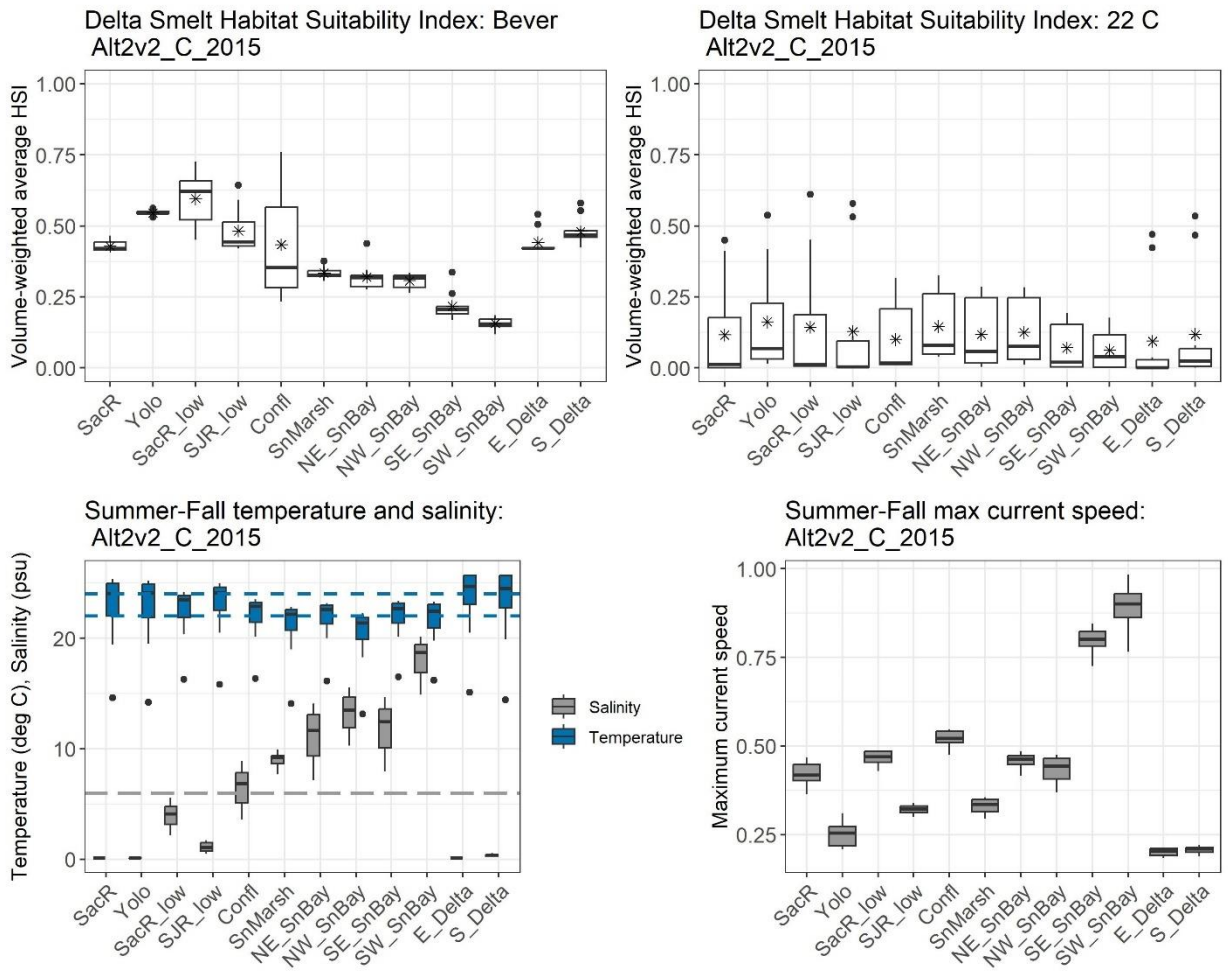

Figure K.1-111. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 2 without temporary urgency change, with Delta Voluntary Agreements (Alt2v2). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

