**Appendix 9K**

# Delta Hydrodynamic Analysis Documentation

This appendix provides information about the methods and assumptions used for the Coordinated Long Term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Environmental Impact Statement (EIS) analysis using the Delta Hydrodynamic analysis. This appendix is organized into the following sections:

- Section 9K.1: Delta Hydrodynamic Analysis Methodology and Assumptions
  - The Delta Hydrodynamic analysis summarizes 15-minute velocity output from DSM2 over the 82-year simulation period (1922 to 2003). This section briefly describes the approach and assumptions for the Delta Hydrodynamic analysis.
- Section 9K.2: Delta Hydrodynamic Analysis Results
  - This section presents the results of the Delta Hydrodynamic analysis. Results are presented in a series of figures showing the proportion positive velocity for each alternative comparison for five DSM2 Hydro channels.

## 9K.1 Delta Hydrodynamic Analysis Methodology and Assumptions

### 9K.1.1 Delta Hydrodynamic Analysis Methodology

For this analysis, 15-minute DSM2 Hydro output (velocity) was summarized over the 82-year simulation period (1922 to 2003) at the midpoint of five DSM2 channels, as follows:

- San Joaquin River mainstem downstream of the Head of Old River (DSM2 channel 21)
- Old River downstream of the facilities (DSM2 channel 212)
- Old River upstream of the facilities (DSM2 channel 94)
- Sacramento River near Georgiana Slough (DSM2 channel 421)
- San Joaquin River mainstem near the confluence with the Mokelumne River (DSM2 channel 45)

DSM2 output is summarized as the proportion of 15-minute observations with a value greater than 0 feet/second (proportion positive velocity). The proportion positive velocity is selected as the hydrodynamic metric because there is evidence that juvenile anadromous fish selectively migrate with the tides (Forward and Tankersly 2001). Thus, in a tidally-influenced system, metric that measures the frequency and directionality of the velocity (proportion positive velocity) is

arguably more relevant for anadromous fish migration than a metric that measures the magnitude of the velocity (e.g., mean velocity).

The 15-minute observations were summarized for every combination of scenario (No Action Alternative, Second Basis of Comparison, Alternative 3, and Alternative 5) for 81 water years (1922 to 2003); DSM2 channels (21, 45, 94, 212, 421); and January through June to provide a total of 9,840 observations (4 * 82 * 5 * 6).

### 9K.1.2 Delta Hydrodynamic Analysis Scenario Assumptions

The key assumption in the Delta Hydrodynamic analysis is that the proportion positive velocity of a channel, measured at a monthly time step, is an indicator of the likelihood that juvenile anadromous fish will successfully migrate through that channel towards the ocean.

## 9K.2 Delta Hydrodynamic Analysis Results

IOS Model results are provided to compare the scenarios. Differences in escapement and egg survival are displayed as time histories across all 81 water years (1922 to 2002), and box plots of median survival across all years.

The results are provided as figures summarizing the proportion of positive velocities in each month at various locations over the 82-year CalSim II simulation period for following runs:

- No Action Alternative
- Second Basis of Comparison (same as Alternative 1)
- Alternative 3
- Alternative 5

The following scenario comparisons are presented in Figures 9K.1 through 9K.25:

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 3 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the No Action Alternative
- Alternative 5 compared to the Second Basis of Comparison

## 9K.3 Reference

Forward, Jr. R.B. & R.A. Tankersley. 2001. "Selective Tidal-stream Transport of Marine Animals." *Oceanogr. Mar. Biol. Ann. Rev*. 39: 305-353.

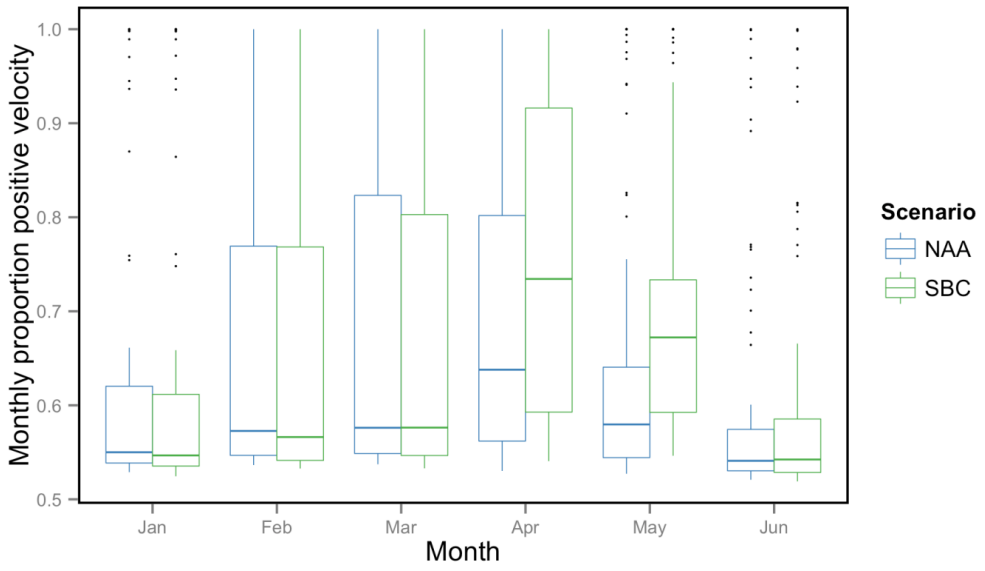


**Figure 9K.1 Proportion of Monthly Positive Velocities in the San Joaquin River Downstream of the Head of Old River under the No Action Alternative (NAA) compared to the Second Basis of Comparison (SBC)**

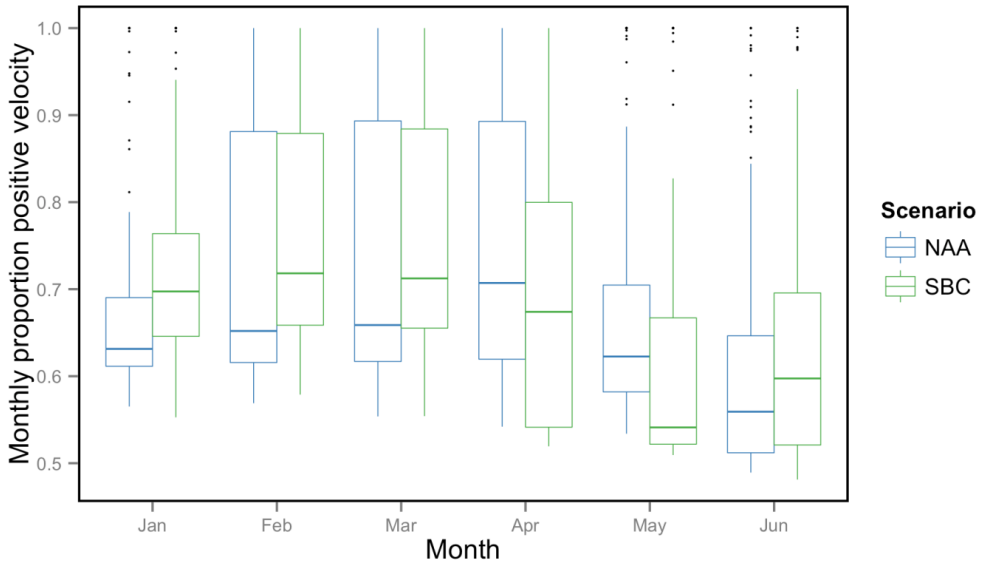


**Figure 9K.2 Proportion of Monthly Positive Velocities in Old River Upstream of the Facilities under the No Action Alternative (NAA) compared to the Second Basis of Comparison (SBC)**