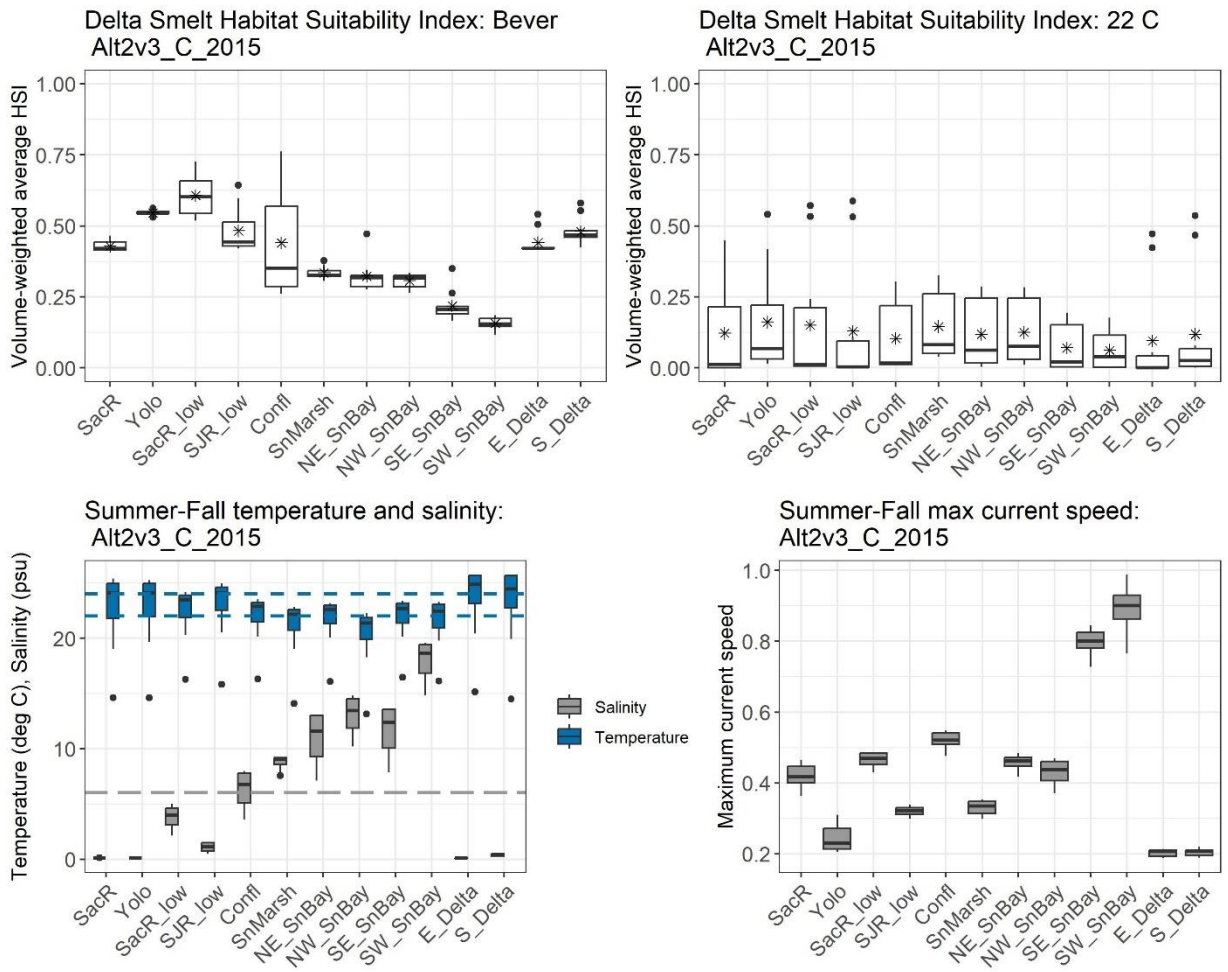

Figure K.1-112. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 2 without temporary urgency change, with all Voluntary Agreements (Alt2v3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

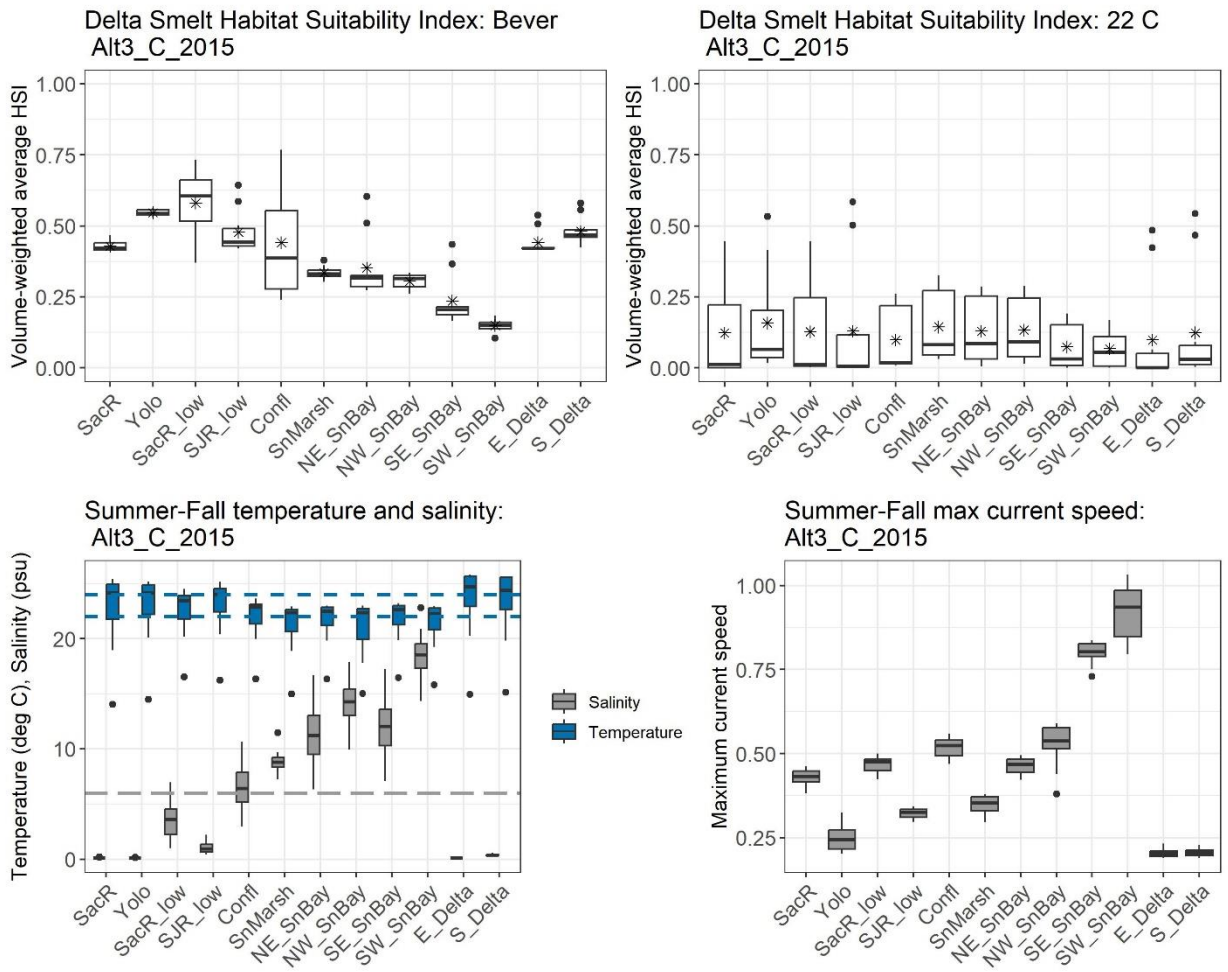

Figure K.1-113. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 3 (Alt3). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

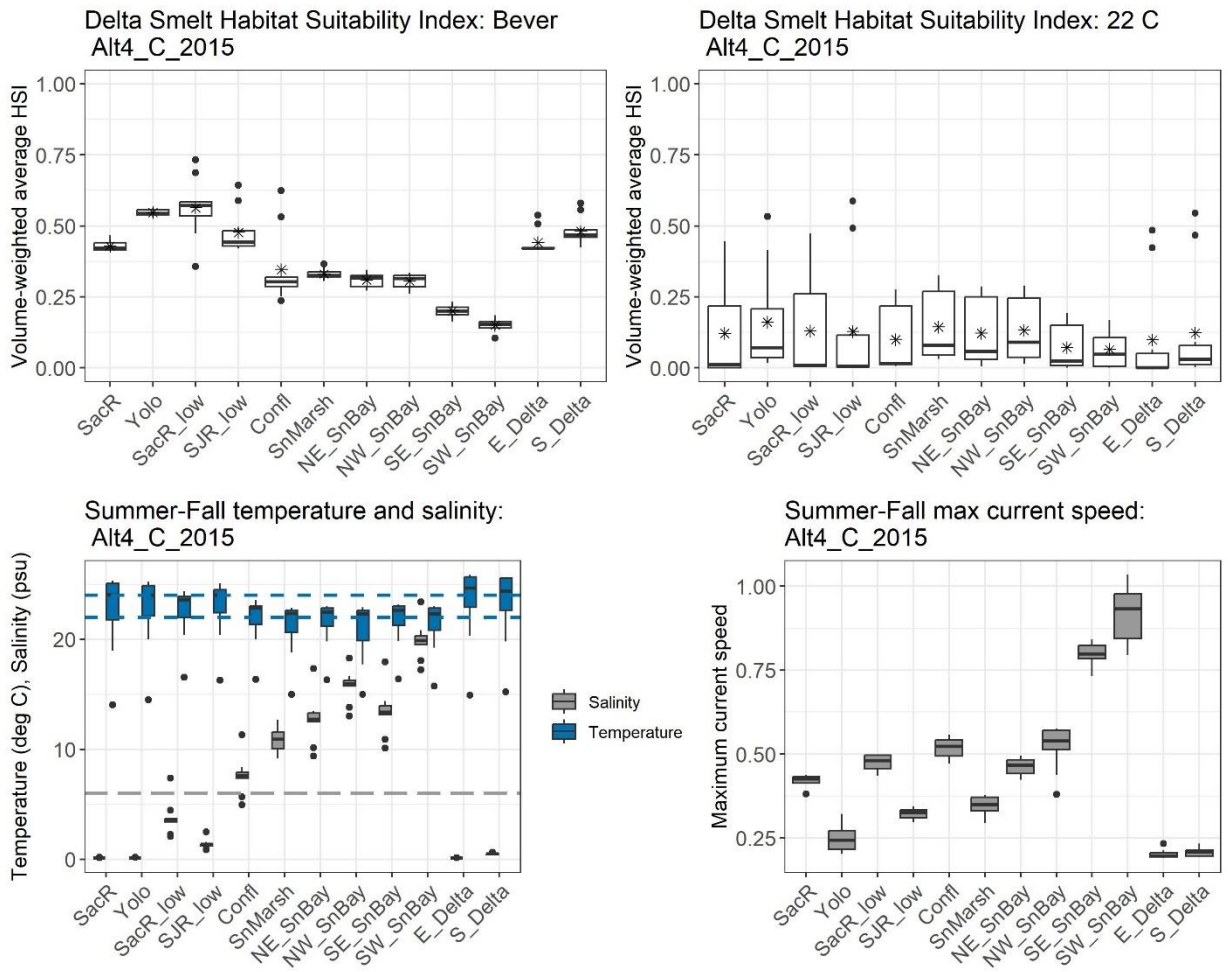

Figure K.1-114. Top left graph: Bever et al. (2016) habitat suitability indices for each subregion. Top right graph: Bever et al. (2016) habitat suitability indices and indices modified by a 22-degree Celsius threshold for each subregion. Lower left graph: temperature (in blue) and salinity (in gray) for each subregion; the dashed gray line indicates the 6 ppt salinity threshold; the dashed blue lines indicate the 22° and 24° C temperature thresholds. Lower right graph: maximum current speed for each subregion. In all graphs, data for the July 1 – November 18 in the critically dry water year (2015) are shown for alternative 4 (Alt4). The median is shown as the horizontal line, the mean is shown with an asterisk (HSI graphs only), the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.3.8 Assumptions / Uncertainty

Using historical turbidity values for a given water year type is the largest source of uncertainty, as we have very poor predictive power for turbidity. Actual turbidities corresponding to the modeled conditions may be quite different. Also, model predictions are subject to limitations in the climate datasets used, and methodologies used to derive the boundary conditions, as well as CALSIM 3 assumptions and uncertainties in the flows that are used as boundary conditions to SCHISM.