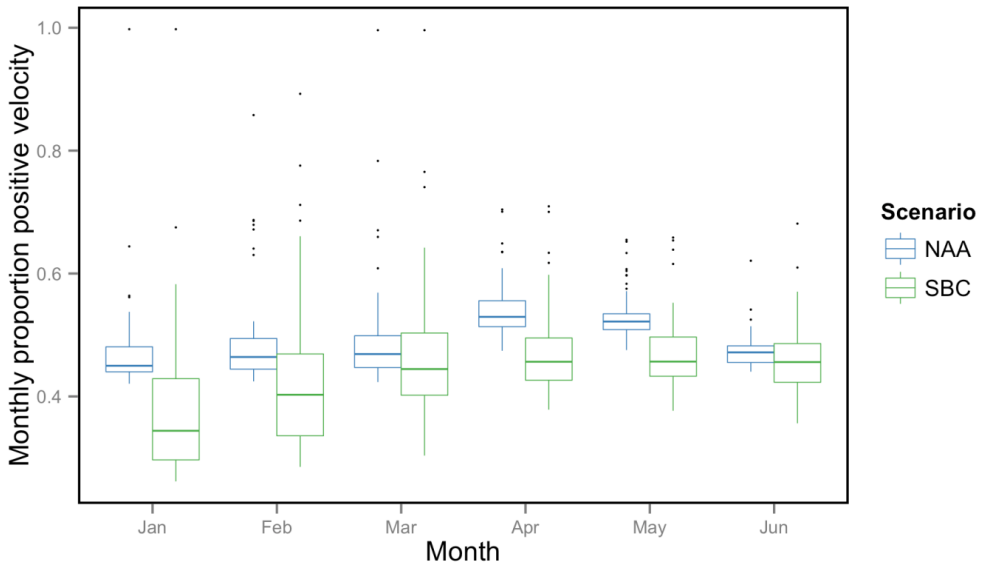


**Figure 9K.3 Proportion of Monthly Positive Velocities in Old River Downstream of the Facilities under the No Action Alternative (NAA) compared to the Second Basis of Comparison (SBC)**

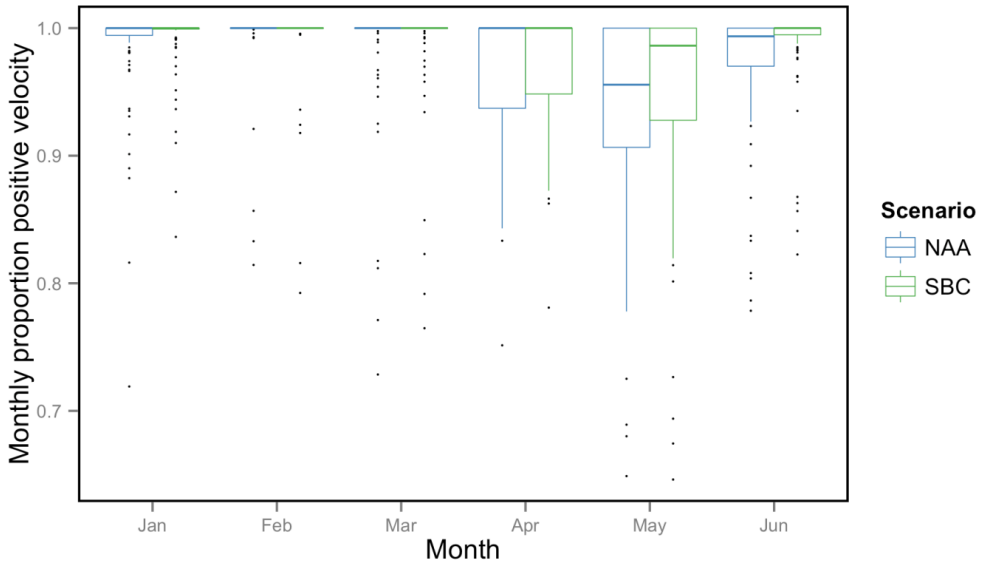


**Figure 9K.4 Proportion of Monthly Positive Velocities in Sacramento River near Georgiana Slough under the No Action Alternative (NAA) compared to the Second Basis of Comparison (SBC)**

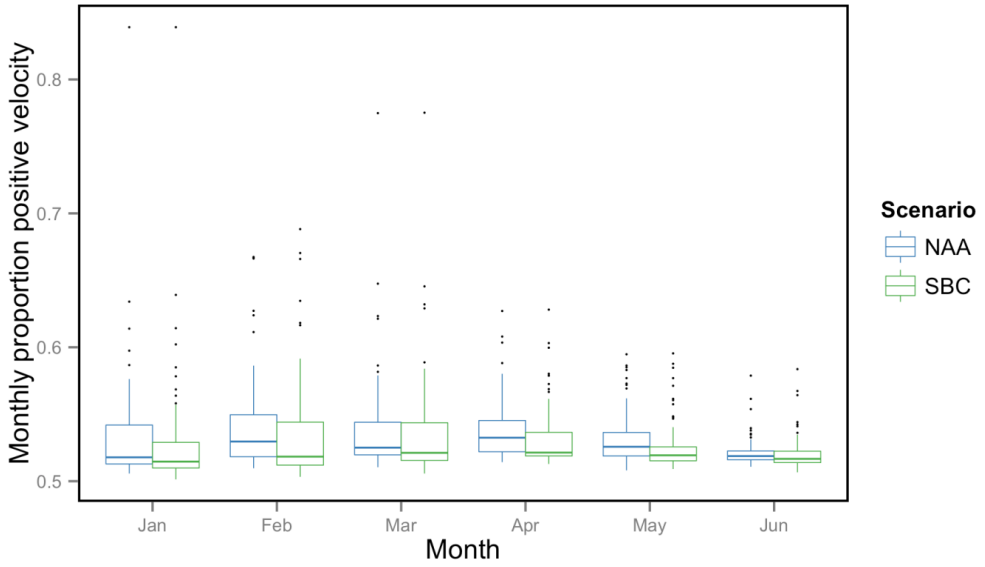


**Figure 9K.5 Proportion of Monthly Positive Velocities in the San Joaquin River near Confluence with Mokelumne River under the No Action Alternative (NAA) compared to the Second Basis of Comparison (SBC)**