For example, in the first exploratory scenario analyzed (EXP 1), total inflows in the selected above normal water year compared to the wet water year differed in magnitude and timing, with above normal year inflows being greater than wet water year inflows during the first half of the summer and fall habitat action period (July – August) and lower during the second half (September – mid-November). This resulted in overall higher salinities in the wet year compared to the above normal year for EXP1 between July and mid-November (Figure K.1-115). The flow magnitude and timing for this case are illustrated in Figure K.1-115.

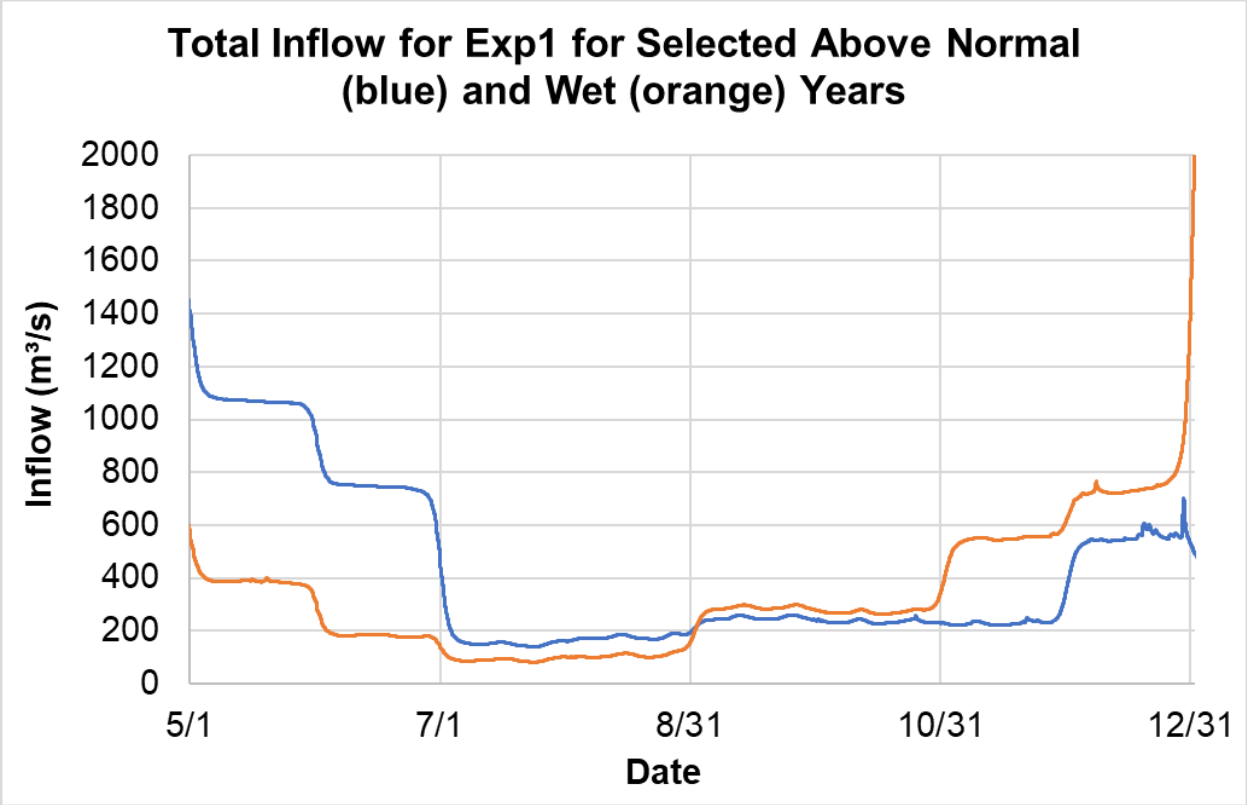

Figure K.1-115. Inflow rates for Exp 1 scenario highlighting differences between AN and W years before and during the summer-fall period considered.

The range of water temperatures during July through November span the 22°C and 24°C temperature thresholds used to modify Bever et al. (2016). This causes HSI calculations using these thresholds to be very sensitive to both the temperature threshold used for calculating HSI and the source of temperature-related atmospheric variables for the SCHISM simulations.

K.1.3.8.1 Temperature Threshold Effects

To demonstrate the effect of a temperature threshold on HSI, HSI was calculated using the Bever et al. (2016) HSI and the Bever et al. (2016) HSI modified by the 22°C and 24°C thresholds for each of the air input sources (Figure K.1-116 through Figure K.1-118). The "hard" cutoff approach of multiplying the Bever et al. (2016) HSI by 1 if water temperature is less than the threshold or by 0 if water temperature is greater than or equal the threshold causes the resulting HSI values to be highly sensitive to including a temperature threshold and to the temperature at which the threshold is set.

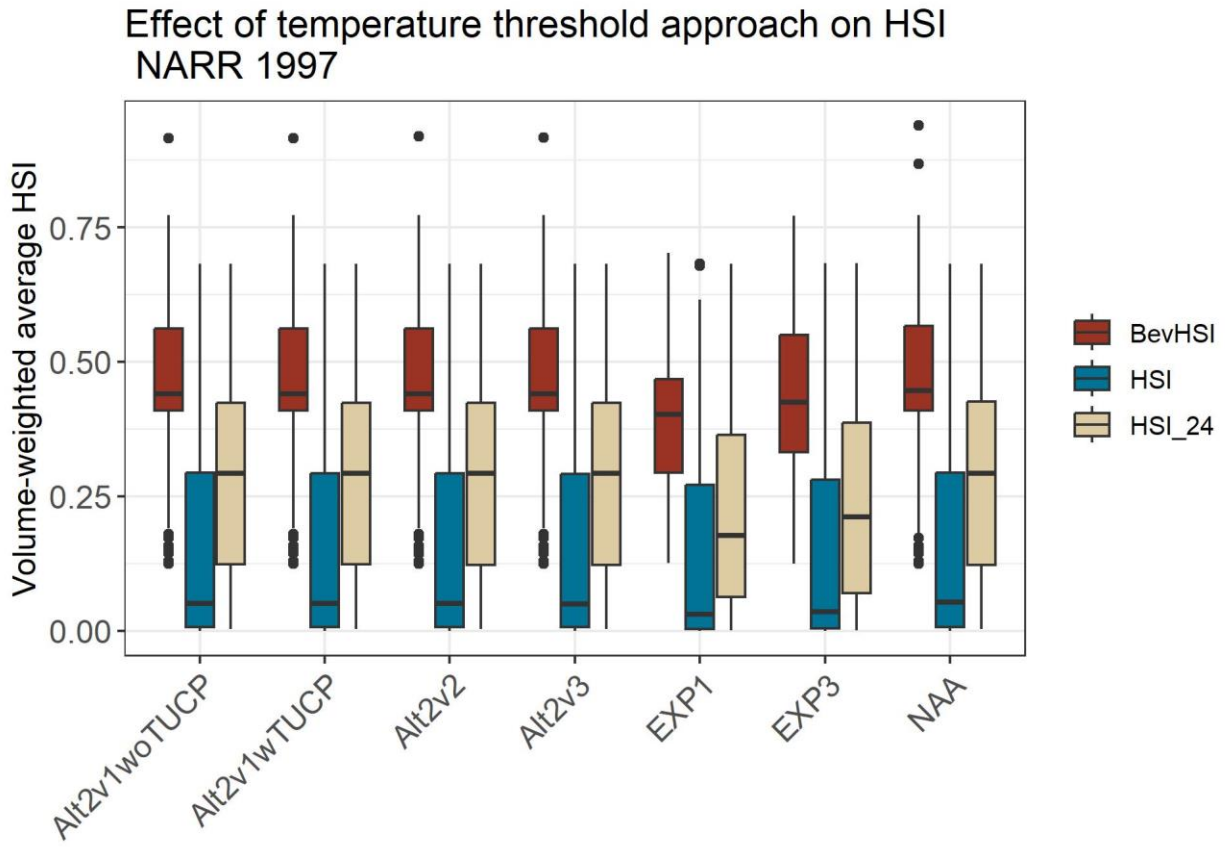

Figure K.1-116. Habitat suitability index (HSI) from July 1 – November 18 calculated using Bever et al. (2016) and Bever et al. (2016) modified by the 22°C and 24°C thresholds and using the NARR 1997 air temperature for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The HSI calculations, from left to right are: BevHSI = Bever et al. (2016); HSI = Bever et al. (2016) modified by the 22°C threshold; and HSI_24 = Bever et al. (2016) modified by the 24°C threshold.