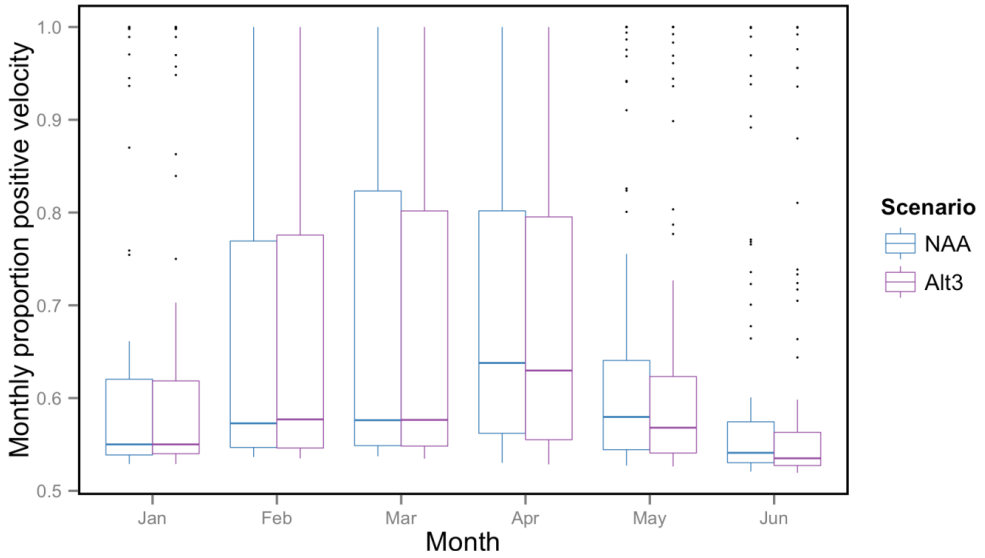


**Figure 9K.6 Proportion of Monthly Positive Velocities in the San Joaquin River Downstream of the Head of Old River under Alternative 3 (Alt 3) as compared to the No Action Alternative (NAA)**

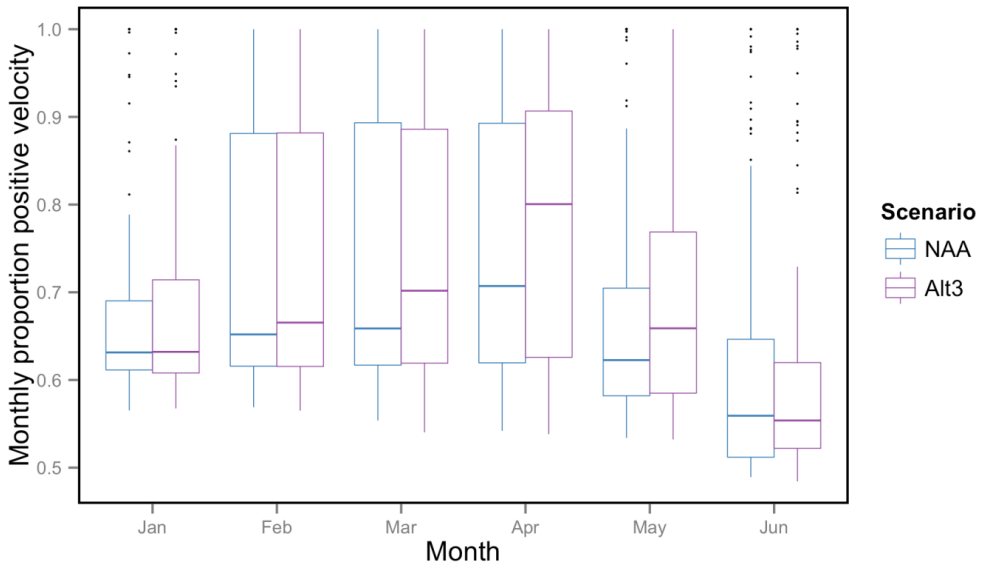


**Figure 9K.7 Proportion of Monthly Positive Velocities in Old River Upstream of the Facilities under Alternative 3 (Alt 3) as compared to the No Action Alternative (NAA)**

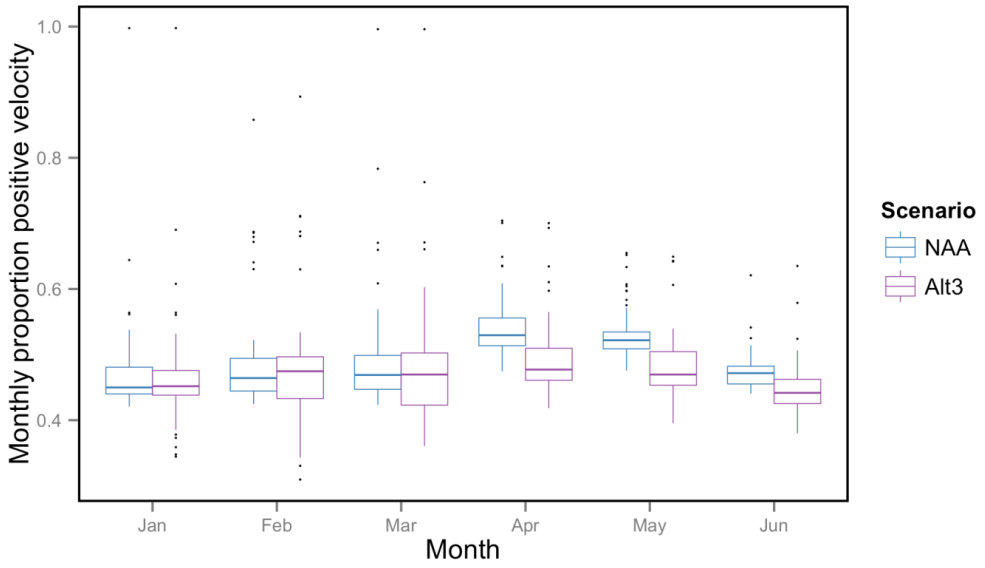


**Figure 9K.8 Proportion of Monthly Positive Velocities in Old River Downstream of the Facilities under Alternative 3 (Alt 3) as compared to the No Action Alternative (NAA)**