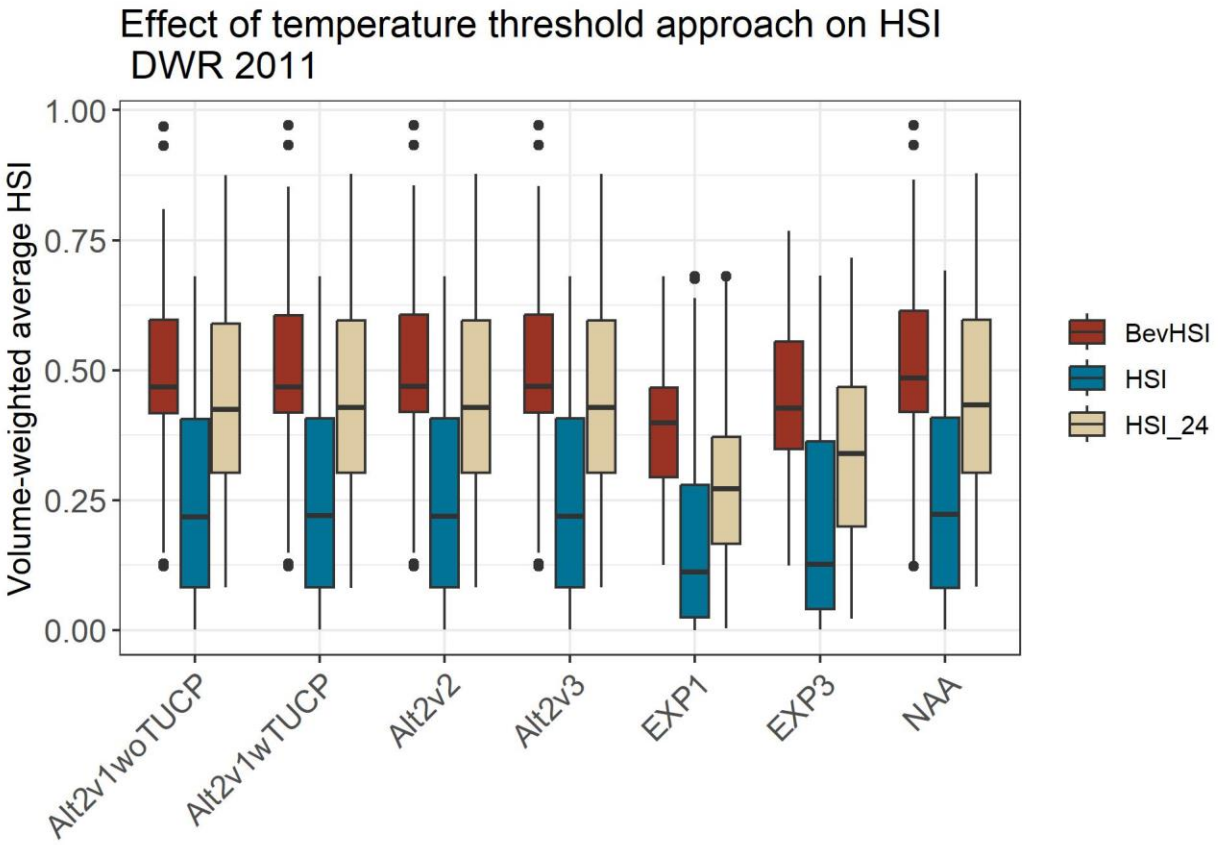

Figure K.1-117. Habitat suitability index (HSI) from July 1 – November 18 calculated using Bever et al. (2016) and Bever et al. (2016) modified by the 22°C and 24°C thresholds and using the DWR 2011 air temperature for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The HSI calculations, from left to right are: BevHSI = Bever et al. (2016); HSI = Bever et al. (2016) modified by the 22°C threshold; and HSI_24 = Bever et al. (2016) modified by the 24°C threshold.

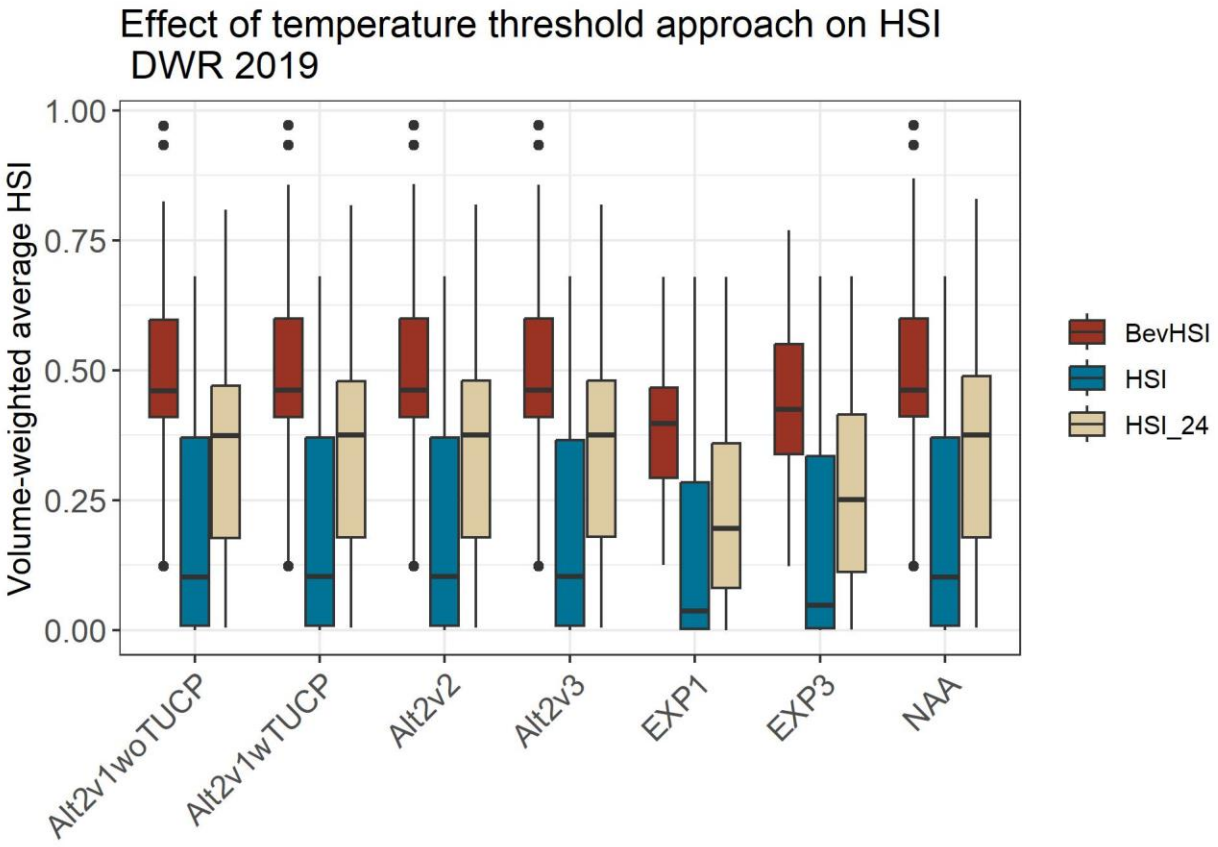

Figure K.1-118. Habitat suitability index (HSI) from July 1 – November 18 calculated using Bever et al. (2016) and Bever et al. (2016) modified by the 22°C and 24°C thresholds and using the DWR 2019 air temperature for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers. The HSI calculations, from left to right are: BevHSI = Bever et al. (2016); HSI = Bever et al. (2016) modified by the 22°C threshold; and HSI_24 = Bever et al. (2016) modified by the 24°C threshold.

K.1.3.8.2 Air inputs source Effects

To demonstrate the effect of atmospheric source on HSI, HSI was calculated using the NARR air inputs, DWR 2011 air inputs, and DWR 2019 air inputs (Figure K.1-119 through Figure K.1-121).

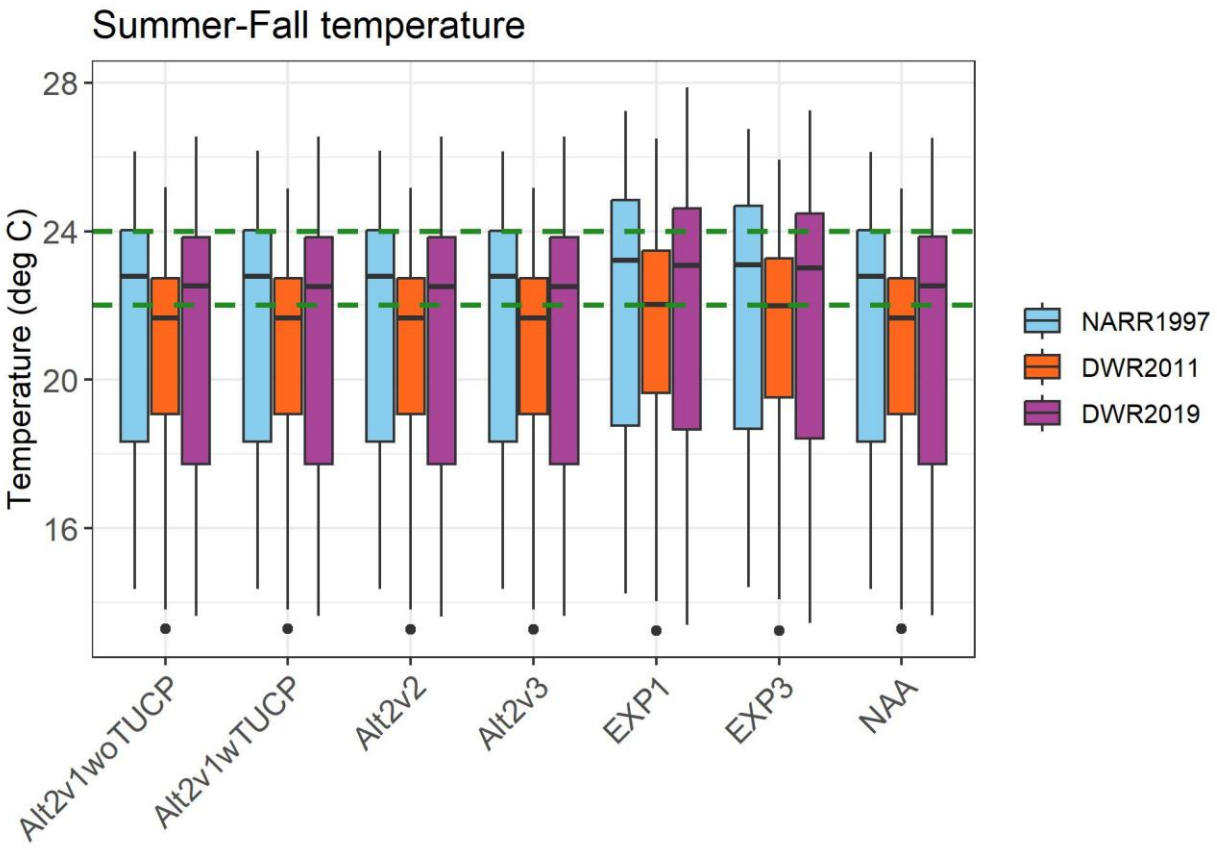

Figure K.1-119. Water temperatures (degrees Celsius [°C]) from July 1 – November 18 using the NARR 1997, DWR 2011, and DWR 2019 air inputs for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