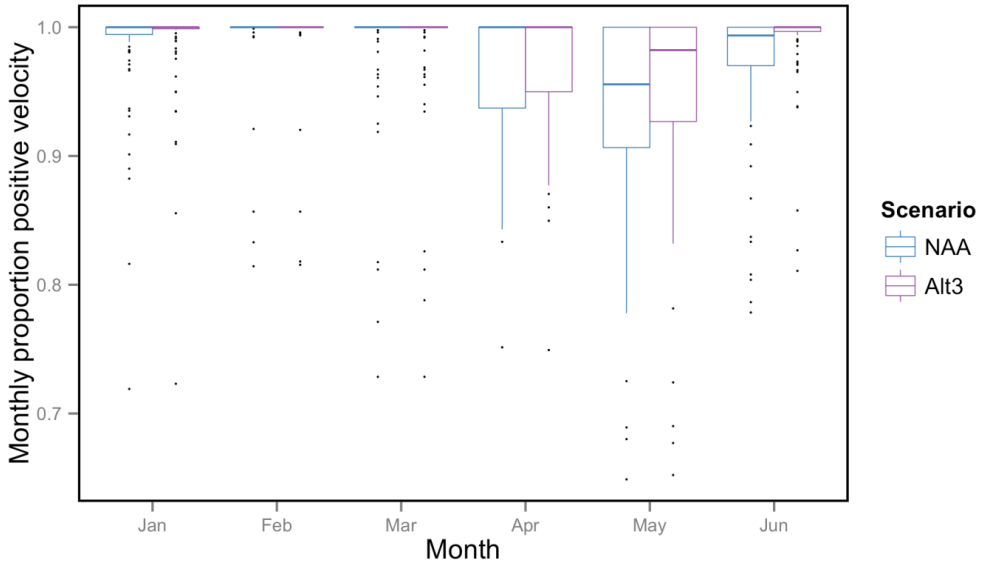


**Figure 9K.9 Proportion of Monthly Positive Velocities in Sacramento River near Georgiana Slough under Alternative 3 (Alt 3) as compared to the No Action Alternative (NAA)**

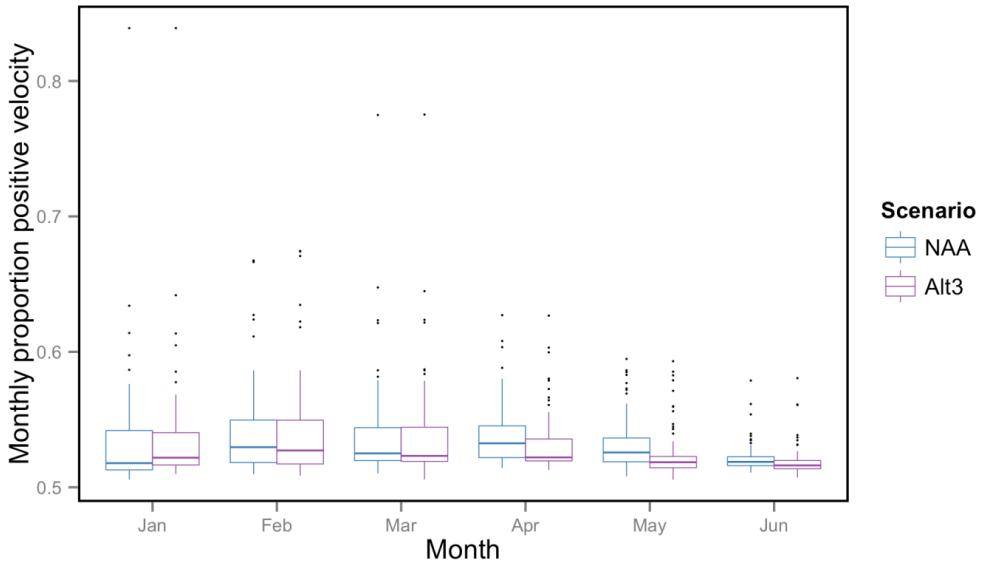


**Figure 9K.10 Proportion of Monthly Positive Velocities in the San Joaquin River near Confluence with Mokelumne River under Alternative 3 (Alt 3) as compared to the No Action Alternative (NAA)**

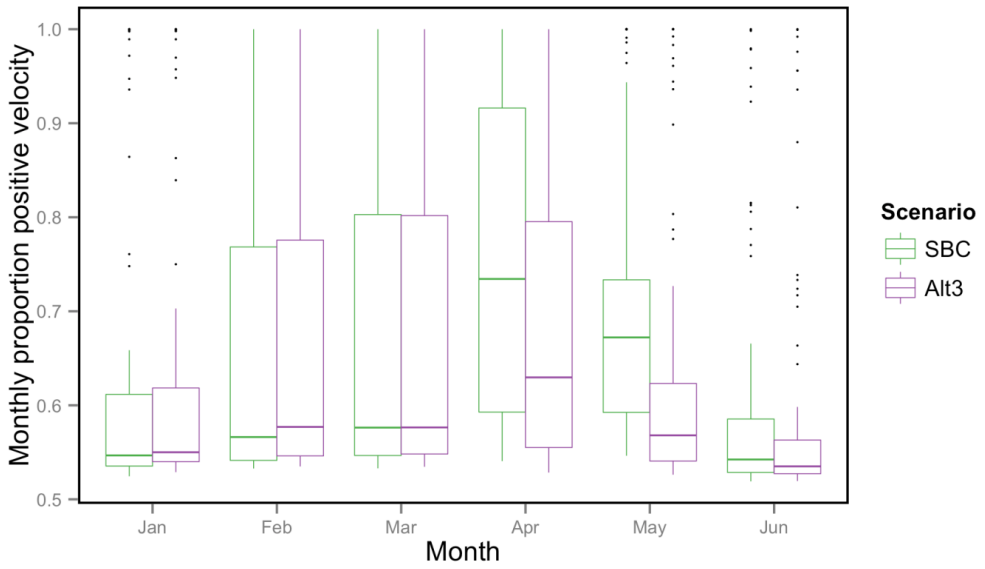


**Figure 9K.11 Proportion of Monthly Positive Velocities in the San Joaquin River Downstream of the Head of Old River under Alternative 3 (Alt 3) as compared to the Second Basis of Comparison (SBC)**

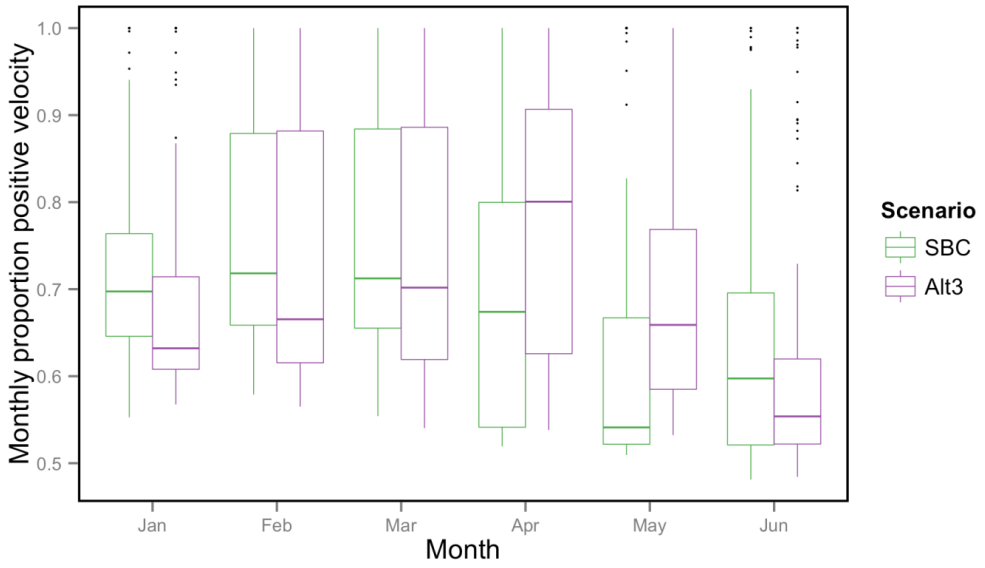


**Figure 9K.12 Proportion of Monthly Positive Velocities in Old River Upstream of the Facilities under Alternative 3 (Alt 3) as compared to the Second Basis of Comparison (SBC)**

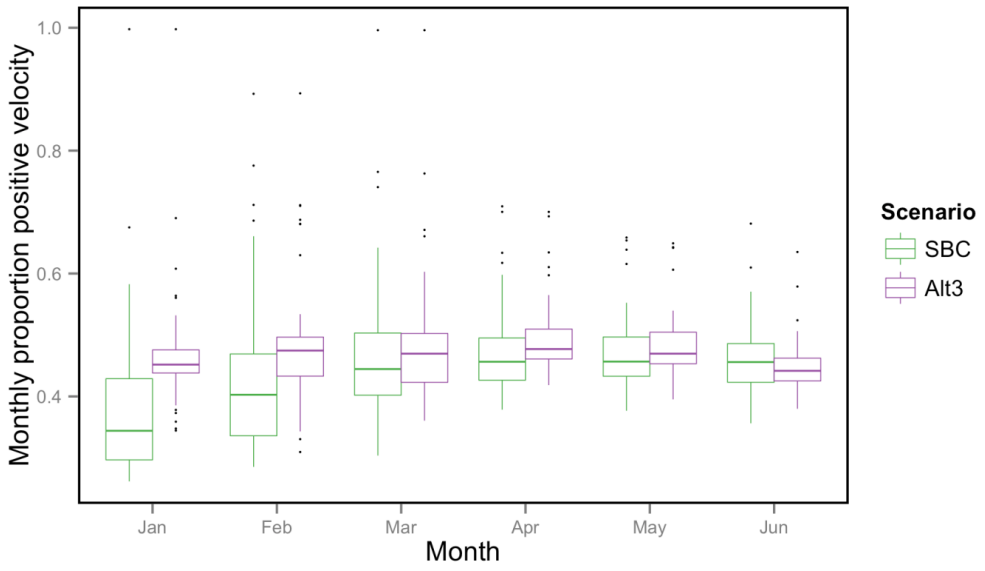


**Figure 9K.13 Proportion of Monthly Positive Velocities in Old River Downstream of the Facilities under Alternative 3 (Alt 3) as compared to the Second Basis of Comparison (SBC)**

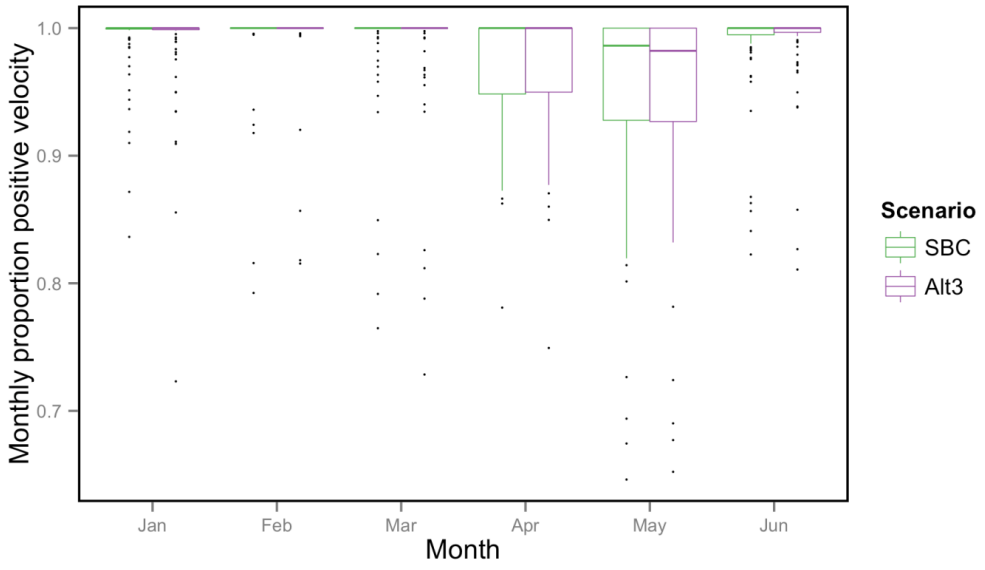


**Figure 9K.14 Proportion of Monthly Positive Velocities in Sacramento River near Georgiana Slough under Alternative 3 (Alt 3) as compared to the Second Basis of Comparison (SBC)**

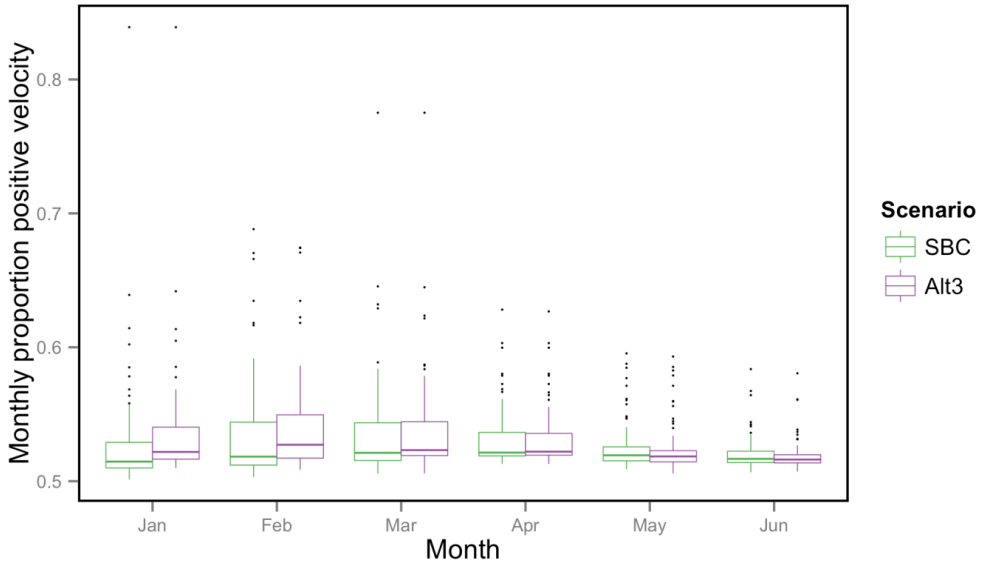


**Figure 9K.15 Proportion of Monthly Positive Velocities in the San Joaquin River near Confluence with Mokelumne River under Alternative 3 (Alt 3) as compared to the Second Basis of Comparison**