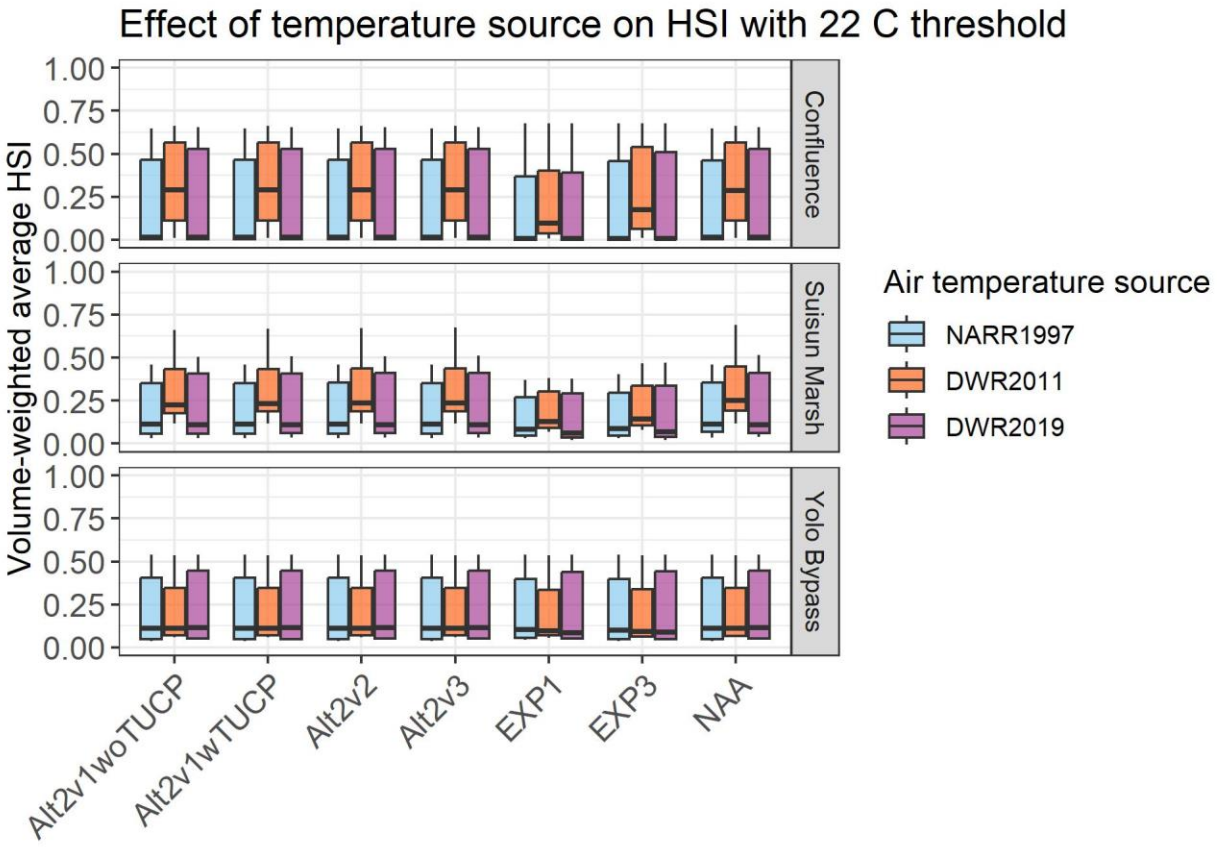

Figure K.1-120. Bever et al. (2016) modified by a 22-degree Celsius threshold from July 1 – November 18 using the NARR 1997, DWR 2011, and DWR 2019 air inputs for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

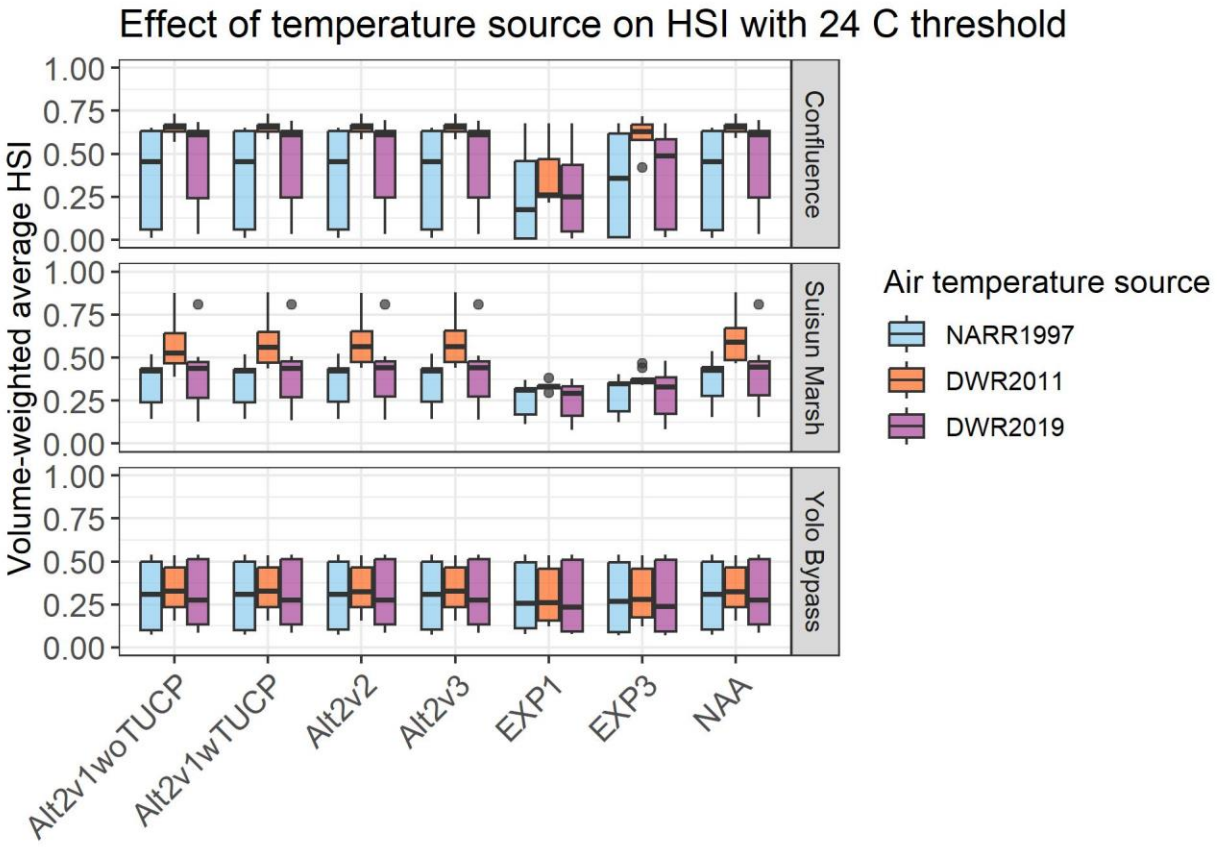

Figure K.1-121. Bever et al. (2016) modified by a 24-degree Celsius threshold from July 1 – November 18 using the NARR 1997, DWR 2011, and DWR 2019 air inputs for each alternative for the 1997 wet water year. The median is shown as the horizontal line, the box indicates the 25th and 75th percentiles, the vertical lines indicate the 25th and 75th percentiles plus 1.5 times the interquartile range, and the dots indicate potential outliers.

K.1.4 References

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