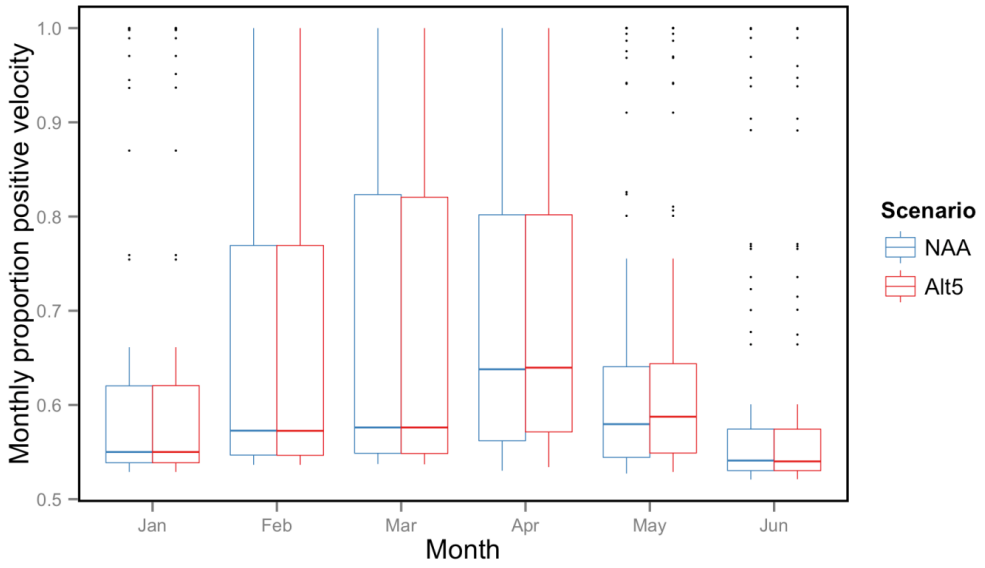


**Figure 9K.16 Proportion of Monthly Positive Velocities in the San Joaquin River Downstream of the Head of Old River under Alternative 5 (Alt 5) as compared to the No Action Alternative (NAA)**

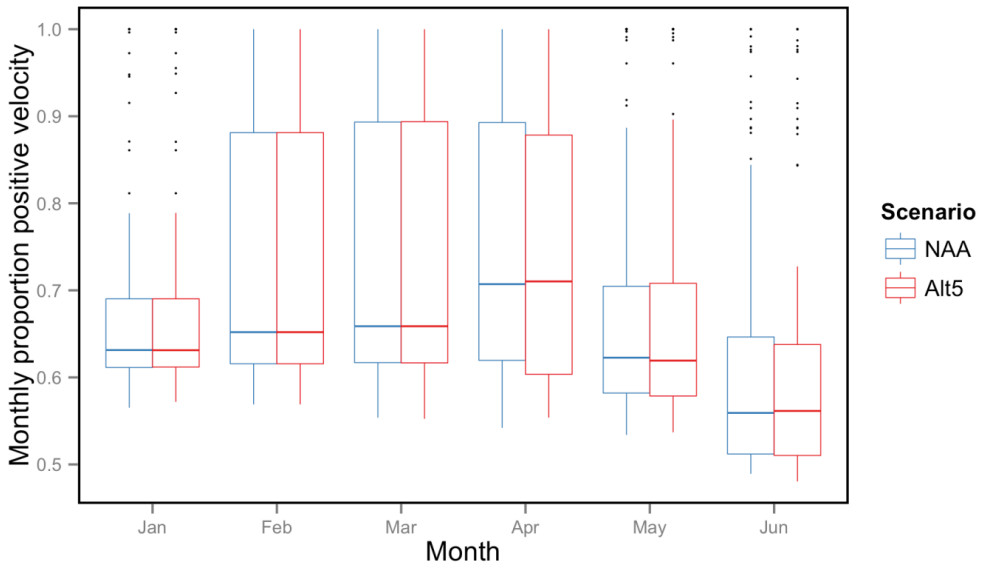


**Figure 9K.17 Proportion of Monthly Positive Velocities in Old River Upstream of the Facilities under Alternative 5 (Alt 5) as compared to the No Action Alternative (NAA)**

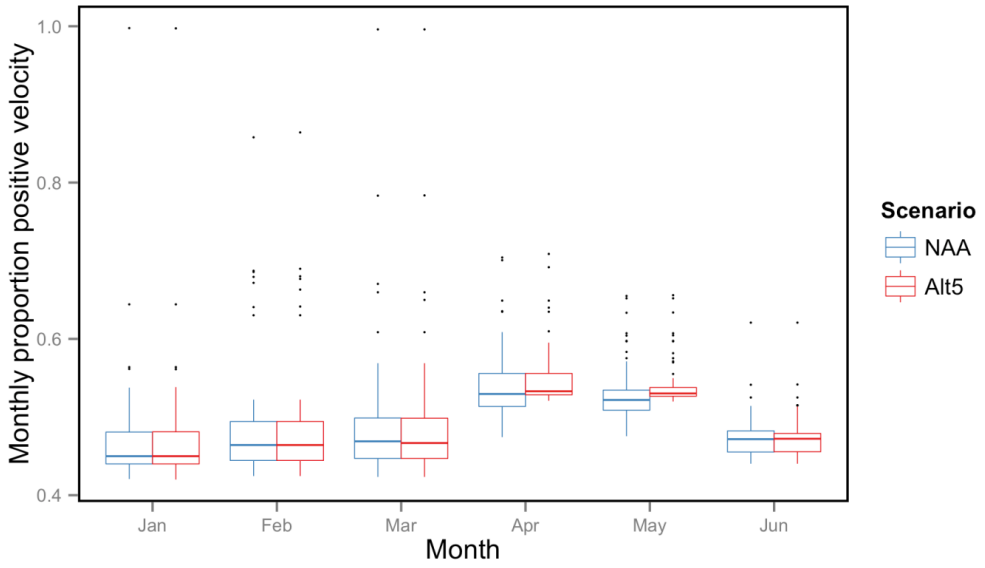


**Figure 9K.18 Proportion of Monthly Positive Velocities in Old River Downstream of the Facilities under Alternative 5 (Alt 5) as compared to the No Action Alternative (NAA)**

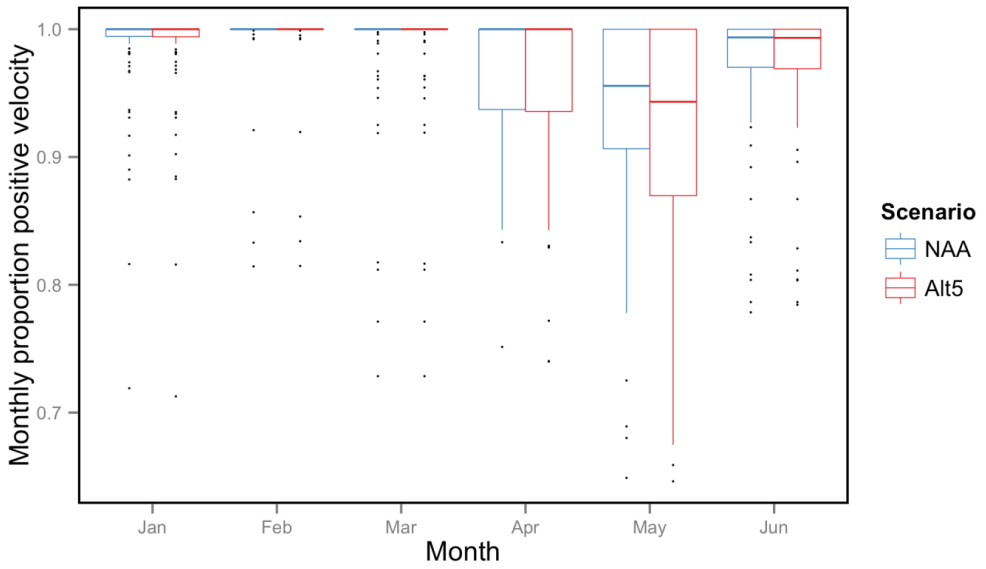


**Figure 9K.19 Proportion of Monthly Positive Velocities in Sacramento River near Georgiana Slough under Alternative 5 (Alt 5) as compared to the No Action Alternative (NAA)**

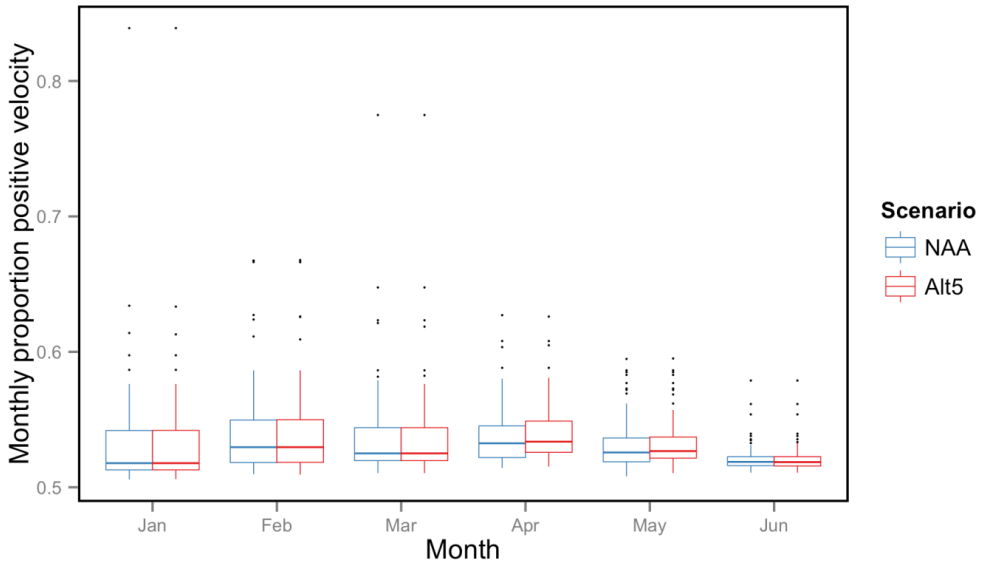


**Figure 9K.20 Proportion of Monthly Positive Velocities in the San Joaquin River near Confluence with Mokelumne River under Alternative 5 (Alt 5) as compared to the No Action Alternative (NAA)**

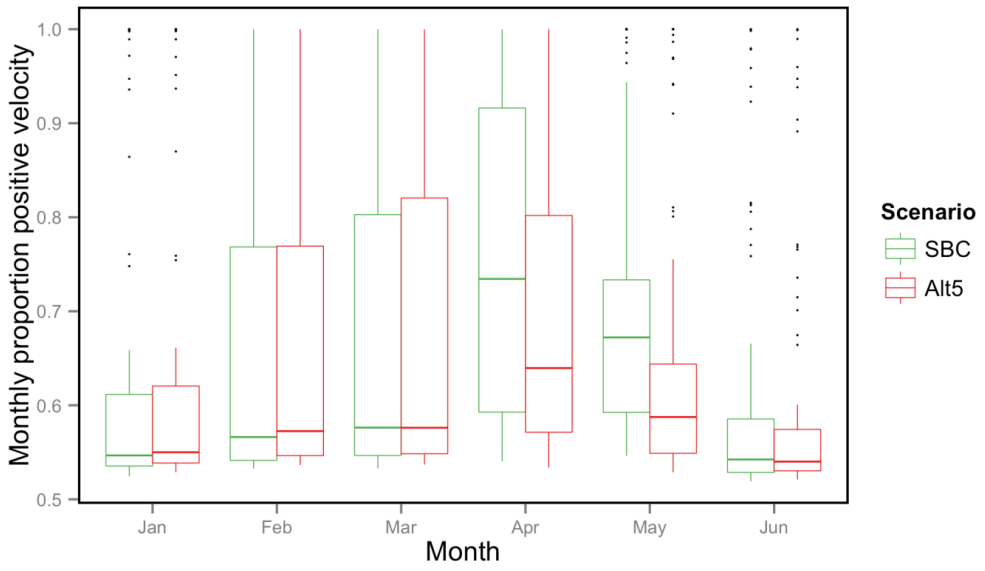


**Figure 9K.21 Proportion of Monthly Positive Velocities in the San Joaquin River Downstream of the Head of Old River under Alternative 5 (Alt 5) as compared to the Second Basis of Comparison (SBC)**

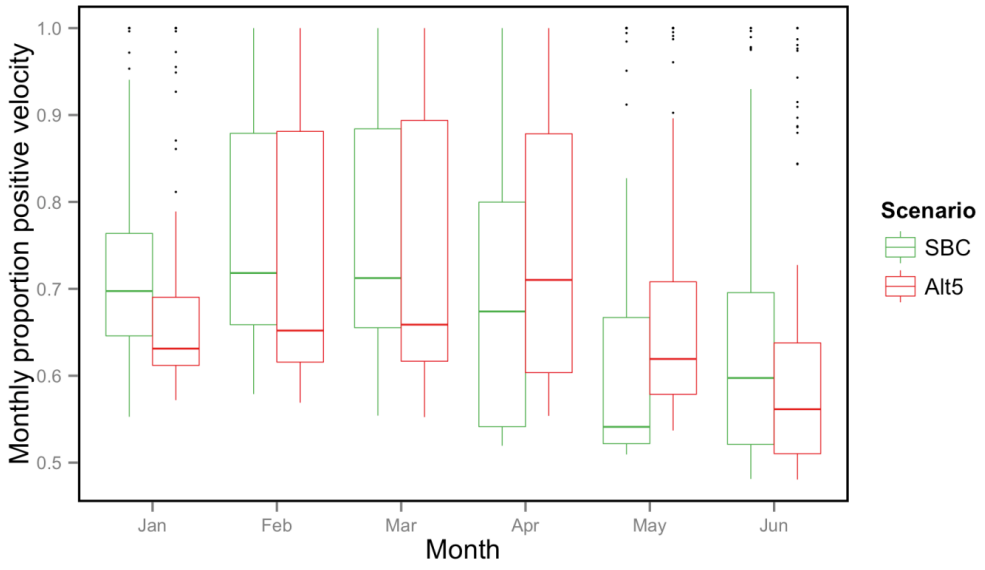


**Figure 9K.22 Proportion of Monthly Positive Velocities in Old River Upstream of the Facilities under Alternative 5 (Alt 5) as compared to the Second Basis of Comparison (SBC)**

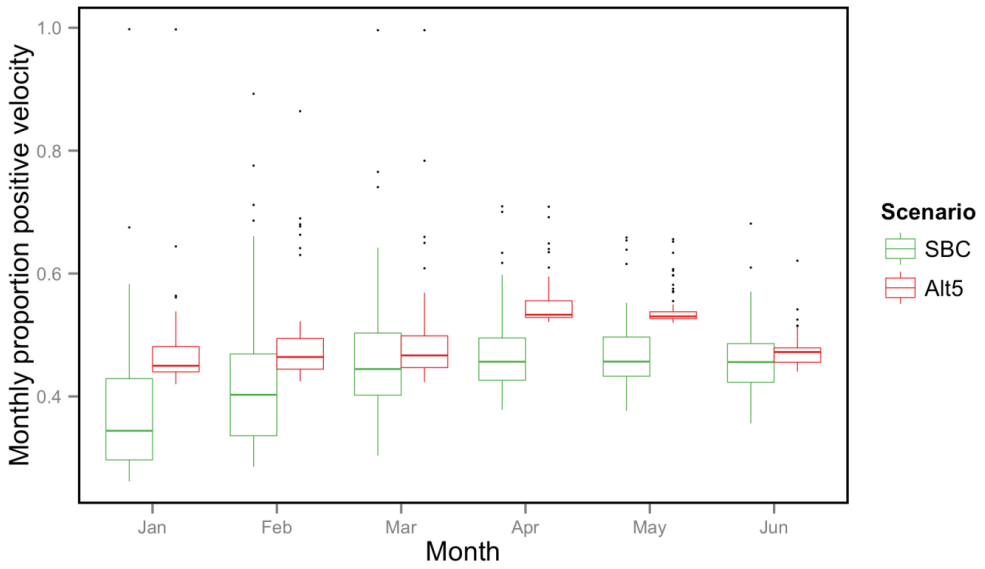


**Figure 9K.23 Proportion of Monthly Positive Velocities in Old River Downstream of the Facilities under Alternative 5 (Alt 5) as compared to the Second Basis of Comparison (SBC)**

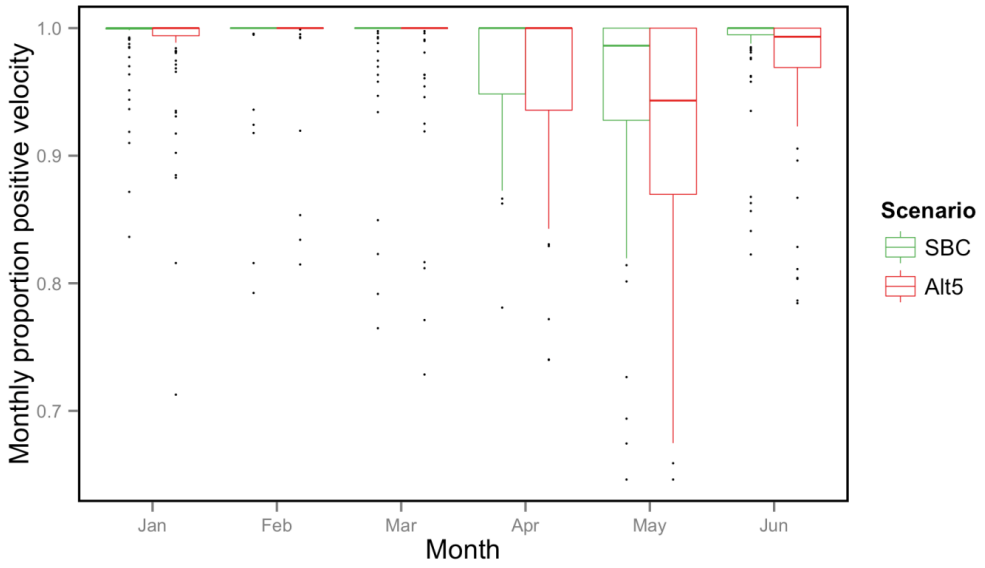


**Figure 9K.24 Proportion of Monthly Positive Velocities in Sacramento River near Georgiana Slough under Alternative 5 (Alt 5) as compared to the Second Basis of Comparison (SBC)**

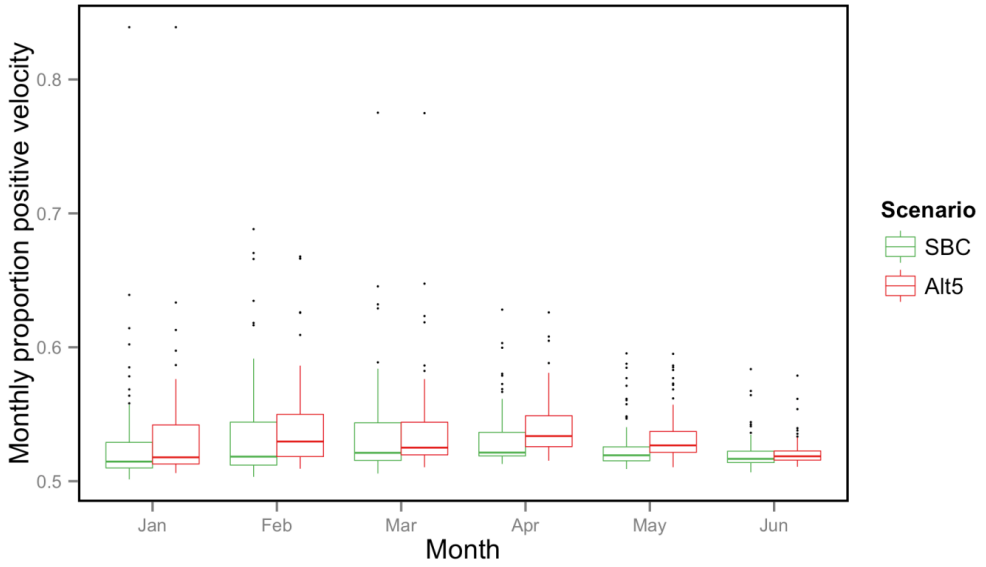


**Figure 9K.25 Proportion of Monthly Positive Velocities in the San Joaquin River near Confluence with Mokelumne River under Alternative 5 (Alt 5) as compared to the Second Basis of Comparison (SBC)**

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